



Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

## *Shri Chhatrapati Shivaji Maharaj College of Engineering, Nepti, Ahmednagar*

Survey No. 162 & 163, Nepti, Nagar - Kalyan Road, Ahmednagar - 414005. Maharashtra

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### **3.2.1 Number of papers published per teacher in the Journals notified on UGC website during the year 2022-23**

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Combined Effect of DEE and Jatropha biodiesel-diesel fuel blends on enhancement of VCR diesel engine parameters at varying loads and compression ratios	Dr.Y. R. Kharde	Mechanical	Australian Journal of Mechanical Engineering - TEMC	2022-2023	10.1080/14484846.2022.2038405	<a href="https://www.tandfonline.com/doi/abs/10.1080/14484846.2022.2038405">https://www.tandfonline.com/doi/abs/10.1080/14484846.2022.2038405</a>
Recent Advancements in Deep Learning	Smt. A.R. Mane	E&TC	GIS Science Journal	2022-2023	1869-9391	<a href="https://drive.google.com/file/d/1m0kDCC-KbplU9Ri0o5vleNq6tTyHt90/view">https://drive.google.com/file/d/1m0kDCC-KbplU9Ri0o5vleNq6tTyHt90/view</a>
5g and internet of things: a survey	Smt. A.R. Mane	E&TC	Dickensian Journal	2022-2023	0012-2440	<a href="http://dickensian.org/Volume-22-Issue-6-2022/">http://dickensian.org/Volume-22-Issue-6-2022/</a>
Effect of SCBA & GGBFS on the performance of binary and ternary blended concrete	Mr. S. M. Palaskar	Civil	Research on Engineering Structures & materials	2022-2023	2148-9807	<a href="https://jresm.org/archive/resm2022_626st1229.pdf">https://jresm.org/archive/resm2022_626st1229.pdf</a>
Enriching Trustworthy trade in decentralized system using block chain	Smt. P.S. Kohakade	Computer	ICSTSN-2023	2022-2023	10.1109/ICSTSN57873.2023.10151512	<a href="https://ieeexplore.ieee.org/document/10151512">https://ieeexplore.ieee.org/document/10151512</a>
Virtual atm through fingerprint and face recognition using Deep learning	Smt. P.S. Kohakade	Computer	International Journal of Innovative research in technology	2022-2023	2349-6002	<a href="https://ijirt.org/master/publishedpaper/IJIRT158680PAPER.pdf">https://ijirt.org/master/publishedpaper/IJIRT158680PAPER.pdf</a>
Modification in fixture design for telescopic shaft which manufacturing on milling machine	Mr. M. D. Mandhre	Mechanical	International Advanced Research Journal in Science, Engineering and Technology	2022-2023	2394-1588	<a href="https://iariset.com/wp-content/uploads/2022/02/IARJSET.2022.9150.pdf">https://iariset.com/wp-content/uploads/2022/02/IARJSET.2022.9150.pdf</a>







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Waste food donation app	Smt. N.B. Gade	Computer	International Research Journal Of Modernization In Engineering Technology And Science, IRJMETS	2022-2023	2582-5208	<a href="https://www.irjmets.com/uploaded/files/paper/issue_11_november_2022/31280/final/fin_irjmets1668591544.pdf">https://www.irjmets.com/uploaded/files/paper/issue_11_november_2022/31280/final/fin_irjmets1668591544.pdf</a>
Post tracking app for finding shortest path	Smt. N.B. Gade	Computer	International Journal of Current Science	2022-2023	2250-1770	<a href="https://ijcspub.org/viewfulltext.php?p_id=IJCSP23A1249">https://ijcspub.org/viewfulltext.php?p_id=IJCSP23A1249</a>
Experimental Investigation on Performance of Cotton seed biofuel blended with diesel on variable compression ratio diesel engine	Dr. Y.R. Kharde	Mechanical	Elsevier	2022-2023	2214-7853	<a href="https://www.sciencedirect.com/science/article/abs/pii/S2214785322058886">https://www.sciencedirect.com/science/article/abs/pii/S2214785322058886</a>
Emotion based music & movie recommendation system	Smt. Y. A. Sisodia	Computer	International Research Journal of Modernization in Engineering Technology and Science	2022-2023	2582-5208	<a href="https://www.irjmets.com/uploaded/files/paper/issue_11_november_2022/31218/final/fin_irjmets1668434528.pdf">https://www.irjmets.com/uploaded/files/paper/issue_11_november_2022/31218/final/fin_irjmets1668434528.pdf</a>





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# Combined effect of DEE and Jatropha biodiesel–diesel fuel blends on the enhancement of VCR diesel engine parameters at varying loads and compression ratios

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## ABSTRACT

In the field of biodiesel performance analysis, the oxygenised alternatives, dimethyl ether (DME) and diethyl ether (DEE), are regarded as one of the promising alternatives due to high Cetane number and oxygen content. In this research, experimental analysis is done for different fuel blends of Jatropha oil and DEE as additives. Biodiesel of 10, 15, and 20% with 10% of DEE is used by mixing with diesel named as A1, A2 and A3. For 20% of DEE with same % of biodiesel, second batch of blends is prepared named as B1, B2 and B3. These blends are prepared, and their physicochemical properties are tested. The compression ratio (CR) at 16, 17, and 18 is used as input for engine performance and emission analysis. Load on the engine is increased from 3 kg to 12 kg as full load for all blends and diesel. Results shows that engine gives better performance at higher load and higher CR. A3 blend shows the highest value of BTE than other fuel blends and diesel at all CR and loads. A3 blend shows the lowest value of BSFC compared to A1, A2, B1, B2 and B3 at CR 16 and CR 18. Performance of A3 and B2 fuel blends is better than all other fuel blends.

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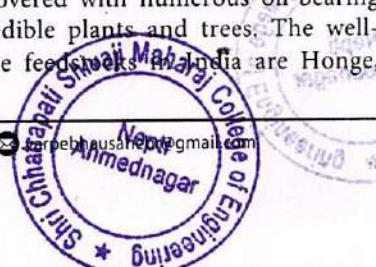
Jatropha biodiesel; Diethyl ether; VCR engine; diesel engine performance; diesel engine emissions

## 1. Introduction

The diesel engines have become the main source of transportation and the diesel fuel is used in wide ranging applications ranging from industries to automobiles (Demirbas 2009). The diesel fuel is well-known to deliver better performance and lower emissions in vehicles (Demirbas 2007). However, rapid and excessive usage of diesel and other fossil fuels has led to exhaustion of these valuable resources (Atabani et al., 2012). Also, the excessive use of fossil fuels has increased the greenhouse gas (GHG) emissions, which in return have increased the global temperature leading to depletion of ozone layer thus enabling UV rays to enter the earth. The drastic use of fossil fuels has also resulted in many health issues due to emission of many noxious emissions such as SO<sub>x</sub>, HC, CO, NO<sub>x</sub>, PM and smoke. Moreover, the excessive use has increased the price of crude oil in global market, and stringent governmental regulation and emissions norms have led to an increase in the demand of non-conventional sources of energy. Biodiesel is one such renowned renewable energy source, and it is produced from edible and non-edible oils (Basha, Gopal, and Jebaraj 2009). India has a vast forest area and the vegetations are covered with numerous oil-bearing edible and non-edible plants and trees. The well-known non-edible feedstocks in India are Honge,

cottonseed, mahua, Jatropha, neem, castor, etc. (Atabani et al., 2012). The potential of Jatropha as a biodiesel feedstock is explored in the current research. Many preceding literatures have reported that Jatropha oil delivers comparable diesel properties; however, the density and viscosity of Jatropha are higher than diesel fuel; thus, sometimes it causes blocking of fuel filters, clogging of fuel lines and cold starting problems (Soudagar, Nik-Ghazali, and Abul Kalam et al. 2018). Hence, to reduce the viscosity of Jatropha in diesel fuel, the authors have successfully added diethyl ether (DEE). Thus, the viscosity and density of the base fuel is reduced, thus making the fuel cleaner resulting in rapid combustion.

A thorough literature has been reviewed in the subsequent paragraphs on the effect of biodiesel and alcohols on diesel engines. Venu et al. (2016) used ethanol-based biodiesel additive with titanium oxide, DEE, and zirconium oxide as extra ternary additives to analyse CI engine behaviour. Oxidation rate increased, light-off temperature dropped and base area was increased with the fuel causing emission enhancement with the addition of nanoparticles. Imdadul et al. (2016) added 5–15% of pentanol to Calophyllum inophyllum oil and engine properties were in detail analysed. BSFC reduced and BTE increased for the added alcohol than the B20 blend without additive. In his similar work (Imdadul et al. 2016), they used





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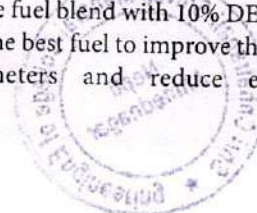


n-butanol and pentanol as alcohols to add them with petroleum-based biodiesel. HC and CO emission reduced but NOx and CO<sub>2</sub> increased. Devarajan et al. (2017) used cyclo-octanol with palm oil with 20% and 30% as additive. The emissions were found to reduce due to better atomisation. Sathiyamoorthi and Sankaranarayanan (2017) used ethanol for lemon-grass biodiesel at lower concentrations. Combustion pressure was higher and more heat release with BSFC and BTE adding to improved performance. Emission increased with the increase in ethanol % in the biodiesel. The ignition delay period was also found to increase with ethanol addition. Xingcai et al. (2004) reported an enhancement of diesel engine characteristics when ethanol is used as a fuel additive with diesel in a 1S DI CI engine. The results illustrated an enhancement in BSFC due to lean mixture, but the BTE enhanced by 1–2.3% with addition of 10 to 15% E vol. in diesel fuel. Also, E-D blended fuels results in lower CO, NOx and smoke emissions. The authors also reported that with the addition of ethanol in the diesel fuel increased the cetane value and encouraging results relate to NOx and CO, while the HC emissions slightly increased. Dogan et al. (2011) investigated the effect of five fuel blends, B5 with 95%D and 5% vol. of n-butanol, B10 with 95%D and 10% vol. of n-butanol, similarly, B15, B20 and D100 (neat diesel fuel) on CI engine characteristics. The results illustrated an increase in the engine characteristics, the BTE and reaction in the BSFC, while all the emissions, CO, HC, NOx and smoke reduced for the fuel blends with n-butanol additive. De Caro et al. (2001) studied the effect of organic additives on physicochemical properties of diesel and ethanol fuel blends. The authors added two percent of additives and varied the percentage of ethanol from 10 to 20% vol. The blends with and without the organic fuel additives were used in the CI engine with direct and indirect injection. The authors reported an increase in the performance and reduction in emissions with the addition of fuel additives. Ajav et al. (1999) investigated the effect of ethanol-diesel fuel blend in diesel engine. The authors used 5, 10, 15 and 20% of E-D fuel blends. The authors reported no loss in power, 5% of E in diesel fuel increased the power output, while 20% E reduced the power due to reduction in Cv of the fuel. For 20%E in diesel, fuel increased the BSFC by 9% compared to neat diesel. The EGT, temperature of lubricating oil and CO and NOx reduced for diesel-ethanol fuel blends as compared to neat diesel. Li et al. (Li et al. 2005) investigated the effect of different percentage levels of ethanol additive in diesel fuel on the performance and emissions characteristics of diesel engine, the blends used in their investigation are E5-D (5% ethanol), E10-D, E15-D E20-D and D100, respectively. The authors reported an enhancement in the BTE and reduction in BTE, and smoke

decreased for E10-D and E15-D fuel blend, also the NOx and CO reduced for higher percentage of ethanol in diesel. While, the HC emissions increased with an increase in the percentage of ethanol in diesel. Rakopoulos et al. (2012) reported that the addition of DEE (8, 16 and 24% vol.) to diesel fuel increases the performance characteristics and reduces the noxious emissions of a high-speed DI CI engine operating at a speed of 2000 rpm at three loads. The authors reported the engine operation was smooth up till 24% vol. of DEE in diesel fuel. Iranmanesh et al. (2008) investigated the effect of DEE and biodiesel-diesel blend on Kirloskar TAF1, 4-S, AC, 1-cylinder diesel engine. The diesel-biodiesel was blended with 5%, 10%, 15% and 20% vol. of DEE. For the fuel blends with DEE, (5–15%) was found desirable, improved the performance and decreased the emissions were observed. While, for the DEE, percentage above 15% lead to instability in engine speed and fluctuations in the engine power output affecting the fuel pump rack. This was due to an inconsistent combustion process owing to the high volatility of DEE. Mohanan et al. (2003) investigated the effect of DEE (5%, 10%, 15%, 20% and 25% (by vol.)) and diesel fuel blend on Kirloskar (AV1), 4-S, 1-cylinder diesel engine. The lowest fuel blend (5%) showed an overall improvement in the engine performance and emitted lower levels of smoke and CO due to an increase in the BTE. On the contrary, the higher fuel blends (20% and 25%) reduced the BTE and thick smoke was observed due to cavitation's in the nozzle of the fuel injector credited to phase separation of the fuel blends leading to large droplet size thus improper fuel injection.

To overcome difficulties of biodiesel blends, Cetane number enhancers and co-solvent additives have wide scope as a diesel fuel blend for diesel engines (Lapuerta, Armas, and García-Contreras 2007). An additive is used to keep the blends homogeneous and stable and used as an ignition improver. Additives are used to compensate for a cetane number, improve the viscosity and stabilise the fuel blend mixture (De Caro P, Mouloungui, and Vaitilingom et al. 2001). The lower percentages of biodiesel blends increase the BTE, reduced emission and BSFC (Jindal et al. 2010).

DEE can be used as a good alternative to diesel fuel because it has good thermal efficiency and lowers exhaust emissions. DEE has no stability problems in diesel, having a higher Cetane number and good solubility in the diesel fuel (Rakopoulos et al. 2012). Varpe et al. performed experimentation on DEE/Jatropha blended Variable Compression Ratio (VCR) diesel engine with varying loads. They obtained at full load and at higher CR the engine parameter BTE increases and the BSFC decreases for DEE-Jatropha biodiesel-diesel fuel blends. The fuel blend with 10% DEE + 20% JME + 70% diesel is the best fuel to improve the engine performance parameters and reduce emission





characteristics compared with other blends and diesel fuel (Varpe et al. 2020). Single-cylinder, four-stroke VCR engine with waste cooking oil methyl ester and its 20%, 40%, 60% and 80% blends with diesel shows reduction of CO, HC and an increase in NOx emissions (Muralidharan and Vasudevan 2011).

emissions 20% DEE and 30% DEE fuel blend shows better performance comparison to with pure rapeseed oil.

Hence, the preceding literature suggests the use of alcoholic fuel additives in biodiesel and diesel fuel increases the cetane number, reduces the viscosity, enhances lubrication, stabilise the mixture and ensures fuel homogeneity. Limited studies are available on the effect of DEE and biodiesel on the diesel engine performance and emission characteristics by varying the CR of diesel engine at four different loads. Hence, the authors have attempted to investigate the effect of DEE-Jatropha-diesel fuel blends by varying the compression ratios (16, 17, 18) at different loading conditions (25%, 50%, 75% and 100%) on 4-S, 1-cylinder VCR engine's performance and emission characteristics. Six different fuel mixtures were studied, DEE-10% + Jatropha-10% + Diesel-80% (A1), DEE-10% + Jatropha-15% + Diesel-75% (A2), DEE-10% + Jatropha-20% + Diesel-70% (A3), and DEE-20% + Jatropha-10% + Diesel-70% (B1), DEE-20% + Jatropha-15% + Diesel-65% (B2) and DEE-20% + Jatropha-20% + Diesel-60% (B3).

The premixed HCCI-DI engine using different DEE percentages varying from 0% to 40% indicates audible knocking at 40% DEE premixed fuel ratio. NOx and soot emissions decreased up to 19.4% and 76.1%, respectively, and CO and HC emissions increased (Cinar et al. 2010). The diesel fuel blends with 8%, 16%, and 24% DEE, in single-cylinder diesel engine revealed that bio-DEE is a very promising fuel for diesel engines (Rakopoulos et al. 2012). Jindal et al. found that the combined increase of C.R. & IP increases the BTE and reduces BSFC while having lower emissions and for small-sized DI constant speed engines used for agricultural applications (3.5 kW), the optimum combination was found as CR of 18 with IP of 250 bar (Jindal et al. 2010). The NOx and CO emissions increase with B100 compared to D100 at all loads. Also increase in NOx emission with B80E20 fuel compared with all fuels blends but biodiesel 76%-ethanol 19%-DEE 5% blend shows reduction of NOx and CO emissions and increase in THC emissions (Carvalho et al. 2020). SFC increases with improvement in BTE for 10% and 20% DEE in Jatropha biodiesel. Addition of DEE is an effective technique improve the results of Jatropha biodiesels (Raja et al. 2019). Diesel engine with 5% DEE and biodiesel mixture increase diesel engine performance considerably for all engine loads compared with all fuels (Ibrahim 2018). DEE fuel blends with 5% DEE and 20% ethanol show lower NOx and PM emissions compared with D100 and B20 fuels for medium and high loads also improvement in BTE at the high load (de Carvalho Mas et al. 2020). Smigins and Zakis (2020) found that engine power reduced by 6.2%–17.3% for all DEE blends gives better results for low level blends compared with pure rapeseed oil. Different DEE blends showing large decrease of NOx

2. Material and methods

2.1. Jatropha biodiesel preparation

Jatropha curcas belongs to a family of plant species known as Euphorbiaceae. It is resistant to strong winds and droughts. It is cultivated in Africa (Ghana, Tanzania, Mozambique, etc.), South east Asia (Malaysia, Indonesia, Myanmar, Vietnam, Brunei, East of India, etc.) and central and south America (Mexico, Chile, Costa Rica, Brazil, Argentina, etc.) (Achten et al. 2007). Figure 1 illustrates the pictorial view of Jatropha plant with fruits and dried Jatropha seeds.

It can be grown in sandy, saline or gravelly soils and any landscape is suitable for its growth. The oil content of J. curcas seeds is around 37% and the tree can grow seeds for a duration of 50 years. The oil has many beneficial properties for its applications as biodiesel

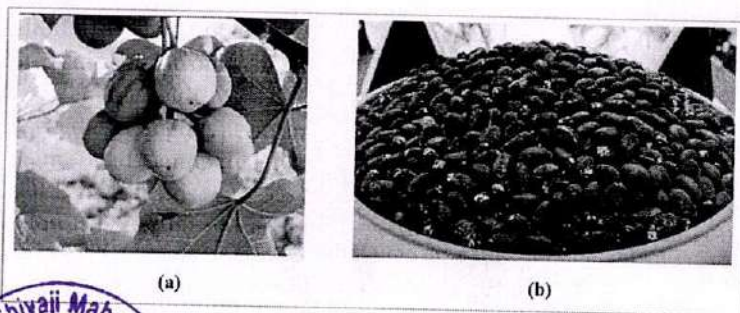


Figure 1. (a) Jatropha plant with fruits and (b) dried Jatropha seeds (Persistent start-up uses Jatropha seeds to make profitable fuel 2013).





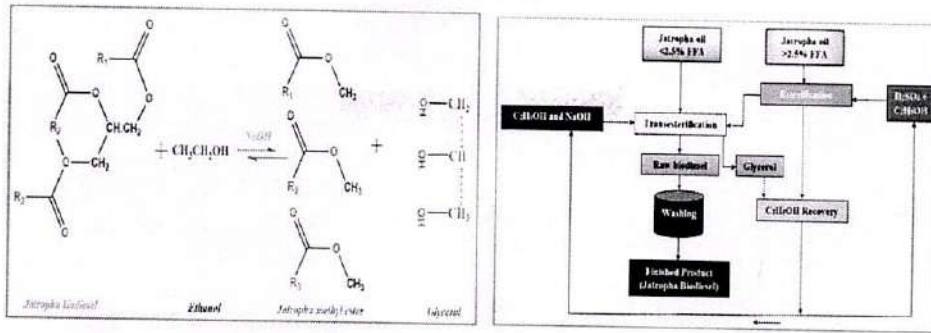


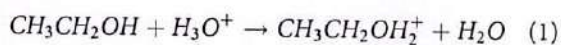
Figure 2. The equation for transesterification reaction of Jatropha oil.

such as low acidity and viscosity, good stability in base oils and superior cold properties compared to other biodiesel feedstocks. Also, *J. curcas* has high cetane number compared to diesel fuel, which makes it the best option fuel with minor engine modifications (Moniruzzaman, Yaakob, and Shahinuzzaman 2017; Silitonga et al. 2011; Mofijur et al. 2013).

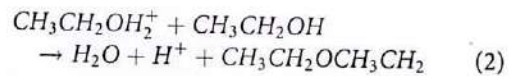
The vegetable oil comprised triglycerides in the transesterification method, ethanol is deprotonated with a Jatropha oil to produce a stronger nucleophile (Parawira 2010; Chauhan, Kumar, and Cho 2012; Imtenan et al. 2014; Soudagar et al. 2019, 2020). In the present investigation, sodium hydroxide and sulphuric acids are used as catalysts. The oil yields 98% of biodiesel, provided the oil contains low moisture and FFA. The process of transesterification reaction is illustrated in detail in Figure 2.

The DEE is completely miscible in diesel and biodiesel fuel blend. The initial valuation tests reveal that the solubility of DEE in the fuel blends with blending ratio of 10% was conducted and found to be miscible and no phase separation as observed for a period of 20 weeks, hence no emulsifying agents were added to the fuel blends. The results obtained in the current investigation are in good agreement with similar research on DEE and biodiesel.

The preparation of DEE is derived from the articles by Patil and Thipse (2015) and Nigam et al. (2011). The DEE is manufactured in lab through distillation of ethanol mixing with sulphuric acid. Initially, ethyl alcohol ( $CH_3CH_2OH$ ) is mixed with concentrated  $H_2SO_4$ . The sulphuric acid dissociates into hydronium ions,  $H_3O^+$ . The H ion traverses the electronegative O atom of the ethanol, producing a positive charge illustrated in Eq. (1).



Later, a nucleophilic O atom of unprotonated ethanol molecule dislocates a water molecule from the transverse (electrophilic) ethyl alcohol producing DEE, H ion and water shown in Eq. (2). Figure 3 shows the structure of a DEE molecule.



### 2.2. Uncertainty analysis

The errors of an engine are calculated using uncertainty analysis, while estimating the errors, it is assumed that the information gathered under ideal conditions and complete understanding and information of all the equipment's and system used are available (Soudagar et al. 2019, 2020). Table 1 illustrates the uncertainty percentage of measured parameters. The numerous unknown uncertainties are determined by mathematical equation, which is shown in Eq. (3).

$$\frac{U_y}{y} = \sqrt{\left[ \sum_{i=1}^n \left( \frac{1}{y} \frac{\partial y}{\partial x_i} U_{x_i} \right)^2 \right]} \quad (3)$$

In the equation, 'y' is a parameter, which is dependent on the factors 'xi' and 'Uy' signifies the deviation/uncertainties in parameter 'y'. At various engine operations, the observations and readings are noted, and the uncertainty is ascertained by repeated experimentations. The uncertainty percentage of the parameters involved in the investigations is estimated as follows:

$$\text{Overall uncertainty} = \pm \sqrt{(BTE^2 + BSFC^2 + HC^2 + CO^2 + NO_x^2 + Smoke^2)}$$

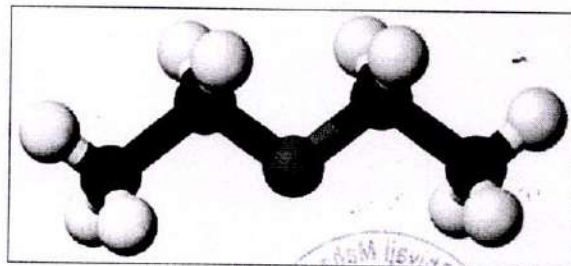
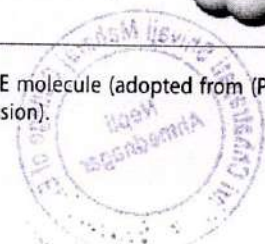


Figure 3. Structure of DEE molecule (adopted from (Patil and Thipse 2015) with permission).





**Table 1.** The agronomic traits and limitations of *Jatropha* plantations (Moniruzzaman, Yaakob, and Shahinuzzaman 2017; Becker and Makkar 2008; Jones and Miller 1992).

*Good agronomic traits*

- (1) Needs less nutrients (nitrogen).
- (2) Robust tree which can spread in semi-arid and dry regions and poor soil conditions.
- (3) Involves minimal workforce and laborious efforts.
- (4) Intercropping can be performed with many precious crops such as sugar cane, fruits and vegetables to protect the crops from insects, pathogens and cattle grazing.
- (5) It is used as an insecticide, nematicide and fungicide in tribal medicines.
- (6) It relatively grows rapidly compared with other biodiesel feedstocks.
- (7) The yield of seeds per hectare is four tones without much maintenance and very little water.
- (8) The *Jatropha* oil is non-edible; hence, the food vs fuel debate does not arise as in the case of edible feedstocks.

*The drawbacks of Jatropha*

- (1) The kernels and leaves are poisonous to animals and humans.
- (2) The phorbol esters, trypsin inhibitors and others chemical present in *Jatropha* make the entire detoxification a complex process.
- (3) The agricultural land used leads to competition with edible feedstocks.

$$\pm \sqrt{((0.38)^2 + (0.40)^2 + (0.25)^2 + (0.62)^2 + (0.28)^2 + (0.66)^2}$$

$$\pm 1.124856$$

335 Different blends of DEE + biodiesel (BD) + diesel (D) were prepared for the conduction of the trial on 4-Stroke, single cylinder, VCR diesel engine. Table 2 illustrates the composition of fuel blends.

**Table 2.** Uncertainty percentage of measured parameters.

Measurement	Range	Accuracy	Uncertainty
CO	0–12% vol	±0.03%	0.62
HC	0–15,000 ppm	±10 ppm	0.25
NOx	0–3000 ppm	±50 ppm	0.28
Smoke	0–99.9	±1%	0.66
BTE	-	-	0.38
BSFC	-	-	0.40

**Table 3.** Composition of fuel blends.

No.	Blend composition	Abbreviation
1.	DEE-10% +Jatropha-10% +Diesel –80%	A1
2.	DEE-10% +Jatropha-15% +Diesel –75%	A2
3.	DEE-10% +Jatropha-20% +Diesel –70%	A3
4.	DEE-20% +Jatropha-10% +Diesel –70%	B1
5.	DEE-20% +Jatropha-15% +Diesel –65%	B2
6.	DEE-20% +Jatropha-20% +Diesel –60%	B3
7.	100% Diesel (Reference)	D100

The properties of diesel, A1, A2, A3 and B1, B2, B3 were determined according to ASTM D6751-15 and EN standards. All the properties were measured in Indian Biodiesel Corporation (IDC), Baramati, India. Table 3 illustrates the properties of neat diesel, Ethanol, *Jatropha* biodiesel, DEE, A1, A2 and A3 blends and B1, B2 and B3. Figure 4 illustrates the fuel blends used in the current investigation.

**2.3. Experimental setup**

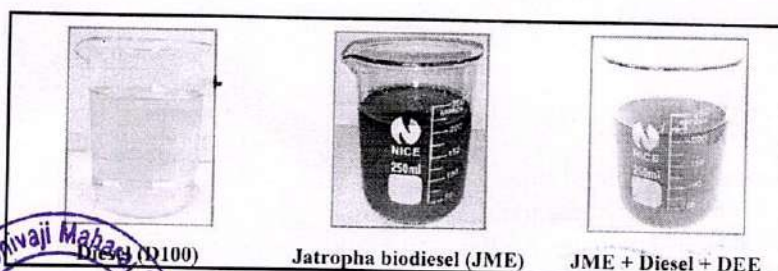
The engine used in the current investigation is a VCR, Kirloskar make, 1-cylinder, WC, diesel engine, as illustrated in Table 1. The engine is coupled to a five-gas analyser and smoke metre and the readings were derived from Enginesoft software. The combustion chamber used in the current investigation is hemispherical and CR is varied without stopping the VCR engine. DAQ and LabVIEW softwares are used as an interface between the computer and the engine sensors (air and fuel flow, temperatures and load measurement sensors). Table 5 illustrates the specification of VCR test engine used in the current investigation. The engine test specifications are illustrated in the Table 4. Figure 5 illustrates the schematic diagram of the test engine used in the current investigation.

**3. Results and discussion**

The experimentation process was performed on DEE/ biodiesel blend (A1, A2, A3, B1, B2 and B3) in diesel fuel at three CRs (16, 17 and 18) and four loads (3 kg, 6 kg, 9 kg and 12 kg). Performance and emission parameters are measured by using gas analyser and eddy current dynamometer. Tables 5 and 6 illustrate the parameters employed in the current investigation and experimentation chart for conducting tests.

**3.1. Effect of load and blends on engine performance at three CRs**

The BTE and BSFC for diesel and blends A1, A2, A3, B1, B2 and B3 are shown in Figures 6–9 for CR 16–18, respectively. From Figure 8, it is clear that BTE increases with the increase in load for all the blends



**Figure 4.** The fuel blends used in the current investigation. Diesel (D100) Jatropha biodiesel (JME) JME + diesel + DEE.





Table 4. Physiochemical properties of fuel blends.

Properties	Standard	Diesel	Ethanol	Biodiesel	DEE	A1	A2	A3	B1	B2	B3
Density (kg/m <sup>3</sup> at 20°C)	ASTM D4052	840	789	880	710	865	869	874	860	866	870
Calorific value (MJ/kg)	ASTM D5865	42.5	27	39.9	34	37.5	34	31.5	36.5	33.5	33.5
Liquid viscosity (CP at 20°C)	ASTM D445	3.03	1.2	4-Mar	0.23	3.1	3.3	3.7	2.9	3.1	3.2
Cetane number	ASTM D613	45-50	5-8	40-50	125	44	49	55	47	56	59
Flash point (°C)	ASTM D93	235	423	-	160	244	249	259	242	245	248
Oxygen content (wt%)	EN 14112	0	34.3	10	21.6	-	-	-	-	-	-

Table 5. Test engine specifications.

Number of strokes	Four
Fuel type	Diesel
Cylinder	Single
Rated power	3.5 kW
Speed	1500 rpm
Cylinder diameter	87.5 mm
Stroke	110 mm
Connecting rod length	234 mm
Compression ratio	12 to 18:1
Load indicator	Digital, range 0-50 Kg, supply 230VAC
Fuel tank	Capacity 15 L with glass fuel metering column
EGR	Water cooled, SS, range 0-15%
Piezo sensor	Range 5000 PSI, with low noise cable
Temperature sensor	Type RTD, PT100 and thermocouple, Type K
Load indicator	Digital, range 0-50 kg, supply 230VAC
Load sensor	Load cell, type strain gauge, range 0-50 kg
Data acquisition device	NI USB-6210, 16-bit, 250kS/s
Rotameter	Engine cooling 40-400 LPH; calorimeter 25-250 LPH
<b>Dynamometer</b>	
Model	AG10
Make	Saj test plant rig
End flanges both sides	Cardon shaft model 1260 type
Air gap	0.77 mm
Torque	11.5 Nm
Hot coil voltage	60 V
Continuous current (amp)	5
Cold resistance ohm	9.8

with load due to the increase in combustion temperature. Also, with the increase in biodiesel and DEE percentages in diesel, BTE increases due to oxygen percentage. The oxygen content increases with the

addition of biodiesel and DEE in diesel. BTE is highest for blend A3 at maximum load than pure diesel, which is 41.2%. In Figure 7, the respective BSFC is depicted for increasing load and blends. BSFC decreases with the increase in load due to more utilisation of fuel during combustion at higher load and CR. For CR 16, diesel fuel and B1 blend showed the lowest value of BSFC compared to other blends, which is about 0.28 kg/kWh at full load condition.

In Figure 6, the BTE and respective BSFC in Figure 7 at CR 17 is provided at all blends compared to diesel with increasing load. From Figure 7, it is seen that with the increase in load BTE also increases. Also, with the increase in biodiesel, percentages in diesel BTE increase. Here too, the same fact of increase in oxygen content and rise in combustion chamber temperature with increasing load is the main driving force for BTE improvement for blends. Maximum BTE is observed at maximum load for A3 and B2 blends. The range of BTE for A3 blend is 20.37% to 39.37%, which is higher than diesel fuel. Figure 7 shows BSFC for B1 and B2 is almost same as that of diesel fuel and at all the loads. B3 shows higher value of BSFC compared to other fuels at CR 17. BSFC decreases with the increase in load. Lowest value of BSFC is observed for B1, B2 and diesel, which is 0.28 kg/kWh.

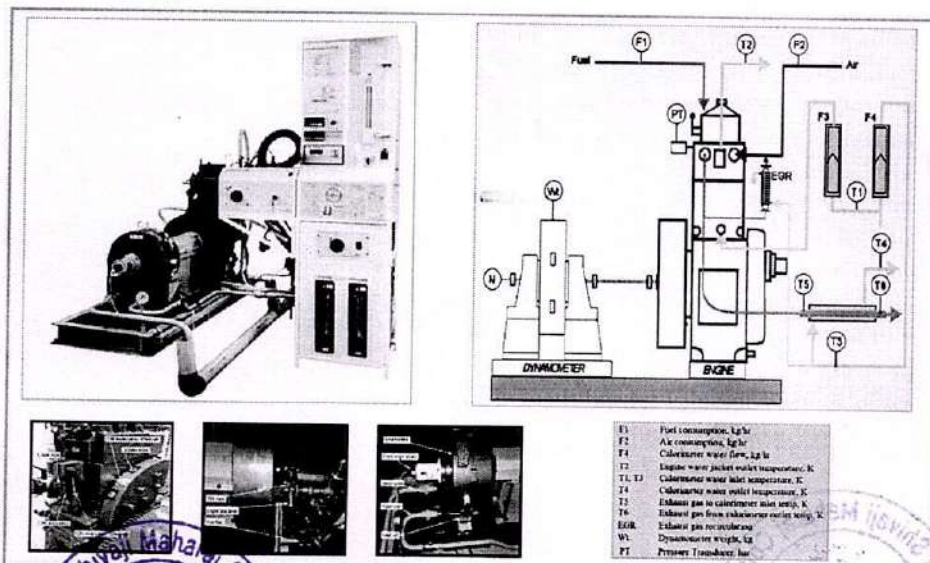


Figure 5. Pictorial representation of the Gnoskar-make VCR diesel engine.



Table 6. The parameters employed in the current investigation.

Factors considered	Parameters employed
Engine	VCR
Combustion chamber (CC)	Hemispherical (HCC)
Injection pressure (IP)	220 bar
Fuel injector (FI) holes	3 holes, 0.3 mm dia.
Speed	1500 rpm (constant)
CR	17.5: 1
Fuel	Diesel, A1, A2, A3

The BTE and BSFC at CR 18 are shown in Figures 8 and Figure 9, respectively, with increasing load. The increase in BTE and reduction in BSFC with load are clearly seen. Figure 8 shows that BTE increases with the increase in load. With the increase in Jatropha percentage, BTE also increases as oxygen percentage increases in fuel blend. As compared with diesel, all the blends show higher values of BTE at all the loads. A3 blend shows highest values of BTE for the entire load. Highest value of BTE is for A3 at maximum load, 410 415

Table 7. Experimentation chart for conducting tests.

CR	Inputs (Blend A)		Inputs (Blend B)		Load (%)	Load (kg)	Equivalent BP (kW)	Output
16	DEE (10%)	Biodiesel-10% (A1)	DEE (20%)	Biodiesel-10% (B1)	25%	3	0.9	BTE, BSFC
17	Diesel	Biodiesel-15% (A2)	Diesel	Biodiesel-15% (B2)	50%	6	1.7	CO, HC, Smoke, NOx
18		Biodiesel-20% (A3)		Biodiesel-20% (B3)	75%	9	2.5	
					100%	12	3.4	

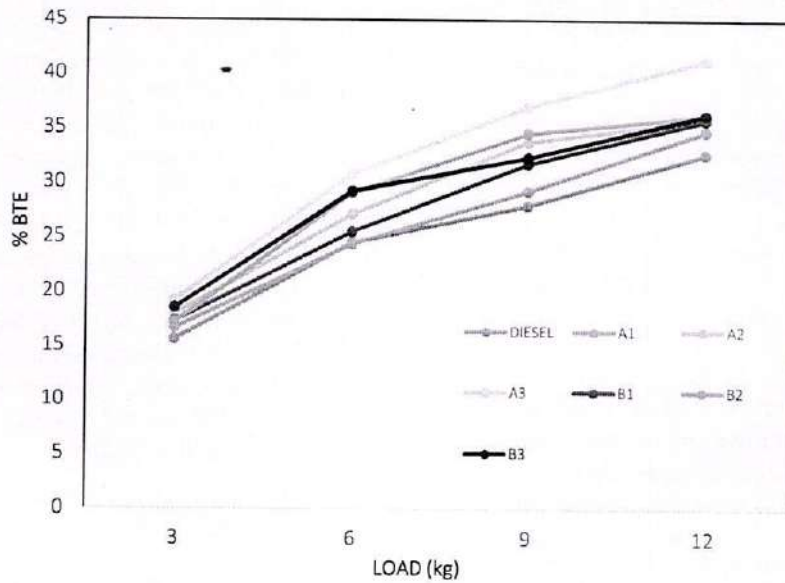


Figure 6. BTE vs Load at CR 16.

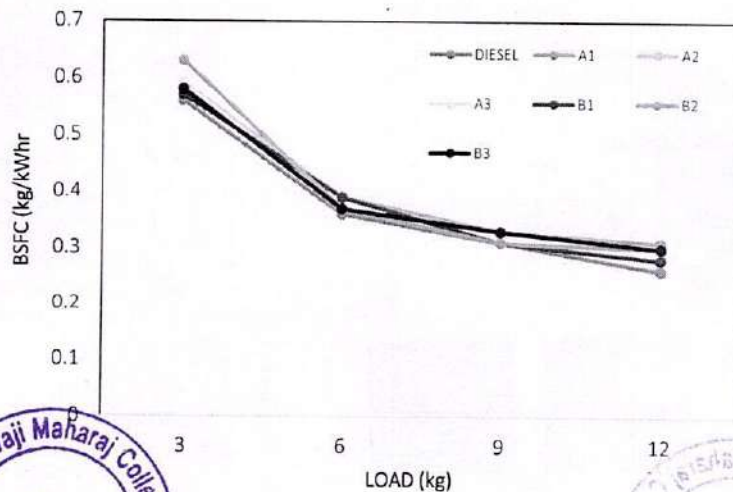


Figure 7. BSFC vs Load at CR 16.





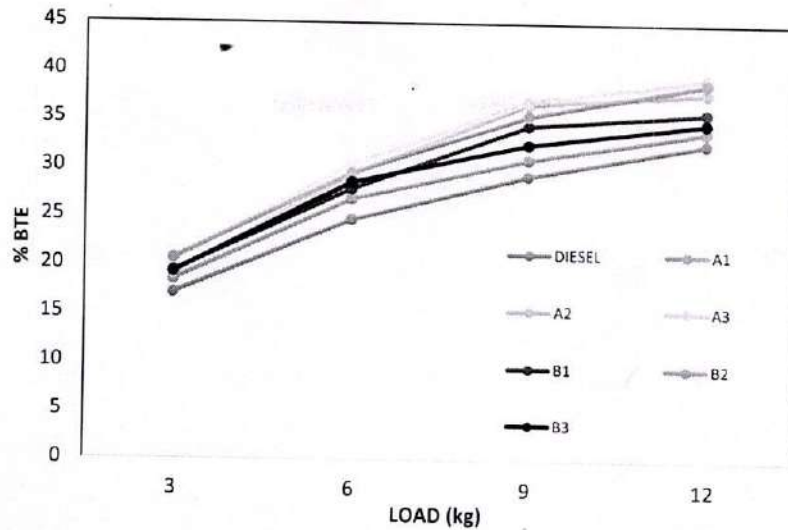


Figure 8. BTE vs Load at CR 17.

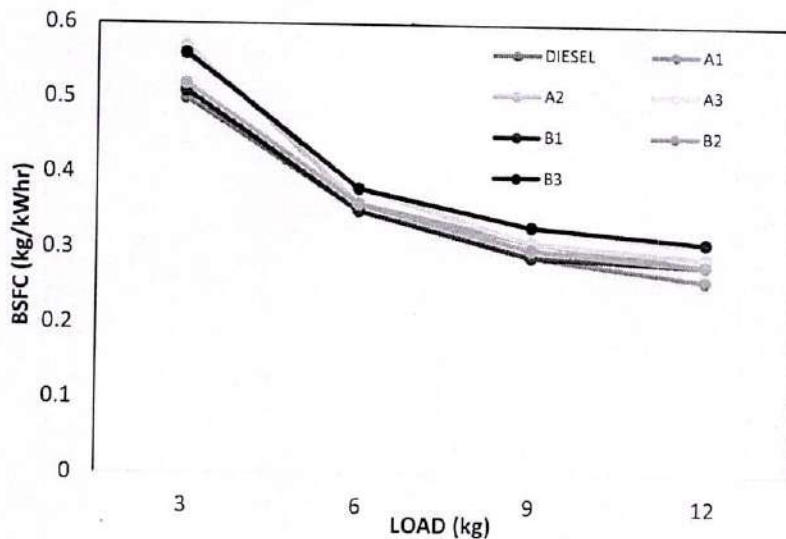


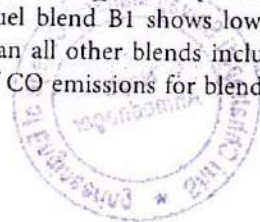
Figure 9. BSFC vs load at CR 17.

which is about 42.54%. In Figure 10, it is shown that BSFC is almost same for all the fuel blends at each load. For diesel fuel, the value of BSFC is lowest at maximum load of 12 kg. Fuel blends A3 and B3 show lower values of BSFC (0.27 and 0.28 kg/kWh) compared with other fuel blends, which is close to the value of pure diesel (0.25 kg/kWh).

From the comparison of Figures 9–11 having CR 16, 17 and 18, the effect of load on BTE for DEE/Jatropha and biodiesel blend can be made. From comparison, it can be said that CR has very little effect on the BTE of the engine almost at all loading range on the engine. Maximum BTE is observed at full load condition with CR value of 17, which is 38.87%. The effect of load and CR on BSFC can also be made. At lower and at higher loads, BSFC is affected by CR. BSFC values are lower at CR of 17 compared to CR 16 and 18. Minimum value is 0.28 kg/kWh for B2 blend.

### 3.2. Effect of load and blends on emission characters at three CRs

Figures 12–14 show the effect of load on CO emissions for DEE/biodiesel blends A1, A2, A3, B1, B2 and B3 relative to diesel for CR 16–18, respectively. From figures, it is seen that CO emissions decrease with the increase in load for all fuels. At CR 16 for higher loads, B1 and B2 show lowest CO emissions than all other fuel blends and diesel fuel. The main reasons of the lower CO in B1, B3 and B2 are the availability of more oxygen in the blend due to the presence of DEE and biodiesel. Also, DEE having higher volatility and Cetane number is responsible for improving combustion efficiency. Fuel blends B1 and B2 show 0% CO at higher load, which are the best performance at CR 16. At CR 17, fuel blend B1 shows lowest value of CO emissions than all other blends including diesel fuel. The range of CO emissions for blend B1 is 0% at full





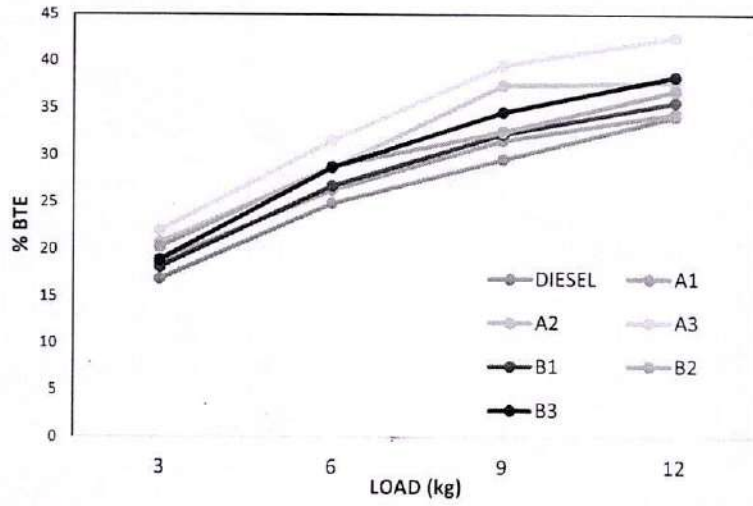


Figure 10. BTE vs load at CR 18.

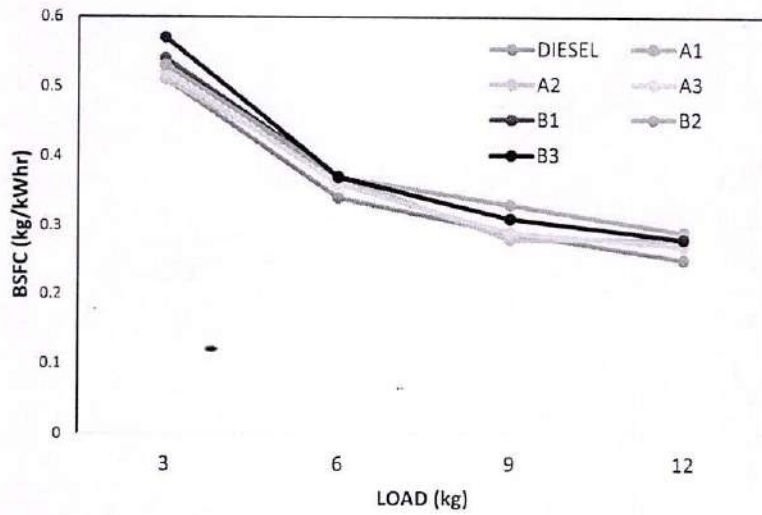


Figure 11. BSFC vs load at CR 18.

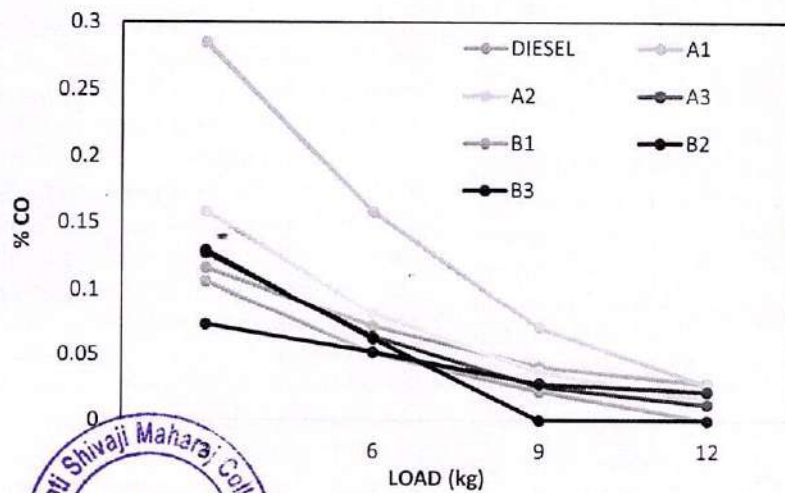


Figure 12. CO vs load for CR 18.





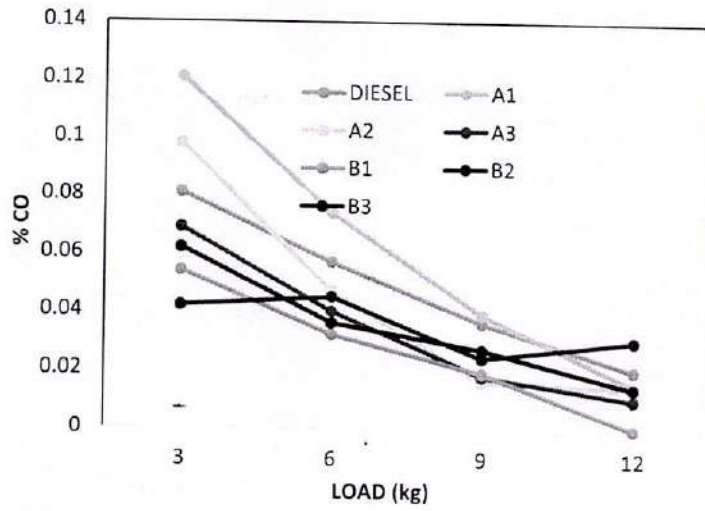


Figure 13. CO vs load for CR 17.

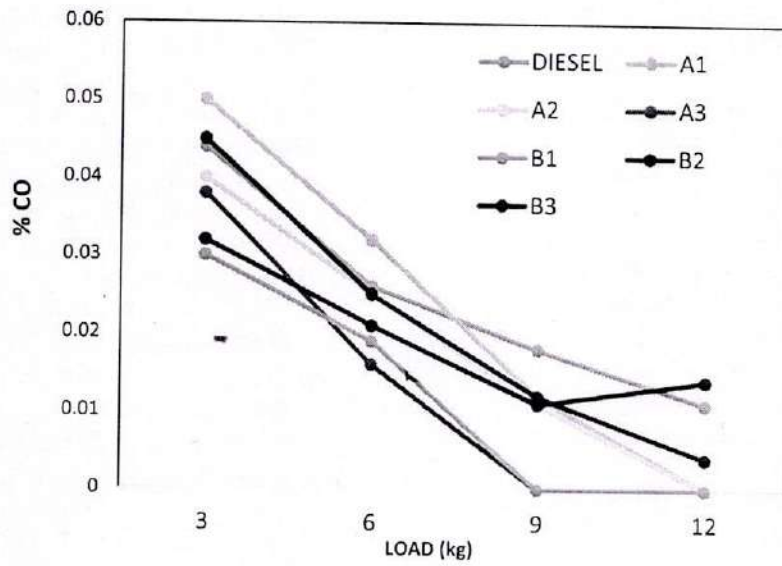


Figure 14. CO vs load for CR 18.

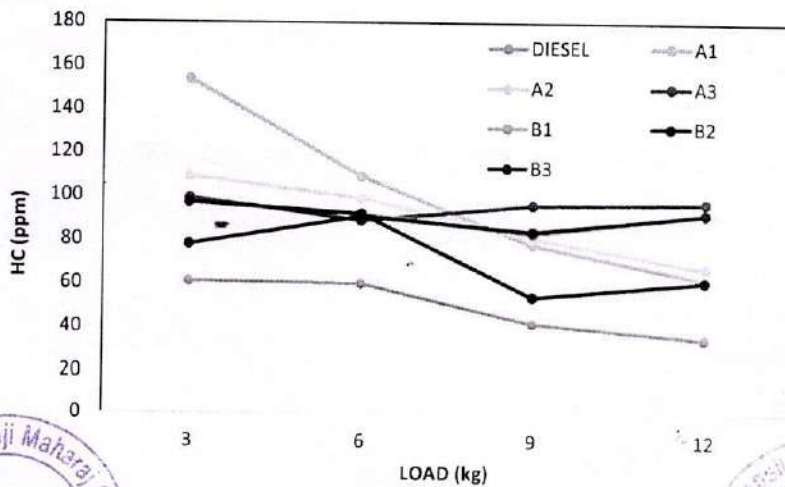


Figure 15. HC vs load for CR 16.





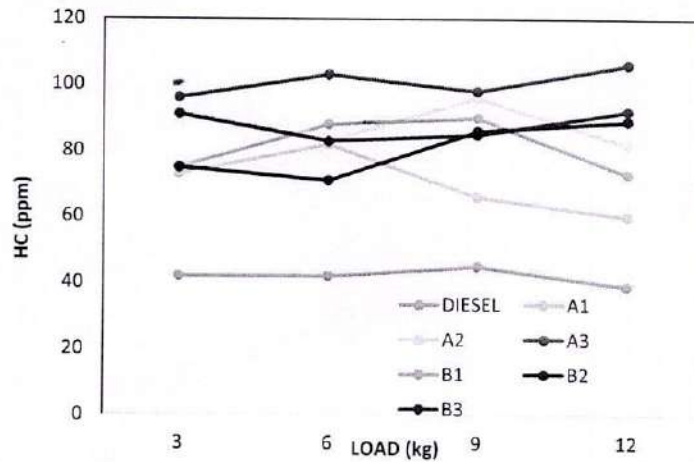


Figure 16. HC vs load for CR 17.

load (12 kg) to 0.055% at low load (3 kg). Fuel blends B2 and B3 have CO emission range of 0.03% at full load to 0.06% at low load. At CR 18, fuel blends A3 and B1 show lowest value of CO emissions than all other blends including diesel fuel. The range of CO emissions for blends A3 and B1 is 0% at full loads (9 kg and 12 kg) to 0.035% at low load (3 kg), which is less than other fuel blends and diesel fuel. This may be due to higher oxygen contents in B1 and A3 fuels. B1 and A3 contents 30% DEE and biodiesel, which give best performance in CO emissions. As blending percentage increases, ignition delay is prolonged. Due to higher latent heat of evaporation of DEE (460 kJ/kg), slow vaporisations occur; hence, incomplete combustion takes place in cylinder, which leads to more CO emissions.

Figures 15-17 show the effect of load on HC emissions for DEE/biodiesel blends at CR 16-18 respectively. From figures, it is seen that CO emissions decrease with the increase in load for all fuels. For CR 16, diesel fuel shows lowest HC emissions than all DEE/biodiesel blends. DEE having the higher latent heat of evaporation causes lower combustion

temperature, especially the temperature near the cylinder walls during the mixture formation. In this case more HC is produced from the cylinder boundary. Secondly, due to DEE/biodiesel blending, calorific value of blend decreases which is also responsible for the increase in HC emissions. Range of HC emissions for B1 and B3 blends is 79 ppm at low load to 95 ppm at full load, which is higher than diesel fuel. For diesel, HC range is 38 ppm to 60 ppm. Blend B2 has lower HC emissions than other fuel blends. For B2, the range of HC emission is 60 ppm to 98 ppm. At CR 17, the range of HC emissions for diesel fuel blends is 40 ppm to 45 ppm, which is much lower than fuel blends. Fuel blend A1 shows lower HC emissions than all other blends, which contains 10% DEE and 10% BD. For A1 fuel blend, the range of HC emission is 60 ppm to 80 ppm. As biodiesel percentage increases, viscosity of fuel blend increases, which tends to have incomplete combustion causing higher HC emissions. Therefore, A1 blend is best blend for CR 17. At CR 18, range of HC emissions for diesel fuel blends is 37 ppm to 48 ppm, which is much lower than fuel blends. Fuel blend A1 shows lower HC emissions than all other blends,

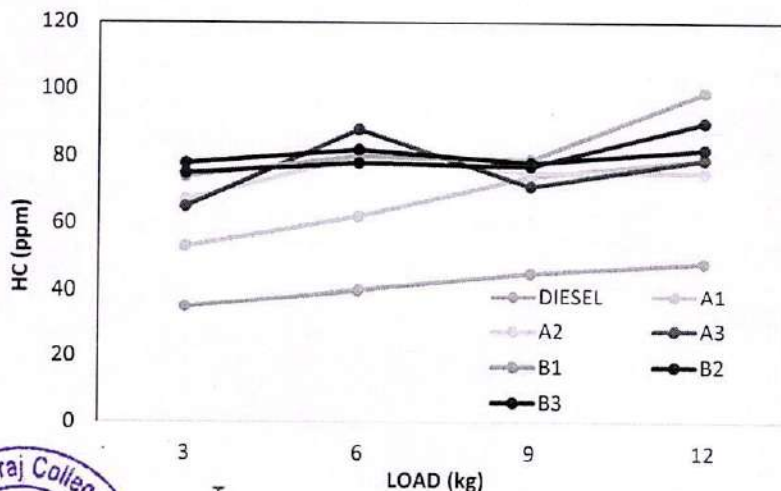


Figure 17. HC vs load for CR 18





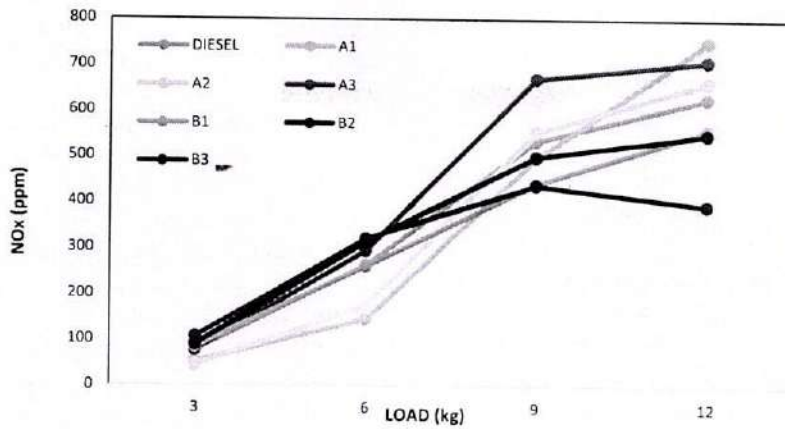


Figure 18. NOx vs load for CR 16.

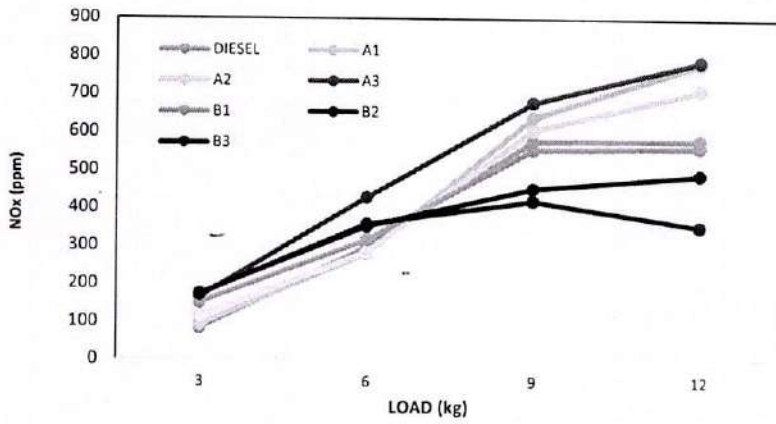


Figure 19. NOx vs Load for CR 17.

500 which contains 10% DEE and 10% BD. For A1 fuel blend, the range of HC emission is 55 ppm to 77 ppm. Therefore, fuel blend A1 gives best performance for HC emissions at CR 18.

505 Figures 18–20 illustrate the effect of load on NOx emissions on diesel and biodiesel blends at C 16, 17, and 18, respectively. NOx emissions mainly depend

upon peak cylinder temperature, spray pattern, atomisation and ignition delay. From figures, it is seen that NOx emissions increases with the increase in load for all fuels. This is due to increase in peak temperature and BMEP (brake mean effective pressure) with increase in load. At higher loads (9 kg and 12 kg), fuel blends B1, B2 and B3 show lower NOx

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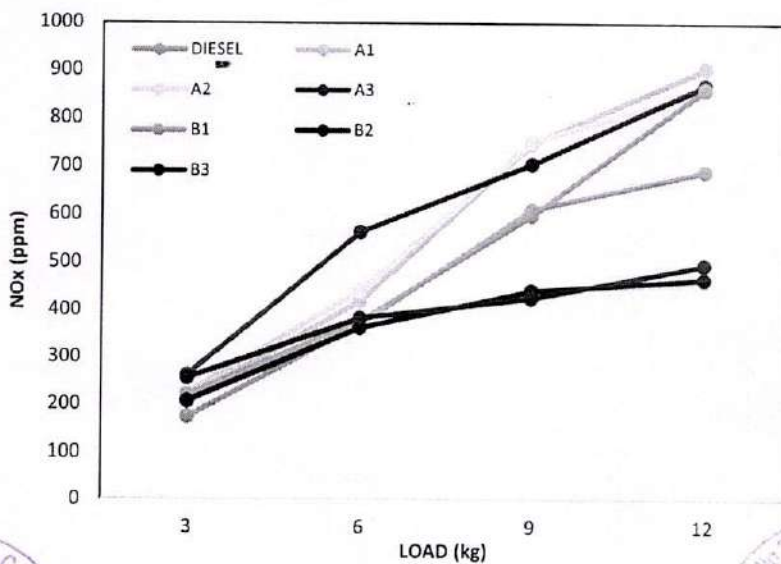
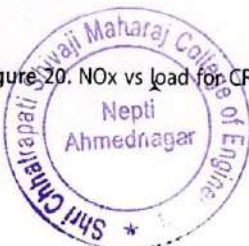


Figure 20. NOx vs load for CR 18.





emissions than diesel fuel. This is because of the presence of higher DEE percentage than other fuel blends. As DEE increases, Cetane number of fuel blend increases and hence ignition delay of combustion is reduced. As a result of reduced ignition delay period, peak cylinder temperature decreases, hence NOx emissions are lower due to the increase in DEE blends. Higher inherent oxygen present in DEE blends also helps for proper oxidation of hydrocarbons, which is also another cause of reduced NOx compared to diesel fuel. Fuel blend B3 gives best performance for NOx emissions for CR 16 at higher loads. For B3 blend, the range of NOx emission is 100 ppm to 394 ppm, which is lower than diesel. For diesel, NOx emission is 98 ppm at low load to 625 ppm at full load condition. At CR 17 fuel, blends B1, B2 and B3 show lower NOx emissions than diesel fuel and A1, A2 and A3 show higher NOx emissions than diesel. Fuel blend B3 gives best performance for NOx emissions for CR 17 at higher loads. For B3,

blend range of NOx emission is 180 ppm to 352 ppm, which is lower than HSD (diesel). For HSD, NOx emission is 98 ppm at low load to 570 ppm at full load condition. When CR is 18, fuel blends A1, A2 and A3 show higher NOx emissions than pure diesel at higher loads (9 kg and 12 kg). Fuel blends B2 and B3 give best performance for NOx emissions for CR 18 at higher loads. For B2 and B3 blends, NOx emissions are nearly same for all loading conditions. NOx emissions for fuel blends B2 are 250 ppm at lower load to 465 ppm at full load, which is lower than HSD. For HSD, NOx emission is 170 ppm at low load to 700 ppm at full load condition.

The smoke opacity varying with the load and CR for biodiesel blends with additive and pure diesel is shown in Figure 21-23, respectively. From the figures, it is visible that smoke opacity increases with the increase in load. At all loads, all fuel blends show lower value of smoke opacity than diesel fuel. The extra content of oxygen in the biodiesel is the cause

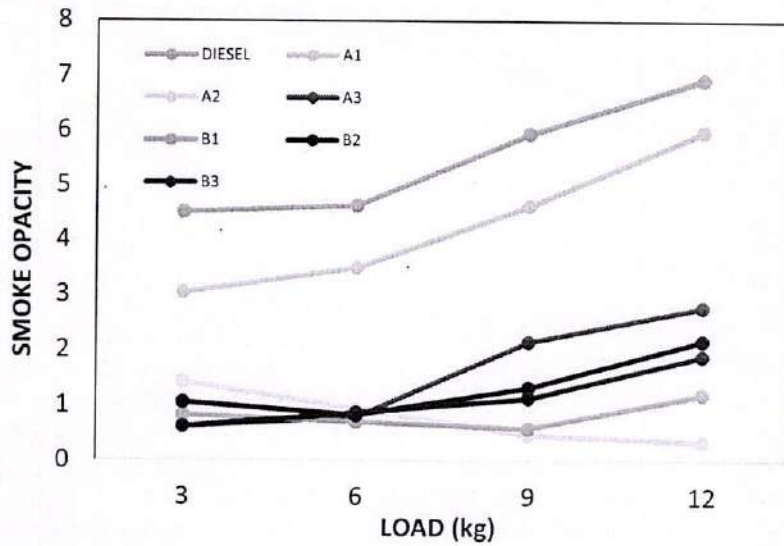


Figure 21. Smoke opacity vs load for CR 16.

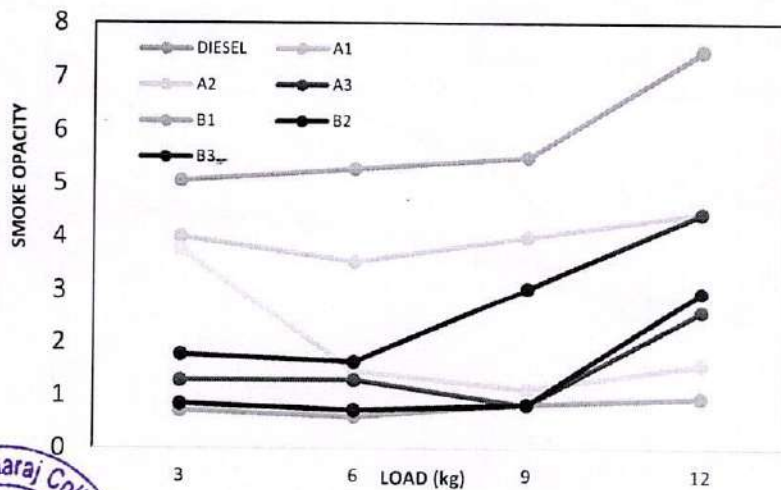


Figure 22. Smoke opacity vs load for CR 17.





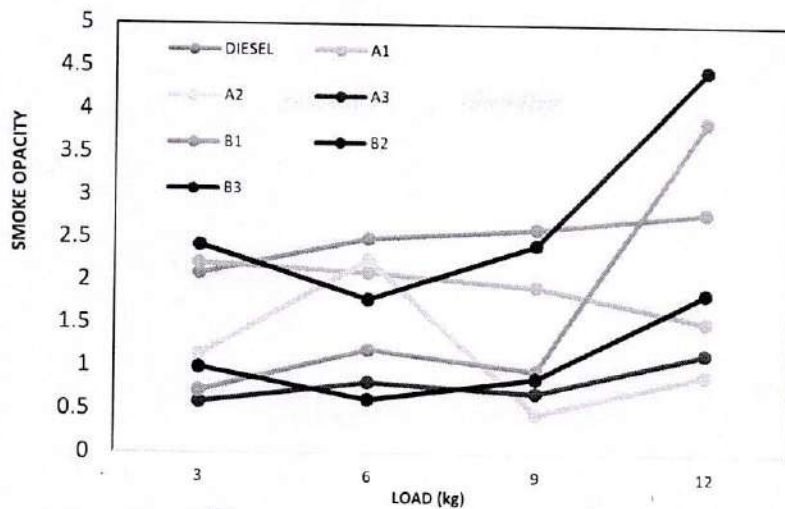


Figure 23. Smoke opacity vs load for CR 18.

for reduction in smoke compared to diesel. Fuel blends B1 and A2 show lower smoke opacity than all other fuel blends. B2 and B3 show higher smoke opacity than B1. Increase in DEE reduces the smoke opacity due to its higher volatility and higher oxygen percentage in blends. But if biodiesel is increased more than 15% in the fuel blends (fuel blends A3 and B3), viscosity of the fuel blend increases. Higher viscosity of fuel blend reduces the atomisation and reduces mixing of air and fuel, which increases the ignition delay. Also, higher fuel viscosity increases C/H ratio in the combustion chamber. Hence smoke opacity increases with higher percentages of biodiesel. Fuel blend A2 shows lowest smoke opacity at higher loads (9 kg and 12 kg). Smoke opacity is 0.35 to 1.5 for blend A2, which is lower than diesel. For diesel, the smoke opacity is 4.5 to 7, which is far greater than all fuel blends. For CR 17, the fuel blends B1 and A2 show lower smoke opacity than all other fuel blends. B1 and B2 show higher smoke opacity than B1. Increase in DEE reduces the smoke opacity due to its higher volatility and higher oxygen percentage in blends. But higher percentage of biodiesel increases the smoke opacity beyond 15% biodiesel. Lowest smoke emissions are observed for Fuel blend B1 at full load. Smoke opacity is 0.77 to 0.96 for blend B1 at CR 17, which is lower than diesel. For diesel, the smoke opacity is 4.5 to 7, which far greater than all fuel blends.

At CR 18, fuel blend A2 shows lower smoke opacity than all other fuel blends. Fuel blend A2 shows lowest smoke opacity at higher loads. Smoke opacity is 0.4 to 0.9 for blend A2 for higher load, which is lower than diesel. For diesel, the smoke opacity is 1.75 to 2.8. Blend B3 shows the highest smoke than diesel fuel at full load. This is because of rich mixture due to reduction in A-F ratio at higher load. B3 fuel contains high percentage of DEE (20%) and biodiesel (20%) than all other fuel blends. Due to higher percentage of DEE

and biodiesel in fuel blend, viscosity of the blend increases. Higher viscosity causes poor atomisation and poor mixing of air and fuel, hence smoke opacity increases.

### 3.3. Effect of CRs on emission characters at full load

In Figures 24–27, the emissions like CO, HC, NO<sub>x</sub> and smoke opacity with respect to CR variations at full load is shown. CO emissions are lowest at CR 18 compared to CR 16 and CR 17. At higher CR, spray pattern and atomisation are good that cause good mixing of air and fuel. Due to good atomisation and mixing, combustion efficiency increases causing complete combustion, hence reduces CO emissions at higher CR. All the fuel blends show lower CO emissions than diesel fuel. Diesel fuel shows 0.011% and 0.028% CO emission. B1 blend shows 0% CO emission at all CR values. Also fuel blends A1, A2 and A3 show 0% CO emission at CR 18. But, if biodiesel and DEE percentage are higher, viscosity of the blend increases that causes increase in delay period and hence CO% increases. Figure 27 shows the variation of HC emissions with respect to CR at constant load (full load) for fuel blends. HC emissions slightly increase with the increase in CR. At higher CR, A-F ratio decreases, which cause more rich mixture during combustion, hence increases the HC emissions. All the fuel blends show higher HC emissions than diesel fuel. The main reasons of the higher HC emission are prolonged delay period due to slow vaporisation of DEE and biodiesel blends. Prolonged delay period is responsible for incomplete combustion, which is the main cause of more HC emissions in fuel blends than HSD. A1 shows lower value of HC emissions (62 ppm to 78 ppm) than all other fuel blends. DEE having the higher latent heat of evaporation causing lower combustion

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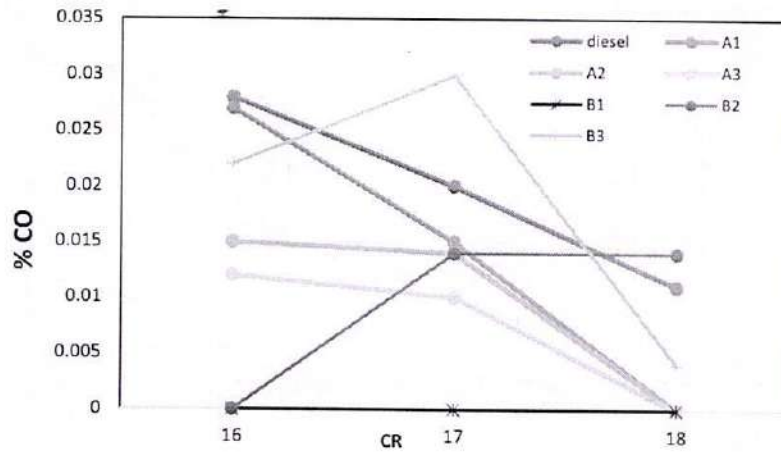


Figure 24. CO vs CR at full load (12 kg /3.4 kW).

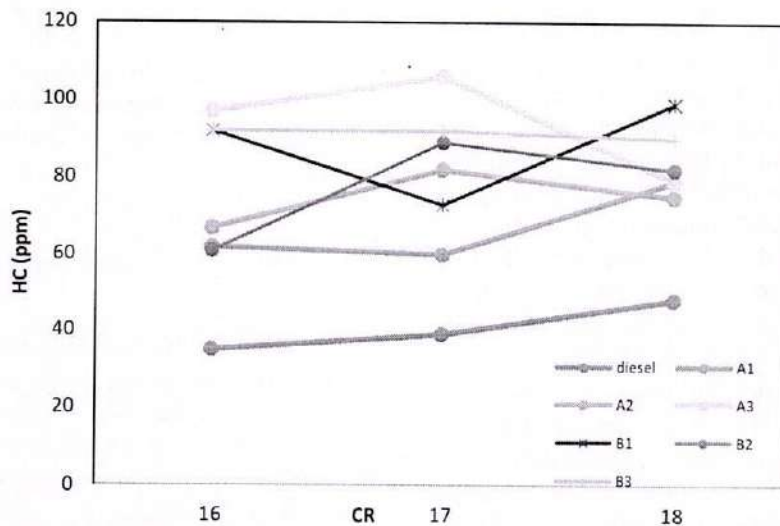


Figure 25. HC vs CR at full load (12 kg/3.4 kW).

temperature, especially the temperature near the cylinder walls during the mixture formation. Diesel fuel shows 35 ppm to 48 ppm HC emission at all CR values. Fuel blends A1, A2, A3 and B2 show almost same value of HC emissions at CR 18, which is about 80 ppm.

In Figure 26, the NOx emissions are found to increase with the increase in CR due to the increase in peak cylinder temperature. Fuel blends B2 and B3 show the lower NOx emissions than diesel. Blends A, A2 and A3 show more NOx emissions than diesel fuel. Fuel blend B3 is the best fuel blend for NOx emission. NOx emissions for B3 are 352 ppm to 495 ppm and for diesel it is 640 ppm to 700 pmm. Smoke opacity decreases with CR for most of the fuels as shown in Figure 29. Also, for all CR, fuel blends show lower value of smoke opacity than diesel fuel. Fuel blends B1, A2 and A3 show lower smoke opacity than all other fuel blends. B2 and B3 show higher

smoke opacity than B1. Increase in DEE reduces the smoke opacity due to its higher volatility and higher oxygen percentage in blends. But if biodiesel is increased more than 15% in the fuel blends (fuel blends A3 and B3), viscosity of the fuel blend increases. A1, A2, A3 and B2 show almost same smoke emissions at CR 18. Fuel blend A2 shows least smoke opacity which is 0.35 ppm to 1.58 ppm. For diesel, smoke opacity is 7 to 7.5%.

#### 4. Conclusions

The effect of compression ratio and Jatropa with DEE blends is performed in this research. Characters of engine performance mainly BTE and BSFC were analysed. An emission characteristic of the engine is also tested. Following conclusions can be drawn from the experimentation for Jatropa /DEE blends at different values of CR and loads.





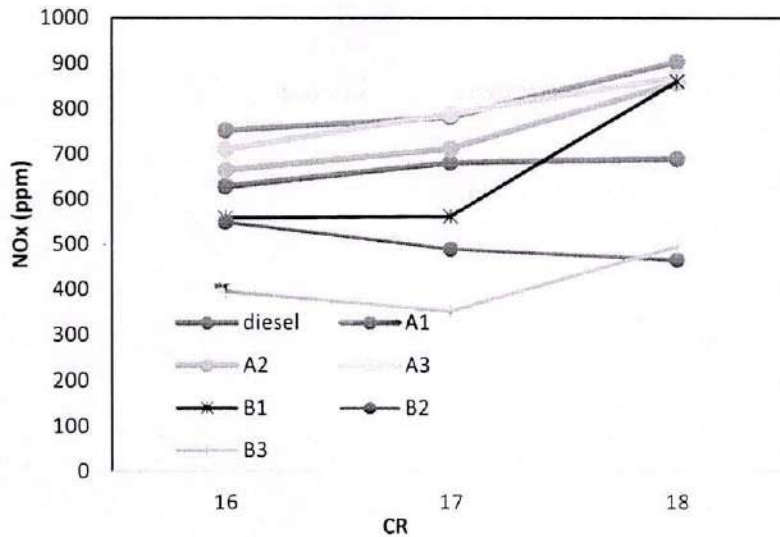


Figure 26. NOx vs CR at full load (12 kg/3.4 kW).

665 For better engine performance, it is better to run the engine at higher load and with higher CR as BTE is enhanced and BFSC is lower due to higher combustion temperature.

670 BTE increases with the increase in biodiesel and DEE percentage in diesel blend due to increase in oxygen percentage in blends.

675 A3 blend shows the highest value of BTE (42.57%) compared to other blends and diesel at all CR and loads. Diesel fuel shows lowest value of BSFC (0.25 kg/kWh) than all fuel blends due to higher heating value. While A3 blend shows lower value of BSFC (0.27 kg/kWh) compared other blends at CR 16 and CR 18.

680 Emission reduces/improves depending upon the load and CR of engine. CO emissions decrease with the increase in CR and load. Fuel blend B1 shows lowest value of CO emissions than all other blends.

Fuel blends B2 having lower HC emissions than other fuel blends at CR 16. Fuel blend A1 shows lower HC emissions than all other blends at CR 17 and fuel blend A1 shows lower HC emissions than all other blends at CR 18.

685 B1, B2 and B3 show lower NOx emissions than diesel fuel at CR 16 and CR 17. Fuel blends B2 and B3 show lower NOx emissions than diesel fuel at CR 18. This is due to higher percentage of DEE in fuel blend.

690 Smoke opacity increases with the increase in load. Fuel blends B1 and A2 show lower smoke opacity than all other fuel blends and diesel fuels at CR 16, 17 and 18.

695 CR 18 gives lower CO emissions and smoke opacity for all fuel blends and CR 16 gives lower HC and NOx emissions. Overall, fuel blends B1 and B2 gives good emission performance.

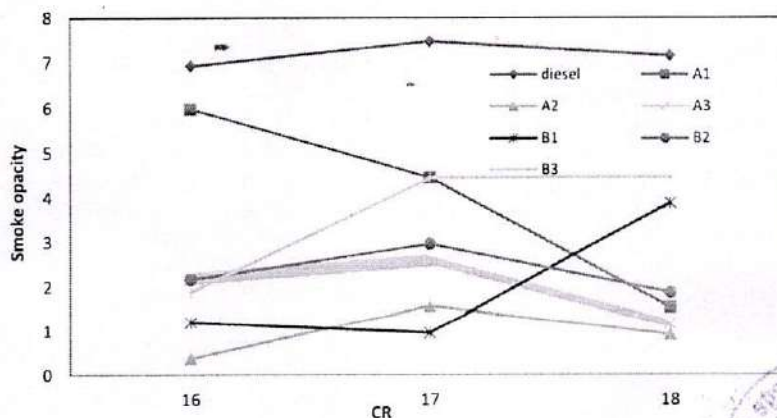


Figure 27. Smoke opacity vs CR at full load (12 kg /3.4 kW).





700 **Nomenclature**

CI	Compression ignition	DI	Direct injection
ATDC	After top dead centre	BTDC	Before top dead centre
CR	Compression ratio	IP	Injection pressure
BTE	Brake thermal efficiency	BSFC	Break specific fuel consumption
BP	Brake power	CC	Combustion chamber
Cv	Calorific value	$\eta_{th}$	Thermal efficiency
UBHC	Unburnt hydrocarbon	CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide	NO <sub>x</sub>	Oxides of nitrogen
HC	Hydrocarbon	PM	Particulate matter
ID	Ignition delay	ppm	Parts per million
DEE	Diethyl ether	D100	Pure diesel (100%)
JME	Jatropha biodiesel	D	Diesel
A1	(10% DEE + 10% JME + 90% D)	A2	(10% DEE + 15% JME + 75% D)
A3	(10% DEE + 20% JME + 70% D)	B1	(20% DEE + 10% JME + 75% D)
B2	(20% DEE + 15% JME + 75% D)	B3	(20% DEE + 20% JME + 75% D)

705

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715 **Disclosure statement**

Q9

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# Recent Advancements in Deep Learning

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**Abstract**— Deep learning (DL) is one of the most promising artificial intelligence (AI) methods that tries to imitate the workings of the human brain in processing information, and automatically generates patterns for decision making and other complicated tasks. DL is able to learn with/without human supervision, drawing from data, even unstructured and/or unlabelled. However, the achievements of DL techniques do not stop at only arriving and outperforming the results of other AI algorithms: DL's accomplishments are generally better than human results for tasks like image recognition or game playing, thus beyond the expectations of the experts. It is also one of the most popular scientific research trends now-a-days. Deep learning methods have brought revolutionary advances in computer vision and machine learning. Every now and then, new and new deep learning techniques are being born, outperforming state-of-the-art machine learning and even existing deep learning techniques. In recent years, the world has seen many major breakthroughs in this field. Since deep learning is evolving at a huge speed, its kind of hard to keep track of the regular advances.

**Keywords**— Neural Networks, Machine Learning, Deep Learning, Recent Advances, Reinforcement Learning

## I. INTRODUCTION

Learning with images and their classification, segmentation, localization, annotation, and abnormally detection is one of the current challenging and exciting task for the researchers. Recently deep learning techniques give excellent performance in Object Detection, Speech Recognition, Abnormality Detection, Business Analysis, and almost all other domains. But one important implication of deep learning techniques can found in Medical Image Analysis. Deep learning techniques beat the human-level performance and come with a better solution in the medical domain. Among different deep learning techniques Convolutional Neural Network, Recurrent Neural Network, Long Short-Term Memory, Deep Belief Network models are topmost priority for the researchers. In this paper, we briefly examine different application area of deep learning techniques and some current state-of-the-art performances of it. Recently Deep Learning Techniques come with a better solution for analysing different kinds of data. The idea of deep learning has a very old history. Because of its high computation power and colossal amount of data, deep learning techniques were not so popularly used back then. But in late 20s deep learning techniques accelerate its performance with the help of Graphical Processing Unit and massive amount of data. Deep Learning techniques gives state-of-the-art performance in almost all the domains like Object Detection, Speech Recognition, Fraud Detection, Face Recognition, Sentiment Analysis. Currently, deep learning techniques give excellent performance in medical image analysis. This paper explains different approaches for Deep learning, overview of Deep Learning topologies, Advancements in Deep Learning, Challenges in Deep learning and applications of Deep Learning.

## II. DEEP LEARNING TECHNIQUES

DL techniques are classified into three major categories: unsupervised, partially supervised (semi-supervised) and supervised. Furthermore, deep reinforcement learning (DRL), also known as RL, is another type of learning technique, which is mostly considered to fall into the category of partially supervised (and occasionally unsupervised) learning techniques.

### • Deep supervised learning

This technique deals with labeled data. When considering such a technique, the environs have a collection of inputs and resultant outputs  $(x_t, y_t) \sim p(x_t, y_t) \sim p$ . For instance, the smart agent guesses if the input is  $x_t$  and will obtain as a loss value. Next, the network parameters are repeatedly updated by the agent to obtain an improved estimate for the preferred outputs. Following a positive training outcome, the agent acquires the ability to obtain the right solutions to the queries from the environs. For DL, there are several supervised learning techniques, such as recurrent neural networks (RNNs), convolutional neural networks (CNNs), and deep neural networks (DNNs). In addition, the RNN category includes gated recurrent units (GRUs) and long short-term memory (LSTM) approaches. The main advantage of this





technique is the ability to collect data or generate a data output from the prior knowledge. However, the disadvantage of this technique is that decision boundary might be overstrained when training set doesn't own samples that should be in a class. Overall, this technique is simpler than other techniques in the way of learning with high performance.

- Deep semi-supervised learning

In this technique, the learning process is based on semi-labeled datasets. Occasionally, generative adversarial networks (GANs) and DRL are employed in the same way as this technique. In addition, RNNs, which include GRUs and LSTMs, are also employed for partially supervised learning. One of the advantages of this technique is to minimize the amount of labeled data needed. On other the hand, One of the disadvantages of this technique is irrelevant input feature present training data could furnish incorrect decisions. Text document classifier is one of the most popular example of an application of semi-supervised learning. Due to difficulty of obtaining a large amount of labeled text documents, semi-supervised learning is ideal for text document classification task.

- Deep unsupervised learning

This technique makes it possible to implement the learning process in the absence of available labeled data (i.e. no labels are required). Here, the agent learns the significant features or interior representation required to discover the unidentified structure or relationships in the input data. Techniques of generative networks, dimensionality reduction and clustering are frequently counted within the category of unsupervised learning. Several members of the DL family have performed well on non-linear dimensionality reduction and clustering tasks; these include restricted Boltzmann machines, auto-encoders and GANs as the most recently developed techniques. Moreover, RNNs, which include GRUs and LSTM approaches, have also been employed for unsupervised learning in a wide range of applications. The main disadvantages of unsupervised learning are unable to provide accurate information concerning data sorting and computationally complex. One of the most popular unsupervised learning approaches is clustering.

- Deep reinforcement learning

Reinforcement Learning operates on interacting with the environment, while supervised learning operates on provided sample data. This technique was developed in 2013 with Google Deep Mind [55]. Subsequently, many enhanced techniques dependent on reinforcement learning were constructed. For example, if the input environment samples:  $x_t \sim p(x_t \sim p)$ , agent predict:  $\hat{y}_t$  and the received cost of the agent is  $r_t$ ,  $P$  here is the unknown probability distribution, then the environment asks a question to the agent. The answer it gives is a noisy score. This method is sometimes referred to as semi-supervised learning. Based on this concept, several supervised and unsupervised techniques were developed. In comparison with traditional supervised techniques, performing this learning is much more difficult, as no straightforward loss function is available in the reinforcement learning technique. In addition, there are two essential differences between supervised learning and reinforcement learning: first, there is no complete access to the function, which requires optimization, meaning that it should be queried via interaction; second, the state being interacted with is founded on an environment, where the input  $x_t$  is based on the preceding actions.

For solving a task, the selection of the type of reinforcement learning that needs to be performed is based on the space or the scope of the problem. For example, DRL is the best way for problems involving many parameters to be optimized. By contrast, derivative-free reinforcement learning is a technique that performs well for problems with limited parameters. Some of the applications of reinforcement learning are business strategy planning and robotics for industrial automation. The main drawback of Reinforcement Learning is that parameters may influence the speed of learning. Here are the main motivations for utilizing Reinforcement Learning:

- It assists you to identify which action produces the highest reward over a longer period.
- It assists you to discover which situation requires action.
- It also enables it to figure out the best approach for reaching large rewards.





- Reinforcement Learning also gives the learning agent a reward function. Reinforcement Learning can't utilize in all the situation such as:
- In case there is sufficient data to resolve the issue with supervised learning techniques.
- Reinforcement Learning is computing-heavy and time-consuming. Specially when the workspace is large.

III. DEEP NETWORK TOPOLOGIES

A. Deep neural network (DNN):

In DNN, there is multilayer perceptron or hidden layer between the input and output. All the layers are connected to previous layers; by going through each layer, the network estimates the exact output based on the weights and activation function. Through DNN, we can model any complex non-linear relation. The backbone of the DNN is the characteristic of learning about the feature that is most relevant to the targets [7]. The DNN has research gap in model selection, training dynamics, by using graph convolution neural network combination optimization, and Bayesian neural network for estimation of uncertainty. There are a lot of applications for DNN, that is, computer vision, machine translation, social network filtering, playing board, video games, and medical diagnosis (Figure 1).

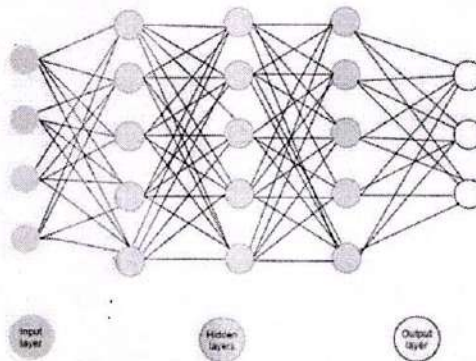


Fig. 1 Deep Neural Network

B. Recurrent neural network (RNN):

RNN is a type of deep learning network that is used specifically when there is sequential data or time-series, that is, video, speech, etc. The RNN usually maintained the data from the previous state to the next state. It is called recurrent because it performs the same function for each input, while the output is different because it also depends on past calculations. The state-of-the-art topic of deep learning with RNN is Long Short-Term Memory Network (LSTM). RNN provides the solution to many problems, that is, intelligent transportation system [8], solving time-varying matrix inversion [9], and many more. The RNN is famous for sentence evaluation and linguistic data processing (Figure 2).

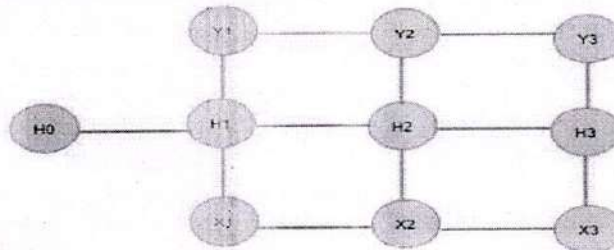


Fig. 2 Recurrent Neural Network





*C. Deep belief network (DBN):*

DBN is a probabilistic unsupervised deep learning algorithm. It has many layers of hidden variables. To solve the more complex problems, it needs more hidden layers; each layer is a special statistical relation with the other layer. DBN can learn probabilistically; after learning, DBN needs training under supervisor to perform classification. The DBN is used to recognize clusters and generates images, video sequences, and motion-capture data (Figure 3).

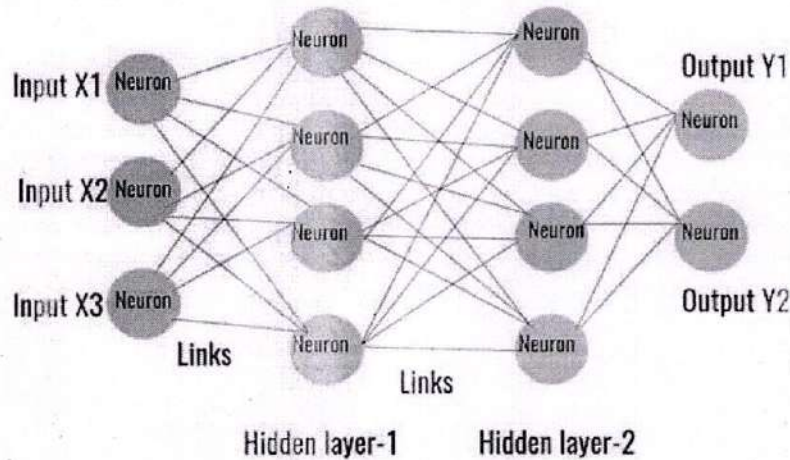


Fig. 3 Deep Belief Network

*D. Boltzmann machine (BM):*

The BM is a network that is a uniformly attached, neuron-like unit, which is responsible for taking decisions stochastically about whether to be off or on. Computational problems are solved through BM like search, optimization, and learning problem. Many features are uncovered in learning algorithm that shows Figure 1. Deep neural network. Figure 2. Recurrent neural network. Advances and Applications in Deep Learning 6 very complex behavior in training dataset. Boltzmann machine is used for classification and dimensionality reduction.

*E. Restricted Boltzmann machine (RBM):*

RBM introduced in 1986 by Smolensky: two layers visible and hidden units, while there is no connection between visible-visible and hidden-hidden. It can learn a probability distribution over a collection of datasets. The applications of RBM are features learning, collaborative filtering, dimensionality reduction, and classification.

*F. Convolutional neural network (CNN):*

In CNN, the layers are delicately connected to input layer as well as each other. There is a specific function for each neuron of the subsequent layer like it is only responsible for only a part of the input. CNN is now widely used for remote sensing, computer vision, audio, and text processing.

Deep auto-encoder: Just like others, deep auto-encoder has also many hidden layers. The difference between a simple auto-encoder and deep-auto-encoder is the simple auto-encoder that has one hidden layer, while the deep-auto-encoder has many hidden layers. In deep-auto-encoder, the training is complex normally, you need to train one hidden layer first to reconstruct the structure of the input data, and this input data are further used to train other hidden layers and so on. Some applications of deep auto-encoder are image extraction, image generation recommendation system, and sequence to sequence prediction.

*G. Gradient descent (GD):*





GD is used to reduce the overall cost function; it is considered as an optimization algorithm and is widely used for determination of coefficient function in machine learning. When there is not possible to estimate the parameters analytically, then Figure 4. Deep belief network. 7 GD is used to calculate the desired parameters. Using the GD weight of the model is updated for every epoch. It is used for supervised machine learning.

H. Stochastic gradient descent (SGD):

Just like GD, SGD is also an optimization algorithm but GD is used when the datasets are small, while SGD is usually used when the datasets are large, and SD becomes very costly if used for a large number of datasets.

IV. ADVANCEMENT IN DEEP LEARNING

A. GrowNet

tl;dr: GrowNet applies gradient boosting to shallow neural networks. It has been rising in popularity, yielding superior results in classification, regression, and ranking. It may indicate research supporting larger ensembles and shallower networks on non-specialized data (non-image or sequence).

Gradient boosting has proven to become very popular in recent years, rivalling that of a neural network. The idea is to have an ensemble of weak (simple) learners, where each corrects the mistake of the previous. For instance, an ideal 3-model gradient boosting ensemble may look like this, where the real label of the example is 1.

1. Model 1 predicts 0.734. Current prediction is 0.734.
2. Model 2 predicts 0.464. Current prediction is 0.734+0.464=1.198 .
3. Model 3 predicts -0.199. Current prediction is 1.198-0.199=0.999.

Each model is trained on the residual of the previous. Although each model may be individually weak, as a whole the ensemble can develop incredible complexity. Gradient boosting frameworks like XGBoost use gradient boosting on decision trees, which are one of the simplest machine learning algorithms.

There has been some discussion on neural networks not being weak enough for gradient boosting; because gradient boosting has so much capability for overfitting, it is crucial that each learner in the ensemble be weak.

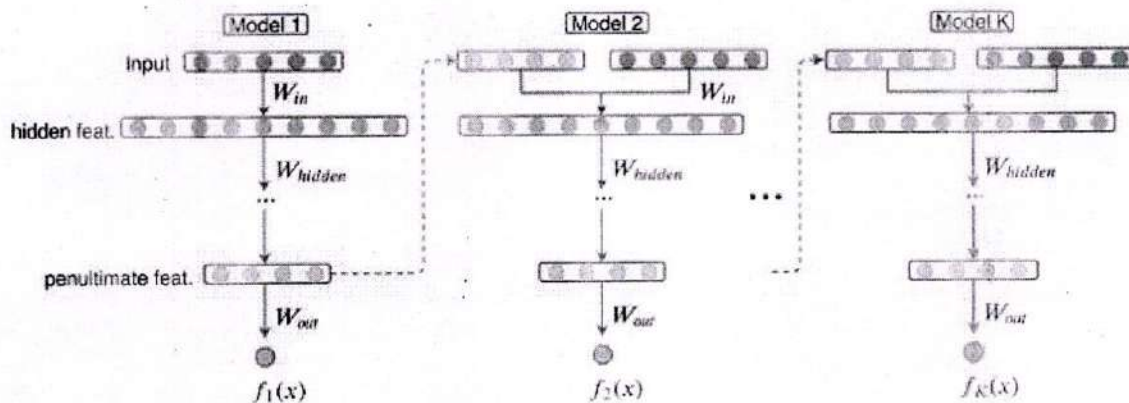


Fig. 4 GrowNet

B. TabNet

tl;dr: TabNet is a deep learning model for tabular data, designed with the ability to represent hierarchical relationships and draws inspiration from decision tree models. It has yielded superior results on many real-world tabular datasets.





Neural networks are famously bad at modelling tabular data, and the accepted explanation is because their structure — very prone to overfitting — instead succeeds in recognizing the complex relationships of specialized data, like images or text.

Decision-tree models like XGBoost or Adaboost have instead been popular with real-world tabular data, because they split the feature space in simple perpendicular planes. This level of separation is usually fine for most real-world datasets; even though these models, regardless how complex, make assumptions about decision boundaries, over fitting is a worse problem. Yet for many real-world datasets, decision-tree models are not enough and neural networks are too much. TabNet was created by two Google researchers to address this problem. The model relies on a fundamental neural network design, which makes decisions like a more complex decision tree.

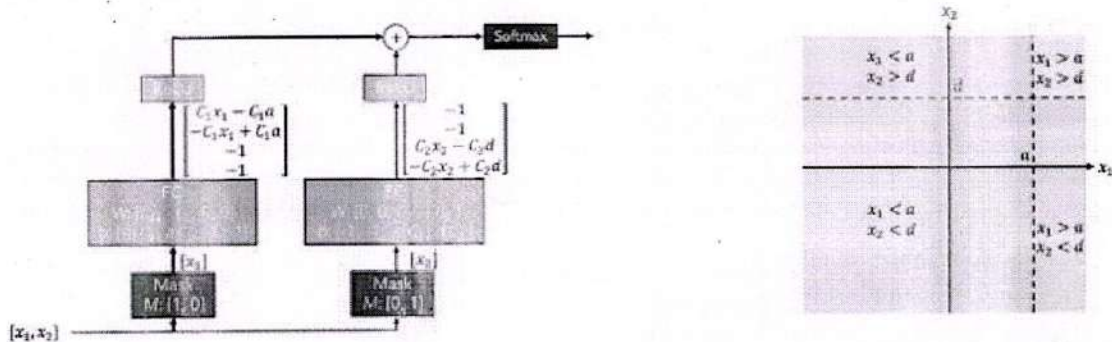


Fig. 5 Simple decision tree-like neural network. The real TabNet architecture is deeper and the left model's division of the feature space, which is much like how a decision tree would split the feature space. Furthermore, TabNet is trained in two stages. In the unsupervised pre-training stage, the model is trained to predict masked values in the data. Decision-making layers are then appended to the pretrained encoder and supervised fine-tuning takes place. This is one of first instance of incredibly successful unsupervised pre-training on tabular data. Critically, the model uses attention, so it can choose which features it will make a decision from. This allows it to develop a strong representation of hierarchical structures often present in real-world data. These mechanisms mean input data for TabNet need no processing whatsoever. TabNet is very quickly rising among data scientists; almost all of top-scoring competitors in the Mechanisms of Action Kaggle competition, for instance, incorporated TabNet into their solutions. Because of its popularity, it has been implemented in a very simple and usable API. This represents a broadening of deep learning past extremely specialized data types, and reveals just how universal neural networks can be.

C. EfficientNet

Model scaling to improve deep CNNs can be unorganized. Compound scaling is a simple and effective method that uniformly scales the width, depth, and resolution of the network. EfficientNet is a simple network with compound scaling applied to it, and yields state of the art results. The model is incredibly popular in the image recognition work.

Deep convolutional neural networks have been growing larger in an attempt to make them more powerful. Exactly how they become bigger, though, is actually quite arbitrary. Sometimes, the resolution of the image is increased (more pixels). Other times, it may be the depth (# of layers) or the width (# of neurons in each layer) that are increased.

Compound scaling is a simple idea: instead of scaling them arbitrarily, scale the resolution, depth, and width of the network equally.

If one wants to use  $2^3$  times more computational resources, for example; increase the network depth by  $\alpha^3$  times





increase the network width by  $\beta^3$  times  
 increase the image size by  $\gamma^3$  times

The values of  $\alpha$ ,  $\beta$ , and  $\gamma$  can be found through a simple grid search. Compound scaling can be applied to any network, and compound-scaled versions of models like ResNet have consistently performed better than arbitrary scaled ones.

The authors of the paper developed a baseline model, EfficientNetB0, which consists of very standard convolutions. Then, using compound scaling, seven scaled models — EfficientNetB1 to EfficientNetB7 — were created.

The results are amazing — EfficientNets were able to perform better than models that required 4 to 7 times more parameters and 6 to 19 times more computational resources. It seems that compound scaling is one of the most efficient ways to utilize neural network space.

EfficientNet has been one of the most important recent contributions. It indicates a turn in research towards more powerful but also efficient and practical neural networks.

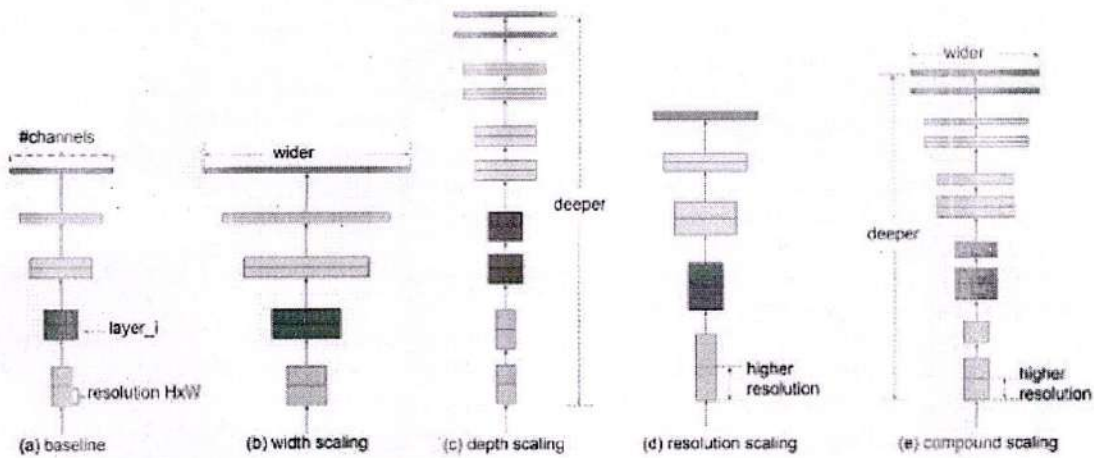


Fig. 6. EfficientNet

*D. The Lottery Ticket Hypothesis*

tl;dr: Neural networks are essentially giant lotteries; through random initialization, certain subnetworks are mathematically lucky and are recognized for their potential by the optimizer. These subnetworks ('winning tickets') emerge as doing most of the heavy lifting, while the rest of the network doesn't do much. This hypothesis is groundbreaking in understanding how neural networks work.

Why don't neural networks overfit? How do they generalize with so many parameters? Why do big neural networks work better than smaller ones when it is common statistics principle that more parameters = overfitting?

"Bah! Go away and shut up!" grumbles the deep learning community. "We don't care about how neural networks work as long as they work." Too long have these big questions been under-investigated.

One common answer is regularization. However, this doesn't seem to be the case — in a study conducted by Zhang et al., an Inception architecture without various regularization methods didn't perform much worse than one with. Thus, one cannot argue that regularization is the basis for generalization.

Neural network pruning offers a glimpse into one convincing answer.





With neural network pruning, over 90 percent — in some cases 95 or even 99 percent — of neural network weights and neurons can be eliminated with little to no loss on performance. How can this be?

Imagine you want to order a pen on Amazon. When the delivery package arrives, you find it is in a large cardboard box with lots of stuffing inside it. You finally find the pen after several minutes of searching.

After you find the pen, the stuffing doesn't matter. But before you find it, the stuffing is part of the delivery. The cardboard box with the stuffing is the neural network, and the pen is the subnetwork doing all the real work. After you locate that subnetwork, you can ditch the rest of the neural network. However, there needs to be a network in the first place to find the subnetwork.

**Lottery Ticket Hypothesis:** In every sufficiently deep neural network, there is a smaller subnetwork that can perform just as well as the whole neural network.

Weights in the neural network begin randomly initialized. At this point, there are plenty of random subnetworks in the network, but some have more mathematical potential. That is, the optimizer thinks it is mathematically better to update this set of weights to lower the loss. Eventually, the optimizer has developed a subnetwork to do all the work; the other parts of the network do not serve much of a purpose.

Each subnetwork is a 'lottery ticket', with a random initialization. Favorable initializations are 'winning tickets' identified by the optimizer. The more random tickets you have, the higher probability one of them will be a winning ticket. This is why larger networks generally perform better.

This hypothesis is particularly important to proposing an explanation for the Deep Double Descent, in which after a certain threshold, more parameters yields a better generalization rather than less.

The Lottery Ticket Hypothesis is one giant step forward towards understanding truly how deep neural networks work. Although it's still a hypothesis, there is convincing evidence for it, and such a discovery would transform how we approach innovation in deep learning.

#### *E. The Top-Performing Model With Zero Training*

tl;dr: Researchers developed a method to prune a completely randomly initialized network to achieve top performance with trained models.

In close relationship with the Lottery Ticket Hypothesis, this study explores just how much information can lie in a neural network. It's common for data scientists to see "60 million parameters" and underestimate how much power 60 million parameters can really store.

In support of the Lottery Ticket Hypothesis, the authors of the paper developed the edge-popup algorithm, which assesses how 'helpful' an edge, or a connection, would be towards prediction. Only the k% more 'helpful' edges are retained; the remaining ones are pruned (removed).

Using the edge-popup algorithm on a sufficiently large random neural network yields results very close to, and sometimes better than, performance of the trained neural network with all of its weights intact. That's amazing — within a completely untrained, randomly initialized neural network lies already a top-performing subnetwork. This is like being told that your name can be found in a pretty short sequence of random letters.

This study is more of a question than an answer. It points us in an area of new research: getting to the bottom of exactly how neural networks work. If these findings are universal, surely there must be a better training method that can take advantage of this fundamental axiom of deep learning waiting to be discovered.

## V. APPLICATIONS OF DEEP LEARNING

### *A. Automatic Speech Recognition (ASR)*

Google has announced that Google voice search had taken a new turn by adopting Deep Neural Networks (DNN) as the core technology used to model the sounds of a language in 2012 [8]. DNN replaced Gaussian Mixture Model which has been in the industry for 30years. DNN also has proved that it is better able to measure which sound a user is fabricating at every instant in time and with this they





delivered prominently increased speech recognition accuracy. In 2013, DL has gained full momentum in both ASR and ML [9]. DL is basically linked to the use of multiple layers of nonlinear transformations to derive speech features, while learning with shallow layers comprises the use of exemplar-based representations for speech features which have high dimensionality but typically vacant entries.

#### B. Image Recognition

Deep max-pooling convolutional neural networks is used to detect mitosis in breast histology images was presented in [10]. Mitosis detection is very hard. In fact, mitosis is a complex process during which a cell nucleus undergoes various transformations. In this approach, DNN as powerful pixel classifier which operates on raw pixel values and no human input is needed. Hence, DNN automatically learns a set of visual features from the training data. DNN is tested on a publicly available dataset and significantly outperforms all competing techniques, with manageable computational effort: processing a 4MPixel image requires few minutes on a standard laptop. Large and deep convolutional neural network is trained to classify the 1.2 million high resolution images in the ImageNet LSVRC-2010 contest into 1000 different classes [11]. On the test data, they achieved top-1 and top-5 error rates of 37.5% and 17.0% which is considerably better than the previous state-of-the-art. From all the experiments, the results can be improved simply by waiting for faster GPUs and bigger datasets to become available.

#### C. Natural Language Processing

Recently, deep learning methods have been successfully applied to a variety of language and information retrieval applications. By exploiting deep architectures, deep learning techniques are able to discover from training data the hidden structures and features at different levels of abstractions useful for the any tasks. In 2013, [12] proposed a series of Deep Structured Semantic Models (DSSM) for Web search. More specifically, they use a DNN to rank a set of documents for a given query as follows. First, a non-linear projection is performed to map the query and the documents to a common semantic space. Then, the relevance of each document given the query is calculated as the cosine similarity between their vectors in that semantic space. The neural network models are discriminatively trained using the click-through data such that the conditional likelihood of the clicked document given the query is maximized. The new models are evaluated on a Web document ranking task using a real-world data set. Results show that the proposed model significantly outperforms other latent semantic models, which were considered state-of-the-art in the performance prior to the work presented in [12].

#### D. Drug Discovery and Toxicology

Quantitative Structure Analysis/Prediction Studies (QSAR/QSPR) attempt to build mathematical models relating physical and chemical properties of compounds to their chemical structure. In [13], multi-task learning is applied to QSAR using various neural network models. They used an artificial neural network to learn a function that predicts activities of compounds for multiple assays at the same time. The method is compared with alternative methods and reported that the neural nets with multi-tasking can lead to significantly improved results over baselines generated with random forests. In 2015, AtomNet has been introduced as first structure-based, deep convolutional neural network which designed to predict the bioactivity of small molecules for drug discovery applications [14]. This paper also demonstrates how to apply the convolutional concepts of feature locality and hierarchical composition to the modeling of bioactivity and chemical interactions. AtomNet outperforms previous docking approaches on a diverse set of benchmarks by a large margin, achieving an AUC greater than 0.9 on 57.8% of the targets in the DUDE benchmark.

#### E. Customer Relationship Management

A framework for autonomous control of a customer relationship management system been charted by [15]. First, a modified version of the widely accepted Recency-Frequency Monetary Value system of metrics can be used to define the state space of clients or donors is explored. Second, a procedure to determine the optimal direct marketing action in discrete and continuous action space for the given individual, based on his position in the state space is described. The procedure involves the use of model-





free Q-learning to train a deep neural network that relates a client's position in the state space to rewards associated with possible marketing activities. The estimated value function over the client state space can be interpreted as customer lifetime value (CLV), and thus allows for a quick plug-in estimation of CLV for a given client. Experimental results are presented, based on Knowledge Discovery and Data Mining Tools Competition, mailing dataset of donation solicitations.

#### F. Recommendation Systems

Automatic music recommendation has become an increasingly relevant problem in recent years, since a lot of music is now sold and consumed digitally. Most recommender systems rely on collaborative filtering. In 2013, [16] proposed to use a latent factor model for recommendation, and predict the latent factors from music audio when they cannot be obtained from usage data. Traditional approach is compared using a bag-of-words representation of the audio signals with deep convolutional neural networks, and the predictions is evaluated by quantitatively and qualitatively on the Million Song Dataset. The result shows that the recent advances in DL translate very well to the music recommendation setting, with deep convolutional neural networks significantly outperforming the traditional approach. Recent online services rely heavily on automatic personalization to recommend relevant content to a large number of users. This requires systems to scale promptly to accommodate the stream of new users visiting the online services for the first time. Work by [17] in 2015 proposed a content-based recommendation system to address both the recommendation quality and the system scalability. They also proposed to use a rich feature set to represent users, according to their web browsing history and search queries. They use a DL approach to map users and items to a latent space where the similarity between users and their preferred items is maximized. Scalability analysis show that the multi-view DNN model can easily scale to encompass millions of users and billions of item entries.

#### G. Bioinformatics

The annotation of genomic information is a major challenge in biology and bioinformatics. Existing databases of known gene functions are incomplete and prone to errors, and the bimolecular experiments needed to improve these databases are slow and costly. While computational methods are not a substitute for experimental verification, they can help in two ways: algorithms can aid in the curation of gene annotations by automatically suggesting inaccuracies, and they can predict previously-unidentified gene functions, accelerating the rate of gene function discovery. In this work [18], an algorithm that achieves both goals using deep auto encoder neural networks is developed. With experiments on gene annotation data from the Gene Ontology project, it shows that deep auto encoder networks achieve better performance than other standard machine learning methods, including the popular truncated singular value decomposition.

### VI. CONCLUSIONS

Deep learning is continuously evolving faster; still, there are a number of problems to deal with and can be solved using deep learning. Even though a full understanding of the working of deep learning is still a mystery, we can make machines smarter using deep learning, sometimes even smarter than human. Now, the aim is to develop deep learning models that work with mobile to make the applications smarter and more intelligent. Let deep learning be more devoted to the betterment of humanity thus making our domain a better place to live. we have touched most of the sensitive applications of deep learning including computer vision, pattern recognition, speech recognition, virtual assistant, driverless car, personisation, etc. Along with applications we also put light on the challenges in deep learning for the successful implementation of these applications. With the fast development of hardware resources and computation technologies, we are confident that deep neural networks will receive wider attention and find broader applications in the future. Still there is vast scope for further extensive research. In particular, more work is necessary on how we can adapt Deep Learning algorithms for problems associated with Big Data with high dimensionality, sparsity, streaming data analysis, scalability of Deep Learning models





improved formulation of data abstractions, distributed computing, semantic indexing, data tagging, information retrieval, criteria for extracting good data representations, and domain adaptation. Future works should focus on addressing one or more of these problems often seen in Big Data.

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#### VII. CONCLUSIONS

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# 5G AND INTERNET OF THINGS: A SURVEY

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**Abstract**— As the IOT is gaining popularity there is a requirement for a technology which can support large amounts of data transmission efficiently and at very high bandwidth. The existing 4G networks have been widely used in the Internet of Things (IoT) and is continuously evolving to match the needs of the future Internet of Things (IoT) applications. The 5G networks are expected to massive expand today's IoT that can boost cellular operations, IoT security, and network challenges and driving the Internet future to the edge. The existing IoT solutions are facing a number of challenges such as large number of connection of nodes, security, and new standards. In the near future, i.e. next gen IOT devices, some of the prime objectives or demands that need to be addressed are increased capacity, improved data rate, decreased latency. The development of next generation wireless mobile communication technology namely, 5G which promises to fulfill the needs of complex IOT architectures. This paper focuses on the 5G-IOT architecture, Requirements in 5G enabled IoT, Key enabling technologies in 5G-IoT, Opportunities and challenges of 5G in IoT, The Impact of 5G on Io, Applications of 5G -IoT.

**Keywords**—IoT, 5G, WNFV

## 1. INTRODUCTION

Over the past few decades, the Internet of Things (IoT) has revolutionized the pervasive computing with multitude of applications built around various types of sensors. A vast amount of activity is seen in IoT based product. With most of the issues at device and protocol levels solved during the past decade, there is now a growing trend in integration of sensors and sensor based systems with cyber physical systems and device-to-device (D2D) communications. 5th generation wireless systems (5G) are on the horizon and IoT is taking the center stage as devices are expected to form a major portion of this 5G network paradigm. IoT technologies such as machine to machine communication complemented with intelligent data analytics are expected to drastically change landscape of various industries. The emergence of cloud computing and its extension to fog paradigm with proliferation of intelligent 'smart' devices is expected to lead further innovation in IoT. Communication technology is a critical component of the Internet of Things (IoT) technology. The interconnection of devices in the Internet of Things is via various networks. The newly developed 5G connectivity technology is critical in the realm of IoT [1, 2]. The evolving of fifth generation (5G) networks is becoming more readily available as a major driver of the growth of IoT applications. New applications and business models in the future IoT require new performance criteria such as massive connectivity, security, trustworthy, coverage of wireless communication, ultra-low latency, throughput, ultra-reliable, et al. for huge number of IoT devices. In the last few decades, wireless technology has advanced significantly. The first generation (paging services) was followed by the second and third generations (voice and message services, as well as Internet access), and subsequently by the fourth generation (4G or Long Term Evolution [LTE]) with video streaming capabilities. The fifth-generation (5G) of mobile communications is now accessible worldwide. The potential presented by 5G technology is undeniably exciting; yet, the technology's adoption is fraught with difficulties and hazards. 5G technology is integrating with the internet of things. Businesses and individuals in cities with mature cellular infrastructure will benefit first from 5G, and IoT advancements will be inextricably linked to this latest generation of cellular networking. Similar to how 4G and LTE enhanced the user experience for personal area networks (PANs) and wide area networks (WANs), 5G promises to do the same for both.[11] This paper summarizes requirements, technologies used, architecture, opportunities and challenges associated with the Internet of Things (IoT) in 5G wireless networks.

## 2. REQUIREMENTS OF 5G ENABLED IOT

With the drastic increase in the total data traffic, 5G networks must urgently provide high data rates, seamless connectivity, robust security and ultra-low latency communication. In addition, with the emergence of the internet-of-things (IoT) networks, the number of connected devices to the internet is increasing dramatically. This fact implies not only a significant increase in data traffic, but also the emergence of some IoT services with crucial requirements. As shown in Fig. 1, such requirements include high data rates, high connection density, ultra reliable low latency communication (URLLC) and security. The required connection density needs to be achieved with quality of service in such a way that at least 99% of the packets get a successful receipt within 10 s.





For higher data rate in 5G enabled IOT, non-orthogonal multiple access (NOMA) is considered as promised technology.

Ultra-Reliable Low Latency Communications (URLLC), a subset of the 5G network architecture, ensures more efficient scheduling of data transfers, achieving shorter transmissions through a larger subcarrier, and even scheduling overlapping transmissions.

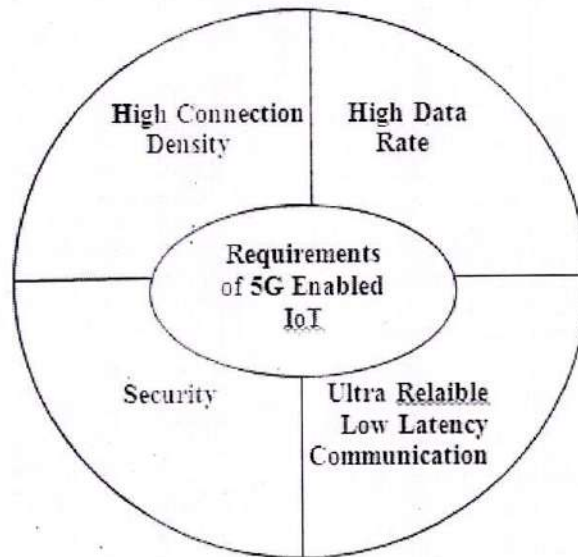


Figure 1. Requirements of 5G Enabled IoT

### 3. KEY ENABLING TECHNOLOGIES IN 5G-IOT

The key enabling technologies used in 5G networks include Nano chips, Device-to-device (D2D) communication, Machine-to-machine (M2M) communication, Millimetre Wave, Wireless Software-Defined Networking (WSDN), Mobile cloud Computing, Quality of Service (QoS), Wireless Network Function Virtualization (WNFV), Vehicle-to-everything (V2X), Full-Duplex and Green Communication, Advanced Spectrum Sharing and Interference Management (Advanced SSIM, Mobile Edge Computing, Data Analytics and Big Data, Security and private Forensic. Some of the key technologies are explained below.

**Nano-chip:** Over the past two decades, Nano-Chip based devices have found general applications in the analysis of biological and chemical samples. A tiny chip, which puts under the skin and by an electric field, reprogrammed cells could be an invention in the form we heal injured or aging tissue. Researchers say Nano-chip could cure injuries or with one touch, regrow organs. However, the usage of Nano-chip based devices will not be limited to medical applications; for example, this technology could be used in military and home automation applications which will cover the huge part of IoT applications.[3]

**Millimeter Wave (mmWave):** In last decade, the accessibility of frequency spectrum below 6 GHz bands have been coming down and the request for higher data rate is rising. The higher frequencies such as the millimeter wave (mmWave) which its frequency bands is above 24 GHz have been recommended as candidates for future 5G IoT applications because larger bandwidth could be considered to improve the capability and permit the users to use very high data rates for short range applications [4]. The frequency band of 24-28 GHz has exploited as one of the considered bands for 5G-IoT applications [5].

**Direct Device to Device (D2D) Communication:** Direct Device-to-Device (D2D) Communication has designed as a new way for short-range data transmission, which will benefit the 5G-IoT with lower power consumption, better QoS for users and load balancing. The traditional Macro-cell Base Station (MBS) has considered supplying low power BS, However, D2D enable information transmissions between edge user equipment without of BS and serves as a "Cell Tier" in 5G-IoT.[3]

**Machine-Type Communication (MTC):** Machine-type communications (MTC) or machine-to-machine communications (M2M) represent automated data communications between the elemental infrastructure of data transport and devices. The data communications developed right between two MTC devices, or between an MTC device and a network. MTC sets up a wide range of applications from a large deployment of autonomous





devices to mission critical services. Cellular systems (especially 5G) has considered as an important candidate to provide connectivity for MTC devices. MTC devices are more becoming an essential part of our lifestyle. The high data rate support and other salient features of MTC appear situation that 5G-Plus- HetNet has seen as a strong technology solution in 5G-IoT to the increasing data transfer demands from MTC devices.

**Wireless Software-Defined Networks (WSDN):** Wireless Software-Defined Networking (WSDN) is new technology that approaches to mobile cloud computing which aids network management and enables network configuration instead of improving network performance or network monitoring. The current networks require more flexibility and easy troubleshooting; to reach this subject, SDN breaks the vertical assimilation of traditional networks and through the centralized network control provide the flexibility to program the network. SDN is able to adapt the parameters of its network on the fly based on its operating conditions [33]. The 5G networks can be implemented through WSDN paradigm to provide faster and scalable 5G-IoT systems.

**Wireless Network Function Virtualization (WNFV):** Wireless Network Function Virtualization (WNFV) refer to network services and functions to wirelessly view network resources, such as databases, routers, links, and data, in a way that is separate from the general physical infrastructure, and to use these resources as service requirements as it needs. The WNFV separate a physical network into various virtual networks, therefore the devices can be reconfigured to organize various networks according to the requirements of applications. The WNFV as a supplementary to the 5G networks will enable the virtualization of the whole network functions for simplifying the deployment of 5G-IoT. The WNFV provides the scalable and flexible network for 5G-IoT applications, which will enable a customized network to create programmable networks for 5G-IoT applications. [3].

**Mobile Cloud Computing (MCC):** The cloud computing is an encouraging computing paradigm in the academia and industry, which refers to leverage virtualization technologies provide a variety of deployment models and service models, from public clouds to private ones, and from Infrastructure as a Service model to Software. Also, the cloud computing provides computing resources like processor, storage, and networks as a service. The benefits, such as efficient capability, on-demand self-service, accessibility, and scalability make cloud computing a computing resource opportunity for mobile devices.

#### 4. ARCHITECTURE OF 5G-IOT

In this section, an architecture that is suitable for the requirements of upcoming IoT applications and Services is explained. The new architecture is developed based on the Technologies like Nano chip, millimeter wave, Mobile Edge computing, Mobile Cloud Computing, Heterogeneous Networks (Het-Net), Direct Device to Device (D2D) Communication, Wireless Software-Defined Networks (WSDN), Machine-Type Communication (MTC), Wireless Network Function Virtualization (WNFV), Data analytics and Big Data etc to provide a more sustainable, scalable, and mobile IoT ecosystem. The architecture is called as the 5G-IoT, which have following features, Modular, Efficient, Agile, Scalable, Simple, responsive to high demands.

The architecture consists of eight interconnected layers with two-way data-exchange capability as shown in Figure 1. The second layer and fifth layer consist of two and three sublayers, respectively, and the security layer covers all other layers. These layers are selected to provide the best performance and maintain the modularity of the architecture simultaneously. The new technologies presented are embedded in the design of this architecture to address the mentioned future challenges. The technologies with completely separate functionalities are embedded in different layers for ease of analysis, scalability, and modularity[12]. Different layers are explained below.





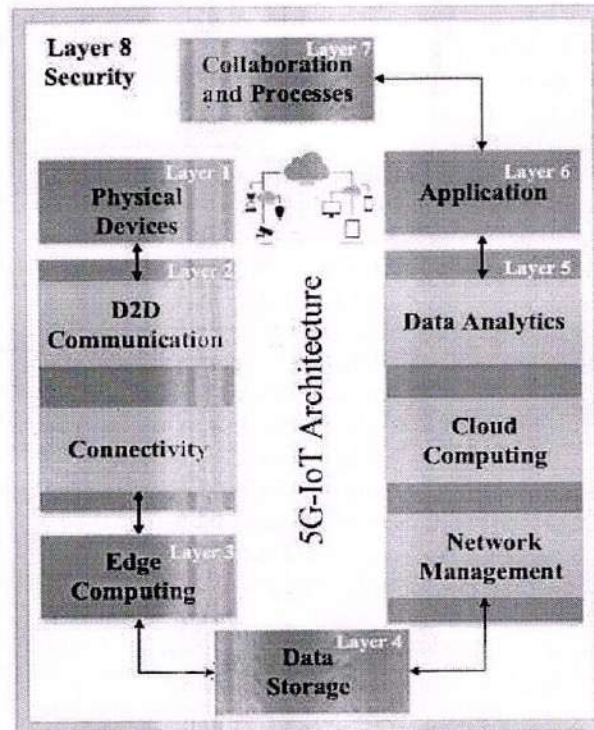


Figure 1. 5G-IoT architecture.

**Physical Device Layer:** This layer consists of wireless sensors, actuators, and controllers, which actually are the Physical devices called as “things” in IOT. In this layer, small size devices such as Nano-Chips are to be employed to increase computational processing power and to reduce power consumption. Nano-Chips are able to produce a high amount of initially processed data which is suitable for Big Data at data analytic layer (layer 7).

**Communication Layer:** This layer consist of two sublayers. D2D Communication and Connectivity layers.

**Direct Device To Device (D2D) Communication Sub-Layer:** Due to the increasing processing power and intelligence of physical devices (nodes), they contain their own identity and personality and generate their own data. To increase the efficiency and capabilities of the IoT systems, these devices should form a HetNet to communicate each other. Up-to-date communication protocols of the wireless sensor network (WSN) are exploited in this sub-layer.

One of the most important technologies which improves this sub-layer is the mm Wave. In addition, at this sub-layer, 5G is another optional technology which is able to enhance the D2Dcommunication. The 5G has considered as an important candidate to provide connectivity for MTC devices. The high data rate support and other salient features of MTC make a situation that 5G-Plus-HetNet has been considered as a strong technology solution in the 5G-IoT architecture.

**Connectivity sub-layer:** In this sub-layer, devices are connected to communication centers, such as BSs. Also, they send and analyze their data through the centers by the Intranet connection to the storage unit. Another technology of this sub-layer is Advanced SSIM. By this technology, the IoT devices attain the capability of choosing suitable spectrum (frequency bands) with sufficiently low interference. In near future, deployment of the 5G makes a great evolution at this sub-layer in the sense of reliability, performance, and agility.

**Edge (Fog) Computing Layer:** The function of this layer to edge process the data by nodes or their leaders in order to make decisions at the Edge level. With the introduction of 5G technology and the rise of mobile devices (such as smartphones), MEC technology will be more powerful to overcome the challenges, and will significantly contribute at this layer.

**Data Storage layer:** This layer provides data storage units in which the information obtained from edge processed information and raw data is stored. This layer requires security and also should be responsive to the huge data volume and traffic of future applications.





**Management Service layer:** This layer consist of three sub-layers as follows:

**Network Management Sub-Layer:** Network management involves changing the type of communication between devices and data centers.

**Cloud Computing Sub-Layer:** In this sub-layer, data and information from the edge computing are (re)processed in the cloud so that final processed information can be derived.

**Data Analytics Sub-Layer:** In this sub-layer, new methods of data analytics and enhanced Big Data algorithms are employed to produce value (manipulatable information) from raw data.

**Application Layer:** In this layer, Software interacts with previous layers and data, which is at rest, so it is not necessary to operate at speed of the network. Applications layer let the business people do the right thing at the right time by the right data.

**Collaboration and Processes Layer:** The IoT system and the information arrives from the previous layers are not useful unless it produces an act. People use applications and associated data for their particular needs. Sometimes, multiple individuals use the same application for different purposes. In fact, individuals must be able to collaborate and communicate to make the IoT serviceable.

**Security Layer:** This layer covers and protects all previous layers but each section (the intersection of this layer with another layer) has its own functionality. The security layer provides various terms of security features including data encryption, user authentication, network access control and cloud security. In addition, security layer also prevents and anticipates the dangers and cyber-attacks, including the forensics to detect the type of attack and fail them.

## 5. OPPRTUNITIES AND CHALLENGES IN 5G-IOT

### Opportunities of 5G in IOT:

When compared to previous generations, 5G technology is capable of significantly greater performance. Under optimum conditions, it produces the best results. Download speeds of up to 20 gigabits (GB) per second, which is 200 times faster than current 4G technology. In comparison to 4G technology, which has a latency of 50 milliseconds or more, 5G technology has a latency of less than one millisecond (the time it takes to send data from the source to the destination); and a significant increase in connection density from the current norm of 2,000 devices per km<sup>2</sup> to one million devices per km<sup>2</sup> [8]. As a result of this enhanced performance, several existing and future technologies will accelerate growth, including the Internet of Things (IoT), which comprises things (such as appliances) that can interact with one another over the Internet.

Among other things, the ability to slice networks will be provided by 5G technology, which will enable a single physical infrastructure to serve several logical networks. As a result, an Internet service provider may offer a range of services with variable performance characteristics (for example, download speed, latency, or download use limits) via the same physical network to meet the demands of various clients. On the other side, network slicing may not be fully compatible with the current concept of net neutrality, and the federal government may need to determine if this is permissible under existing law. Canada and other nations might see significant economic benefits from the deployment of 5G technology. India would require as much as 22 million or 2.2 crore skilled manpower by 2025 as the country inches closer to the fifth-generation or 5G-centric technologies such as Internet of Things (IoT). To be sure, the Organization for Economic Cooperation and Development states that the extent to which 5G technology benefits society will be decided by the speed with which it can be developed and deployed, as well as the speed with which the regulatory environment can be reformed[7,8].

### Challenges of 5G in IOT:

The global growth of IoT is projected to necessitate the development of future 5G mobile networks with billions of connected smart objects and sensors. There will be real-time IoT application cases to aid in the creation of a realistic portrayal of mission-critical. From vehicle-to-infrastructure communications to automated responses. Vehicle-to-vehicle (V2V) communication and movement at high speeds, as well as a Process control system. The internet of things includes sensor nodes called motes that are capable of performing certain tasks and collecting data. Then transmit this data across the network to the embedded system for additional processing and analysis [7]. Security is the most promising challenge for 5G-IOT. Managing security issues has always been a critical component of establishing a foothold in the realm of IoT [9]. The need of protecting and securing IoT devices cannot be overstated these days, as the number of IoT devices grows rapidly not only in common/private areas but also in



contemporary places. As IoT is the execution and synthesis of many enhancements and foundations, the IoT framework that utilizes these breakthroughs acquires all security challenges and risks associated with each organization's innovations. This implies that security risks exist at all tiers of an IoT design. IoT frameworks have outstanding characteristics that enable the creation of new types of security offers that are not available in conventional businesses. The majority of gadgets that operate at the sensor/actual layer of an IoT framework have limited processing power and storage capacity; as a result, typical security measures such as public-key encryption and spread-range processes cannot be used by all endpoints. Despite the growing number of (Industrial) IoT applications, there is still no widely accepted standard for IoT frameworks.

## 6. THE IMPACT OF 5G ON IOT

Today, disconnected networks are a major challenge for IoT technologies. The capacity of 5G to transmit data more rapidly and allow more connections will help at once address this issue as well as simplify the management of connected devices. In contrast, 5G will be able to process data quickly using 4G/LTE networks, which has been a challenge for IoT solutions. The result was a long delay from the time the data was sent to the time it was received. The 5G connectivity would allow everyone to understand the IoT technology's strength. As of now, IoT's potential is enormous, but the real networking must come to fruition with 5G technology. Using sensors, "Smart" apps can easily transmit data even from thousands of miles away. The implications on an individual and municipal scale are endless. The 'smart' city has become a reality that will reap the rewards for both local businesses and residents [10].

5G will make it possible for companies investing in IoT technology or creating IoT-based platforms to have many of the desired specifications. Better connectivity, lower latency and faster connection mean more people can transmit more data at the same time. As a result, IoT solutions will grow companies constantly without thinking about disconnected networks that have plagued IoT developments so far. 5G facilitates the development of IoT applications to help all.

## 7. APPLIVATIONS OF 5G-IOT

5G and IoT together would also help to put each product on the shelves to the Internet. Consumer products do not need to be continuously connected to the Internet as hardware devices, but they can send and receive data about themselves as connected smart products based on event-based experiences with clients and other entities through scanning, RFID readers, NFC tags and more [10]. The current wireless infrastructure is not up to the task of dealing with so many network devices, but 5G will make it possible. Smart Packaging and Digital Labels can transform the way retailers manage inventory and logistics and provide a hotbed of imagination to use them as a way to interact with consumers in a creative manner. 4G does not manage data load from the 132 M. Khuntia et al. ever-increasing number of online sensors and connected devices, limiting what IoT can actually do. The 5G is the ideal enabler for the Internet of Things with its high data speed, low latency, increased mobility, low energy consumption, cost efficiency and the ability to handle much larger devices. 5G can play a major role not only in transforming the way we communicate but also in changing industry and society. There are a number of companies in which 5G as well as IoT can cause interruption together, that are:

1. **Self-driving cars:** Sensors generate large quantities of data on self-driving cars, temperature measurement, traffic conditions, weather, GPS location, etc. The collection and assimilation of each quantity of data require a great deal of energy. These cars also heavily rely on real-time information transmission in order to provide optimum services. Nevertheless, with high-speed communication and low latency, this intelligent care will be able to collect all kinds of data on an ongoing basis, including time-critical data on which algorithms will work independently

to keep track of the working condition of the car and improve future designs.

2. **Healthcare:** As all types of medical devices are powered by IoT, changes in their services will also be seen in the medical field. Notwithstanding proper healthcare infrastructure, the IoT link will greatly benefit rural areas and other similar remote locations. With such low latency, it becomes an option to provide world-class health care services such as remote surgery.

3. **Logistics:** 5G networking will improve end-to-end logistics operations with advanced IoT monitoring sensors. High speeds and low latency will not only Allow data to be obtained in real-time, but also enable energy efficiency to generate more diverse information at all points within a supply chain for a very long time. A buyer would have access to detailed information such as where the fish she had just bought was caught, the temperature at which it was treated during processing, and when delivered to the seller.





4. **Smart cities:** 5G will allow broader applications from water and waste management to smart city projects, traffic control to enhanced facilities for health care. Smart cities will benefit from the benefits of the new generation network as more and more devices reach urban infrastructure. Not only will 5G be able to handle the massive data load, it will also make it a reality to incorporate multiple smart systems that continuously interact with each other, bringing a truly connected city's dream closer.

5. **Retail:** As they attempt to shape customer engagement and experience through mobile phones, retail IoT will see a positive impact from 5G's arrival. Improved connectivity and a larger number of network-connected devices would allow new and innovative ways of engaging consumers to engage faster with shoppers through better digital signage. With increased reality and virtual reality, it will become more popular. Retailers will be able to enhance the shopping experience by implementing omni channel sales activities more efficiently.

6. **Automotive:** It is one of the main uses of 5G connecting cars to Augmented Reality (AR) and Virtual Reality (VR). Enhanced vehicle communication Impact of Internet of Things (IoT) on 5G 133 services will include direct vehicle-to-pedestrian and vehicle-to-infrastructure communication, as well as autonomous driving communication that is network friendly. Supported use cases would concentrate on vehicle comfort and safety, including real-time communication of purpose, route planning, organized driving and community updates.

7. **Industrial:** By incorporating 5G security into the core network architecture, we would also provide an extremely secure network for industrial IoT. The Impact of 5G on IoT

## 8. CONCLUSION

The 5G provides features that can satisfy the requirements of the future IoT, however, it also opens new set of interesting research challenges on the architecture of 5G-IoT, trusted communications between devices, security issues, etc. The 5G-IoT integrates a number of technologies and is creating significant impact on applications in IoT. As of now, IoT's potential is enormous, but the real networking must come to fruition with 5G technology. This paper reviews the recent research on both 5G and IoT. We firstly introduce the background and current research on 5G and IoT. Then, we analyse the new requirements in 5G enabled IoT. Afterwards, we detailed the key techniques in 5G-IoT and analysed the challenge and trends of the future IoT. We also detailed impact of 5G on IOT and applications of 5G IOT.

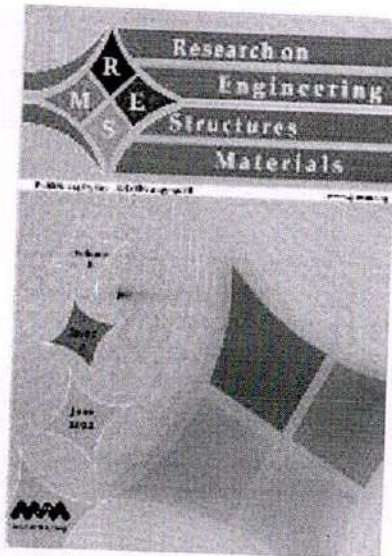
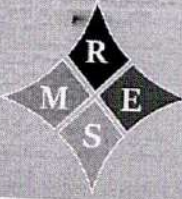
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## Effect of SCBA and GGBFS on the performance of binary and ternary blended concrete

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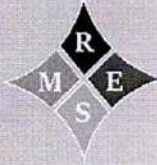
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Research Article

Effect of SCBA and GGBFS on the performance of binary and ternary blended concrete

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Abstract

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Keywords:

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The present studies focus on the characteristics of binary and ternary concrete in plastic and hardened stage for a mix of grade M25. Two mineral admixtures were used, sugarcane bagasse ash (SCBA) and ground granulated blast furnace slag (GGBFS). In preparing binary and ternary blended concrete, these admixtures partially substituted cement. Cement was replaced with SCBA and GGBFS, with the substitution percentage being 15%, 20%, 25%, and 30% by mass. Fresh properties were evaluated in terms of slump cone and setting time. Moreover, the mechanical characteristics were assessed concerning the strength of concrete in compression, split, and flexure. The microstructural properties were investigated in terms of scanning electron microscope (SEM) images. The experimental result indicated that the inclusion of SCBA and GGBFS improves workability and strength in compression while strength in the split and flexural hampered in binary as well as ternary concrete.

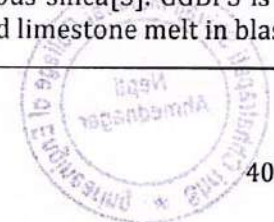
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1. Introduction

Ordinary Portland cement (OPC) is the world's leading cement. According to statistics from the U.S. government, approximately 4.1 billion tonnes of OPC were generated globally in 2015 alone. Since the creation of concrete, OPC has been integrated as the primary binder material [1]. OPC's financial and environmental issues have motivated scientists to find other product to replace OPC. Supplementary cement products are helpful for concrete properties and play a role in some extra production of calcium silicate hydrate (C-S-H) gel. The concept of partly substituting OPC with supplementary products may be backed by the reality that's there a considerable quantity of unwanted material generated by different sectors with appropriate characteristics for use in concrete. These waste materials generally require a lot of effort and energy for disposal. Among the most widely used industrial waste in concrete are fly ash and GGBFS. Along with industrial waste, certain farming waste has revealed excellent performance when utilized in concrete, such as rice husk ash (farming waste of the rice milling sector) [2].

Sugarcane crops are cultivated all over the world to produce sugar, ethanol, and much more. The bagasse, waste material after drying in the sugar sector, is generally used as fuel for boilers. Sugarcane bagasse ash is commonly found in boilers under non-controlled burning situations. When the bagasse is heated under controlled circumstances, it can generate ash with more excellent amorphous silica[3]. GGBFS is a waste generated in iron-making blast furnaces. Iron-ore, coke, and limestone melt in blast

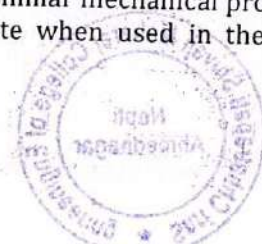
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furnaces, producing molten iron and slag. Mostly silicates and alumina are included in the molten slag. The slag granulation method includes refrigerating molten slag with water jets with high pressure. This quickly quenches the formation of slag as well as granular particles. The granulated slag is further dried and ground to an extremely fine particle in a revolving ball mill called "GGBFS." The variables determining a slag's cementitious characteristics are the slag's chemical composition and the fineness of the slag[4].

The employment of supplementary cementitious material considerably improves the concrete microstructure. Reactive silica in these materials reacts with calcium hydroxide when using pozzolanic materials and produces extra C-S-H gel. Due to pore enhancement and extra C-S-H formation, concrete permeability is significantly reduced. Grinding of the burnt sample of SCBA at 700°C presented maximum pozzolanic activity. SCBA in concrete significantly enhance durability [5]. It has been shown to have greater strength in compression at 20% substitution of cement with SCBA[6]. Besides the increase in strength, there are cost savings of 35.62%, as noted by Tayyab Akram et al. [7]. Workability is seen to be increased up to 25% cement replacement, as noted by R. Srinivasan et al. also, strength in compression, split and flexural increases up to 10% replacement [8]. There will significantly enhance workability, compressive strength, and tensile strength by using GGBFS and rice husk ash [9]. Moulshree Dubey et al. found the addition of GGBFS and metakaolin in binary concrete enhances the concrete performance [10]. G. C. Cordeiro et al. found significant pozzolanic activity corresponding to be mechanical as well as a chemical method of evolution [11]. Noorul Amin et al. showed activation of bagasse ash in which mechanical activation was done using grinding and chemical by different alkalis. Strength increases with fineness and decreases by chemical activation [12]. Chemical test outcomes indicate SCBA has pozzolanic characteristics when burned at 700°C and sieved through a 45-micron sieve [13]. Setting time is slightly affected by use of SCBA at 50% and strength in compression is up to 90% of reference concrete for 50% replacement. There is an increase in durability properties especially chloride ion penetration [14]. Strength in compression is higher for 10% substitution of cement by SCBA while flexural strength is lower when revealed to temperature from 300°C to 500°C for two hours [15]. The influence of residual rice husk ash and SCBA in binary and ternary blended concrete permitted attainment of high intensity of cement substitution and retained steady or improved strength in compression [16]. Ashhad Imam et al. developed several synergic equations using micro silica, marble dust, and rice husk ash. These equations could explain the early and long-term strength [17]. Mateusz Radlinski and Jan Olek used fly ash and silica fume in ternary concrete. They found improved compressive strength and resistance to chloride ion penetration with a reduced water adsorption rate [18]. G.C. Isaia et al. found increased pozzolanic and physical effects when fly ash, rice husk ash, and limestone filler are increased in concrete. These effects are higher at 91 days compared to 28 days [19]. Shweta Goyal et al. used silica fume and fly ash with different water-cement ratios, along with water cured to continuously air-cooled regime, and found the economic combination of silica fume and fly ash [20]. There will be an increase in compressive and flexure strength when silica fume and fly ash are used in concrete at a different water-cement ratio, as noted by Muhannad Ismeik. At a later age, fly ash incorporation showed better results [21]. OPC was substituted by ground fly ash and ground bagasse ash. Compressive strength at 20% replacement by both ashes is similar to reference concrete; water permeability is reduced, and resistance to chloride penetration is improved [22]. Microstructural studies revealed that fly ash and bagasse ash fiber equally dispersed throughout the matrix. Both strengths in compression and flexure decrease. Bagasse fiber exhibits better tensile strength and decreased density [23]. Calcium carbide residue and bagasse ash mixture in concrete reduce cement consumption up to 70% with similar mechanical properties [24]. SCBA produces more viscous and plastic binary paste when used in the binary and





ternary systems, along with cement and fly ash [25]. There is a decrease in strength for compression, flexure, and split at three days of curing but at 7, 28, and 90 days it increases when GGBFS partially replaces cement. Abrasion resistance also increases with curing age [26]. The flowability of ultra-high-performance concrete increases steadily with GGBFS and fly ash content. Under standard curing, there is limited influence on compressive strength by incorporating fly ash [27]. Workability decreases for 10% micro silica and 30% GGBFS, while compressive strength is maximum for 5% microsilica and 30% GGBFS when used as a cementitious material in concrete [28]. The incorporation of fly ash and GGBFS decrease permeability and improve sulfate attack resistance under any curing condition [29]. It was found that compressive strength is maximum when manufactured sand is used in concrete containing GGBFS. Abrasion resistance was influenced by strength irrespective of GGBFS and manufactured sand content [30]. The consistency of cement decreases with increases in GGBFS amount while workability and setting time increases. GGBFS speeds up the hydration of OPC at the initial time of hydration. Sulfate resistance is superior as compared with normal concrete [4]. Compressive strength is seen to be maximum for 90 days of curing for cement replacement by slag [31]. Zheng et al. used a fly ash and silica fume combination and found a significantly higher strength retention ratio [32]. The mixture of calcium carbide residue and fly ash was used by Kittiphong Amnadhua et al., who found improved compressive strength with lower water permeability [33]. Liwa Mo et al. used ground granulated blast furnace slag, fly ash, and magnesia and found the same or higher mechanical strength at 28 days and 90 days [34]. The chloride permeability was low to moderate when quarry dust powder, silica fume, and fly ash were used in concrete by H.A.F Dehwah et al. [35].

## 2. Research Significance

The construction industry is currently concentrating on replacing cement with locally available environmental friendly products. The main emphasis is on reducing the quantity of consumption of cement content in the production of concrete, which in turn decreases the release of greenhouse gases into the atmosphere. The utilization of these products also assists in preventing the difficulties of disposal and landfill that cause significant environmental problems. The use of these products in a lucrative manner as an alternative to cement is essential for preserving sustainability. Many investigators concentrated on alternative cemented materials and concluded that the usage of these materials revealed improved strength along with durability properties. A comprehensive analysis of the literature suggested that fly ash is a significant material used to replace cement in mixed concrete partially. Only a few emphasized using SCBA as one of the complementary cement components in producing cement concrete mixture together with GGBFS. The application of these products is a significant benefit in environmental and economic terms. It also answers the problems of landfill and global warming and their applicability in the construction sector. It is planned to consider the above aspects to address the following issues. Whether the use of SCBA, a sugar industry by-product, along with GGBFS, may or may not be used in the preparation of blended concrete mix? How does this substitute affect the strength and microstructural properties?

## 3. Objectives and Methodology

The goal of the current research is to find out blended cementitious concrete via two materials. The materials are SCBA and GGBFS. The mechanical and microstructural characteristics are evaluated concerning the reference mix. To accomplish the research goals, a comprehensive experimental program was scheduled. The research aims to identify the optimal amounts of SCBA and GGBFS that can be substituted in cement. The





concrete blend of target strength in compression of 25MPa was designed with no mineral admixtures. Initially, sugarcane bagasse ash was optimized from 0 to 30% cement. Ternary blended cement concrete mix proportion was established utilizing SCBA and GGBFS as partial substitution of cement from 0 and 30%. This optimization method substantially improves the volume of cement use and can decrease at least some quantity of carbon dioxide released due to cement production. The mechanical and microstructural properties were assessed and correlated with the reference mix. An assessment of binary and ternary blended composite with reference mix was conducted by evaluating mechanical performance by preparing cubes, cylinders, and standard-size beams.

#### 4. Materials and Mix Proportion

The materials utilized in this investigation are cement, aggregate, SCBA, GGBFS, and water. OPC affirming IS12269-1987 [36] was used in the investigation. The grade was 55, and specific gravity was 3.15 having a setting time of 200 min as initial and 312 min as final. The fine aggregate affirming Zone-II of IS: 383-1970 [37] was utilized. The fine aggregate so employed was obtained from the local river source. Well-graded crushed granite having size confirming to IS: 383-1970 [37] was used, which was obtained from the local crushing unit. The physical properties of fine and coarse aggregate are shown in Table. 1. For this investigation, SCBA was collected from Prasad Sugar and allied Agro-Products limited, Maharashtra (India). SCBA is burnt at 700°C for two hours in a muffle furnace, and then ground to make it fine. The chemical properties of SCBA are presented in Table 2.

Table 1. Physical properties of aggregate

Property	Fine Aggregate	Coarse Aggregate	Coarse Aggregate
Particle Shape, Size	Round, < 4.75 mm	Crushed angular, 20 mm	Crushed angular, 10 mm
Fineness modulus	6.63	6.79	6.57
Silt content (%)	1.0	Nil	Nil
Specific Gravity	2.81	2.82	2.79
Surface moisture	Nil	Nil	Nil
Water absorption (%)	1	1.33	1.45

GGBFS was collected from Guru Corporation Ahmedabad, Gujarat (India). The chemical properties of GGBFS are presented in Table 2. Portable water affirming to IS 456-2000 [38], was utilized for mixing and curing. Concrete mix design is done concerning the Indian standard code [39] for M25 grade. A water-cement ratio of 0.5 was used. Mix proportions for binary and ternary blended concrete are presented in Table 3.

Table 2. Chemical properties of SCBA and GGBFS

Content	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	SO <sub>3</sub>
SCBA	85.23	12.62	0.60	2.34	1.04	0.001
GGBFS	34.12	18.95	0.23	35.46	8.2	0.45





Table 3. Concrete mix proportion for binary and ternary blended concrete

Mix Designation	Cement (kg/m <sup>3</sup> )	SCBA %	GGBFS %	SCBA (kg/m <sup>3</sup> )	GGBFS (kg/m <sup>3</sup> )
P	394.32	0	0	0	0
B15	368.69	15	0	65.06	0
B20	347.00	20	0	86.75	0
B25	325.31	25	0	108.44	0
B30	303.62	30	0	130.13	0
G15	368.69	0	15	0	65.06
G20	347.00	0	20	0	86.75
G25	325.31	0	25	0	108.44
G30	303.62	0	30	0	130.13
B10G05	368.69	10	05	43.38	21.69
B10G10	347.00	10	10	43.38	43.37
B10G15	325.31	10	15	43.38	65.06
B10G20	303.62	10	20	43.38	86.75
B15G05	347.00	15	05	65.06	21.69
B15G10	325.31	15	10	65.06	43.38
B15G15	303.62	15	15	65.06	65.06
B20G05	325.31	20	05	86.75	21.69
B20G10	303.62	20	10	86.75	43.38
B25G05	303.62	25	05	108.45	21.69

## 5. Result and Discussion

### 5.1. Workability and Setting Time

The workability of concrete was obtained concerning IS 1199-1959 [40]. As shown in Fig. 1, the test result noticed that concrete without SCBA and GGBFS i.e. [P], had the lowest slump of 140 mm compared with binary concrete. At the same time, a lower slump of 145 mm and 140 mm was noticed in binary composite with substitution of cement at 15% and 30% by SCBA & GGBFS, respectively. In ternary composite, the lowest and highest slump value was noticed at B10G20 (cement replaced by 10% SCBA and 20% GGBFS) and B15G10 (cement replaced by 15% SCBA and 10% GGBFS), which are 100 mm and 160 mm, respectively. It was also noticed that the slump increases as SCBA content increases and decreases as GGBFS content increases. The initial and final setting times are found concerning IS 4031-1988 [41]. As shown in Fig. 2 Initial setting time (191 min) was noticed to be less against the 15% substitution of cement with SCBA, but the final setting time (380 min) will be more for concrete without any replacement. However, incorporating GGBFS resulted in a lower setting time at 30% and a higher one at 15%. Ternary blended concrete exhibited lower initial setting times at B15G10 and B25G05 while final setting times were higher at all replacement levels. The increase in setting





time may be due to carbon content and crystalline particles. As SCBA was a burnt material, the carbon content was found to be reduced, producing amorphous silica content that may be active. This can be attributed to the slowing down of the initial hydration process due to excess water. Genesan et al. 2007 reported a rise in setting time with an increase in bagasse ash because of the dilution effect [42]. The water requirement of the SCBA blended mix was more than the control mix due to the presence of large fibrous particles [5].

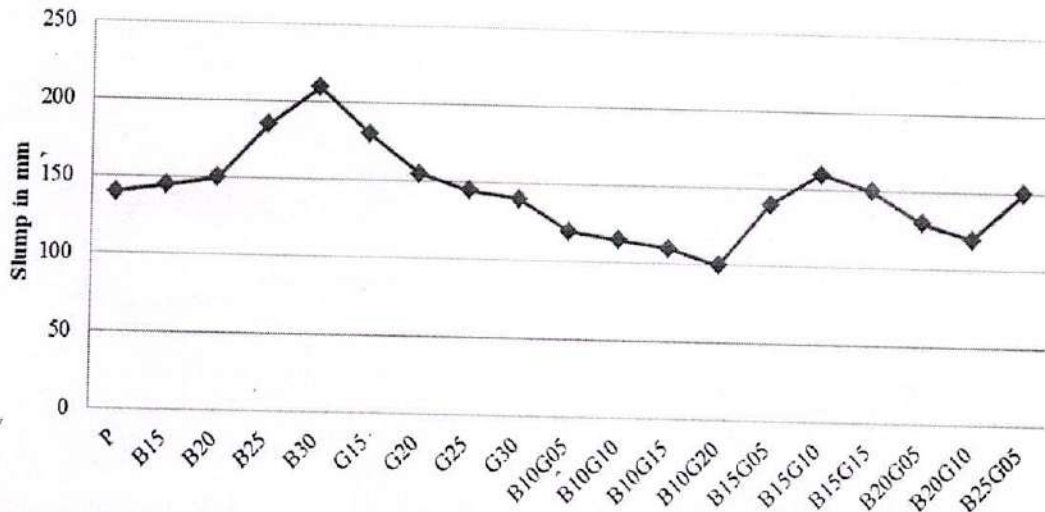


Fig. 1 Slump for various binary and ternary mixes of SCBA & GGBFS

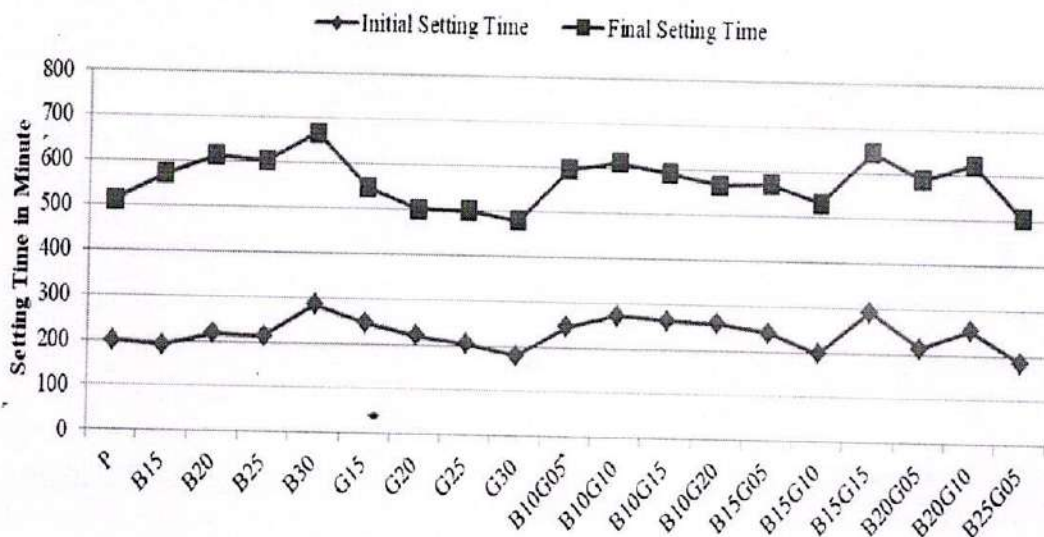
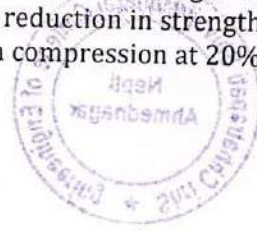


Fig. 2 Setting time for various binary and ternary mixes of SCBA & GGBFS

### 5.2. Compressive Strength

Concrete is well known for its strength in compression, as, in most places, it is used due to this property only. Concrete properties influence the structures' service life in harden stage. The strength of concrete in compression was measured at 7 and 28 days as per the procedure of IS 516-1959 [43]. The addition of SCBA increases the strength in compression at 15% substitution whereas addition of GGBFS increases the strength in compression at 15% and 20%. For all other substitutions, there is a reduction in strength in compression. Ternary blended concrete exhibit higher strength in compression at 20%





(B15G05) substitution. These results showed a substantial effect of SCBA and GGBFS on seven days of compressive strength which is lower for all replacement levels. Improvement in strength results with SCBA and GGBFS may have been caused by the filler effect and the pozzolanic reaction between  $\text{Ca}(\text{OH})_2$  from cement hydration and reactive  $\text{SiO}_2$  from SCBA. The dilution effect may cause a decrease in strength in compression. Govindarajan and Jayalakshmi 2011 also observed an increase in strength at 5, 10, and 15% replacement.

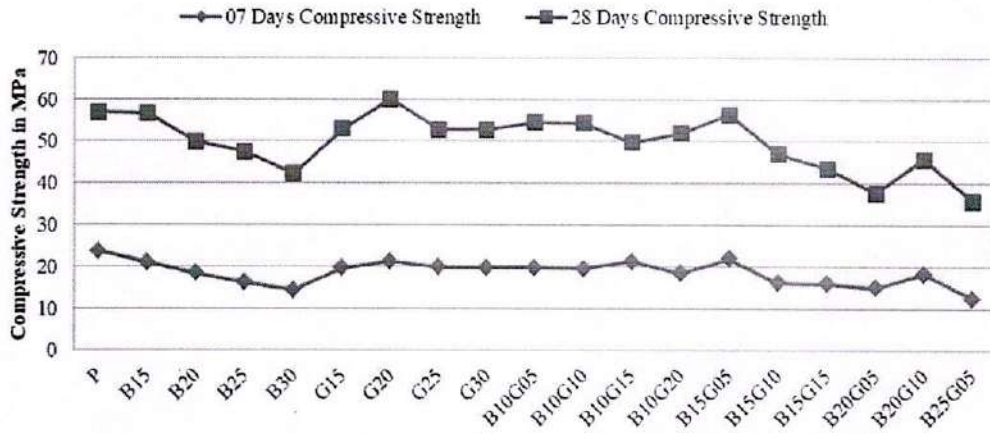


Fig. 3 Strength in compression of concrete for various binary and ternary mixes of SCBA & GGBFS

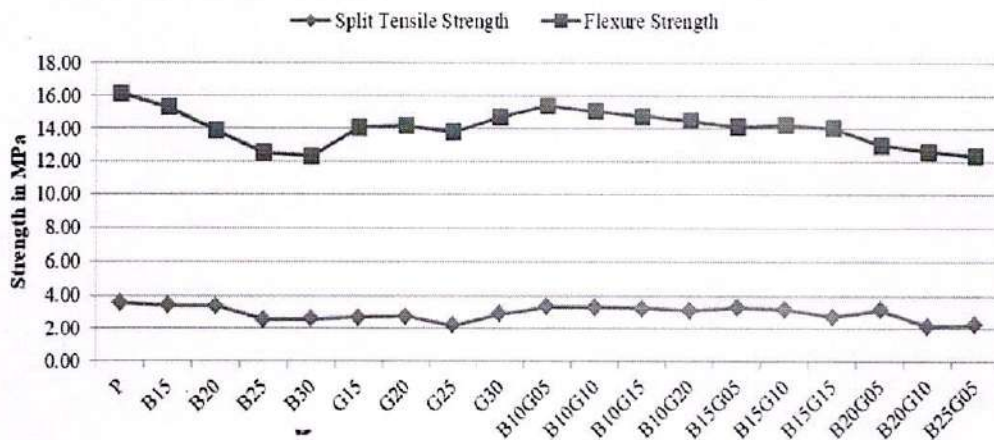


Fig. 4 Strength in flexural and split tensile of concrete for various binary and ternary mixes of SCBA & GGBFS

A sample of SCBA showed that when C-S-H increased (strength improved), peaks of  $\text{Ca}(\text{OH})_2$  diminished, indicating that a pozzolanic reaction occurred between  $\text{Ca}(\text{OH})_2$  & amorphous silica present in SCBA [44]. The reason for the improvement in the strength of SCBA may be attributed to silica content, fineness, and pozzolanic reaction between calcium hydroxide and reactive silica in SCBA. Similar behaviour was reported in previous work [45-46].

Flexural strength is measured following IS 516-1959 [43] on a 100 X 100 X 500 mm beam, and split tensile strength is carried out as per IS 5816-1999 [47] on 150 mm dia. X 300 mm height Cylinders. The result illustrated in Fig. 4 shows that adding SCBA and GGBFS causes a decrease in the average value of flexure and split tensile strength.





### 5.3. Microstructural Properties

To observe the microstructure of binary and ternary blended concrete specimens with SCBA and GGBFS, SEM and Energy Dispersive Spectroscopy (EDS) analysis were performed in the field emission scanning electron microscope laboratory of the College of Engineering Pune. Fig.5-13 shows the SEM/EDS micrographs. For the specimen with 20% and 30% of SCBA, unreacted bagasse ash particle was observed, leading to lesser compressive strength. Moreover, voids were also detected, representing permeable concrete. With the rise in the replacement amount, the unreacted particle of SCBA will rise and decrease the compressive strength. Binary concrete containing GGBFS have less voids than binary concrete containing SCBA, indicating a compacted and dense matrix. Crystalline particles were observed at high magnification as coated by a rough layer pertaining to the additional C-S-H product. The internal structure of reference concrete and concrete containing SCBA and GGBFS is dense at B20, G20, and B10G20 mixes, and C-S-H gel exists in the form of continuous block [48]; this results in higher compressive strength. Chemical compound analysis by EDS was investigated and shown in Fig. 5-13. The ratio of Si/Al was calculated from the EDS analysis. The ratio of Si/Al for ternary concrete with 10% SCBA and 10% GGBFS was observed to be higher, making it more rigid in terms of its microstructure. Similar behaviour in the cementitious medium is clearly defined by P. C. Hewlett (2004) [49]. The Ca/Si ratio represents the overall cementitious medium properties. Ca/Si ratio was found to be decreasing with an increase in replacement level for both binary and ternary blended concrete. Ca content decreased with an increase in SCBA and GGBFS in binary and ternary concrete. Fe content was found to be increased up to 20% SCBA replacement, and then it started decreasing. The pozzolanic nature of SCBA with C-H can be confirmed with an increase in the concentration of ferrous content with the inclusion of SCBA and GGBFS content [50].

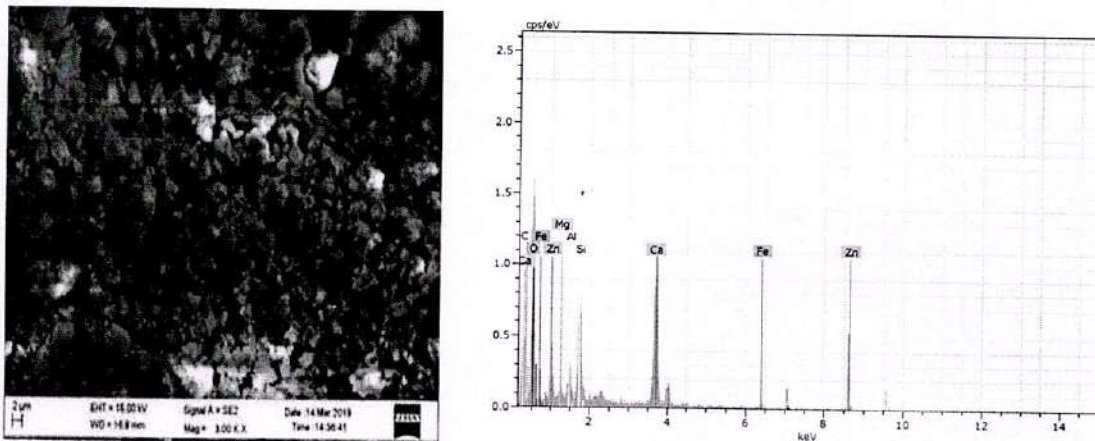


Fig. 5 SEM evaluation of concrete specimen using OPC





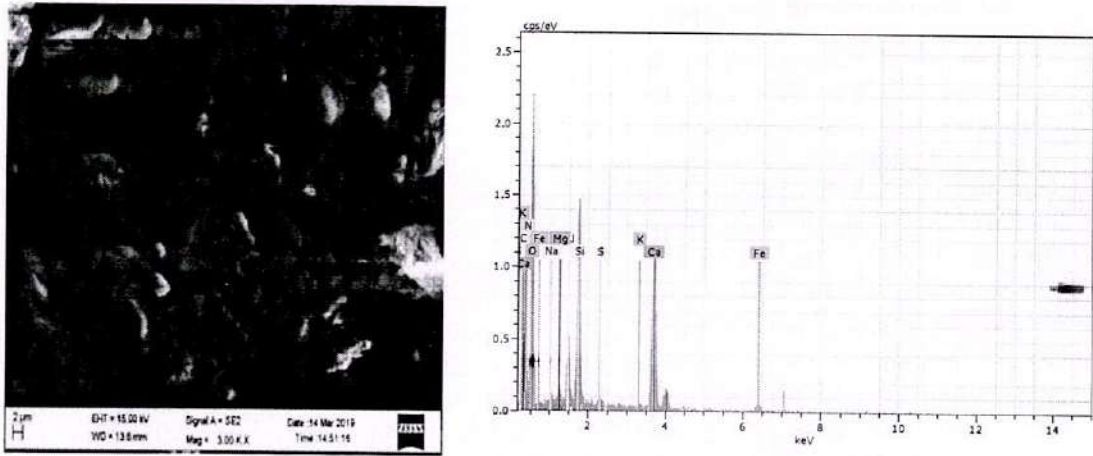


Fig. 6 SEM evaluation of concrete specimen using OPC by 20% SCBA

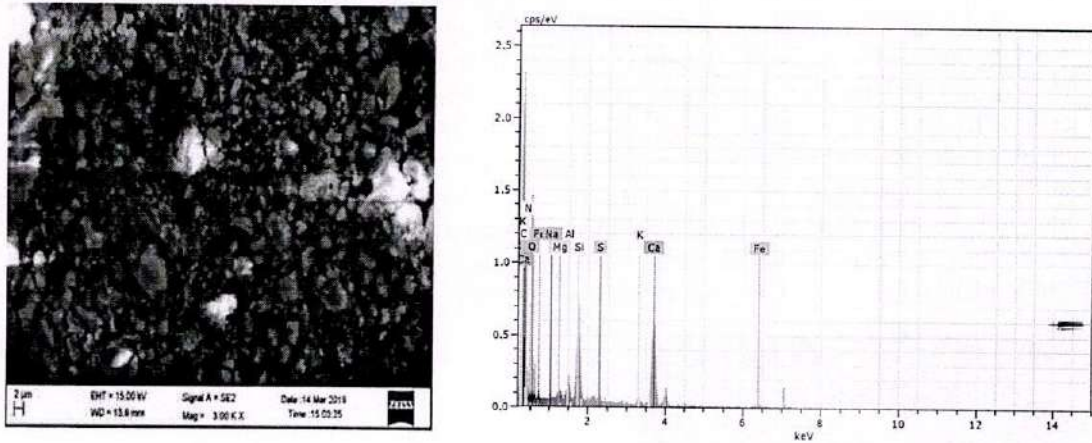


Fig. 7 SEM evaluation of concrete specimen using OPC by 30% SCBA

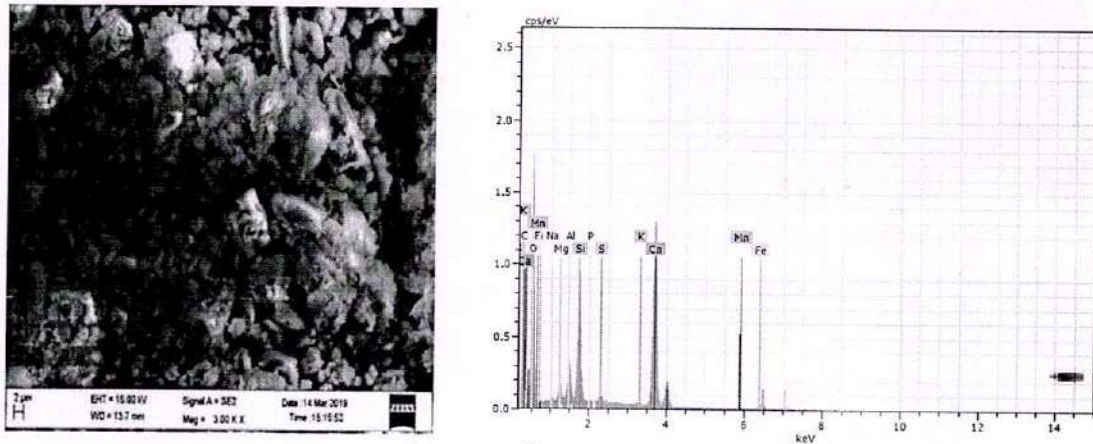


Fig. 8 SEM evaluation of concrete specimen using OPC by 20% GGBFS





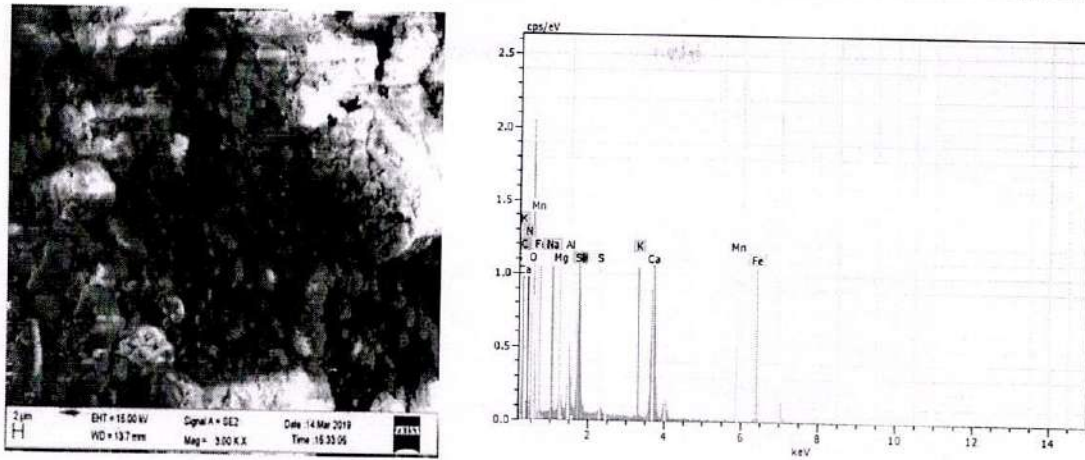


Fig. 9 SEM evaluation of concrete specimen using OPC by 30% GGBFS

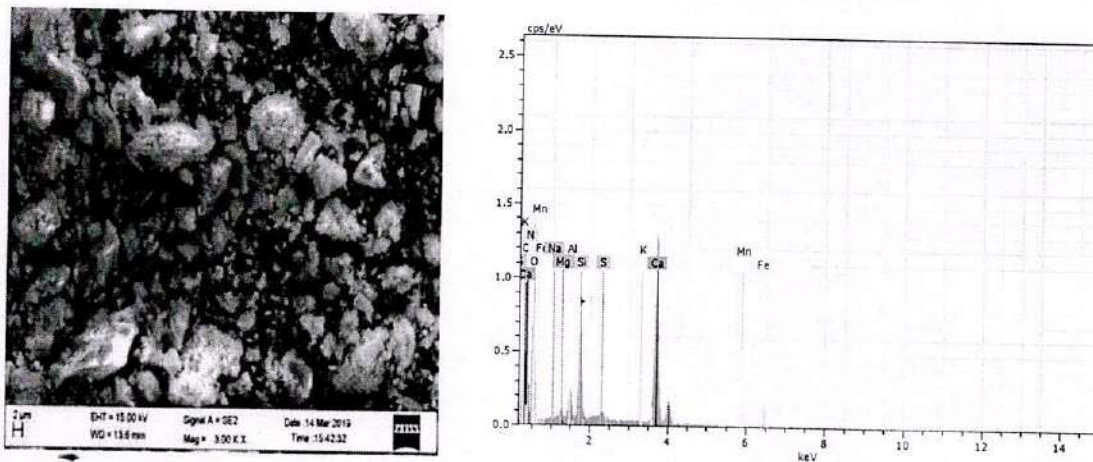


Fig. 10 SEM evaluation of concrete specimen using OPC by 10% SCBA & 10%GGBFS

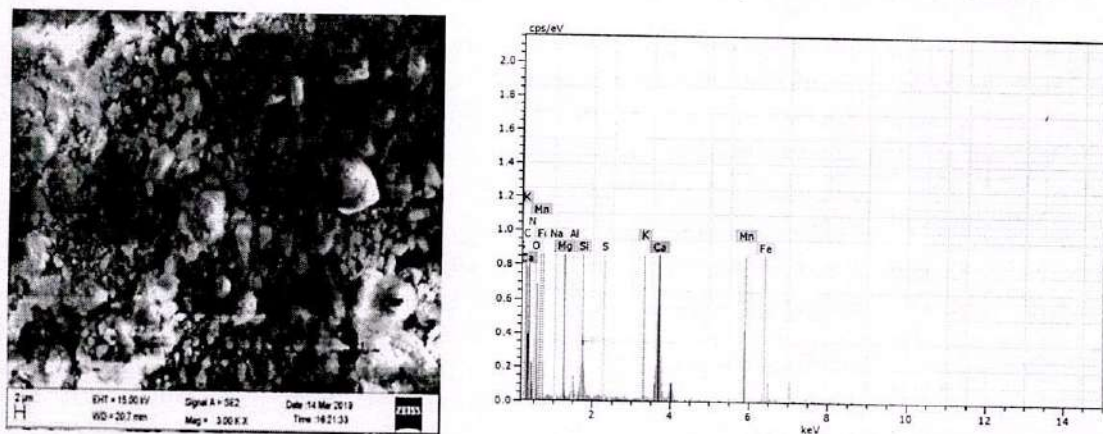


Fig. 11 SEM evaluation of concrete specimen using OPC by 10% SCBA & 20% GGBFS





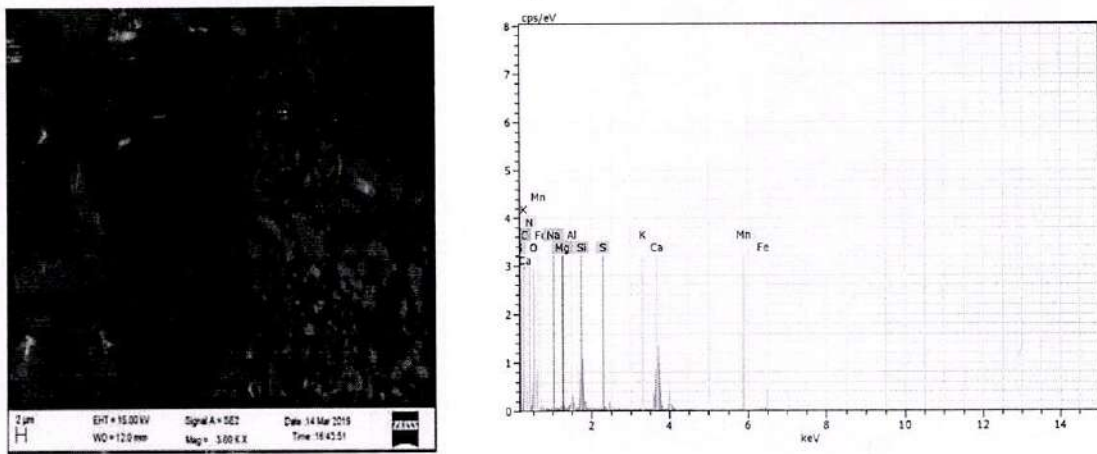


Fig. 12 SEM evaluation of concrete specimen using OPC by 15% SCBA & 15% GGBFS

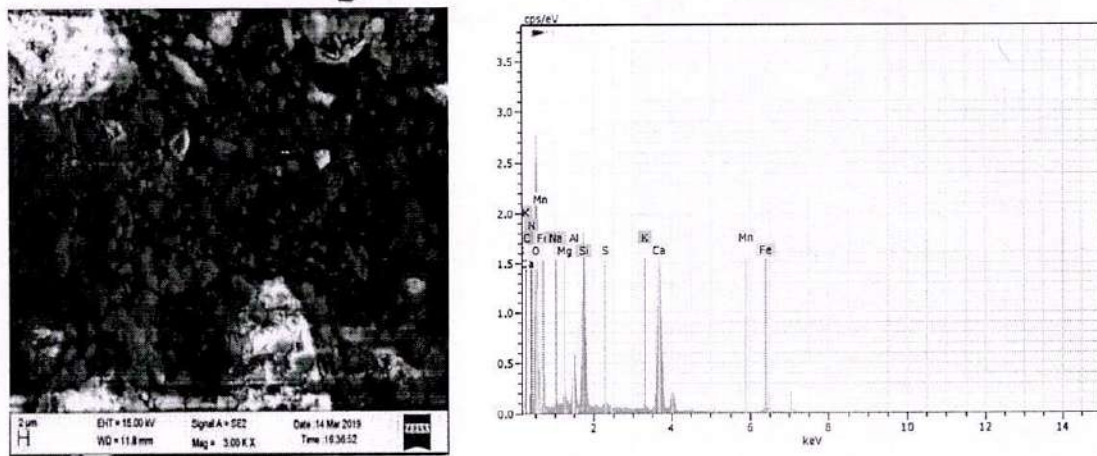


Fig. 13 SEM evaluation of concrete specimen using OPC by 20% SCBA & 10% GGBFS

Fe content in the present study was found more for the B20 mix than the B30 blend; also, for ternary concrete, it was found more for the B10G20 combination. This investigation supports explaining and relating the strength enhancement due to SCBA and GGBFS inclusion.

### 6. Conclusions

This research focussed on the effect of different pozzolanic materials on the properties of binary and ternary blended concrete in fresh and hardened stages. Pozzolanic materials are agriculture and industrial waste. Sugarcane bagasse ash was heated and ground before using it. The chemical properties of SCBA were determined, and for GGBFS, they were obtained from the supplier. Concrete mixes were cast using % variation up to 30% replacement in binary and ternary concrete. Experimental data were also analysed by using microstructural studies.

- The workability of binary concrete mixes follows an increasing trend with a rising percentage of SCBA and a decreasing trend with a rising percentage of GGBFS. A maximum slump was obtained for 30% replacement of cement. However, for the optimum replacement percentage, the slump obtained was 145 mm and 155 mm in binary concrete, whereas 140 mm in ternary concrete.





- The setting time of binary concrete mixes follows an increasing trend with a rising percentage of SCBA and a decreasing trend with a rising percentage of GGBFS. The value of both setting times is more for all binary and ternary mixes than concrete without any cement replacement.
- The optimum value for compressive strength was obtained at 15% SCBA and 20% GGBFS in binary concrete and 15%SCBA + 5%GGBFS in ternary concrete. At this replacement, the compressive strength value at 28 days was observed as 35.6MPa, 38.7MPa, and 34.5MPa. Similarly, for flexure and split tensile strength, the value obtained are 11.93MPa, 11.45MPa, 10.85MPa, 3.38MPa, 2.72MPa, and 3.26MPa, respectively.
- Microstructural studies indicate that extra calcium-silicate-hydrate gel, which is responsible for compressive strength development, was found in concrete containing SCBA and GGBFS, due to which compressive strength increases for 15% SCBA and 20%GGBFS use in concrete.

Considering the excess amount of sugarcane bagasse ash and ground granulated blast furnace slag, the amount of cement in concrete can be lowered. The partial substitution of cement by SCBA and GGBFS has an economic and environmental benefits. Concrete properties are improved using these materials; therefore, both are better in binary and ternary concrete. Studies on using these agricultural and industrial wastes open the path for creating sustainable construction materials. This research work can be extended using sodium hydroxide and sodium silicate solution while manufacturing concrete.

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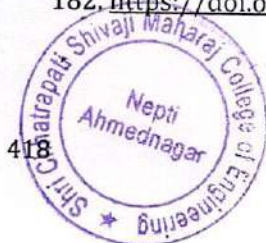


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# Enriching Trustworthy trade in Decentralized system using Blockchain

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**Abstract**—A growth in consumers of current Web Applications may be attributed in large part to the improved affordability of the internet platform, which has led to a surge in users across a wide range of internet networks in current history. This data can be put to many good uses, but it really shines when applied to machine learning and artificial intelligence systems. Machine learning algorithms are additional essential and basic technique for gaining in-depth understanding of a topic or event of interest. Machine-learning algorithms perform best with massive amounts of data. Multiple solutions for providing safe ways to transfer data have indeed been investigated in this research. These methods have indeed been instrumental in assisting us in developing a safe, reliable, and productive system for managing information flows and accessibility. Therefore, there is a need for an effective and useful mechanisms that can allow for the effective sharing of the data as well as incorporate reliability and accountability to the entire system. This is achieved through the use of the reward and penalty scheme that is enabled through the use of a judgement module that is integrated with the distributed blockchain framework. The approach has been subjected to extensive tests that have been crucial in the realization of the superiority of the approach in achieving effective and accountable data sharing through blockchain.

**Keywords**— Blockchain Framework, Reward and Penalty Scheme, Integrity Evaluation, Crowd Sourcing Data.

## I. INTRODUCTION

Blockchain's possibilities for information exchange, trust-building, and permissions management has been the subject of several additional research efforts. While some research has been conducted on data sharing, it is often limited to one phase or either facet of the process, or it takes a stance in the debate by focusing on the issues of just one party (in this case, data proprietors). Blockchain technology may function as a trusted connection point for data amongst data owners and consumers. Data trust frameworks may benefit from the blockchain's decentralized, transparent, and dependable characteristics.

Sung-Jung Hsiao [1] constructs a five-layer architecture of proper inventory management flow using blockchain, consisting of the organization tier, the blockchain specification component, the internet protocol, the cooperation surface, as well as the network protocol. The

approach defines the compositional and database structure characteristics of primary and secondary information resources in the distribution chain, and then provides a block capturing methodology for multi-sensor relevant data from both within and beyond the distribution chain. Cryptographic hash indications serve as the glue that holds the blockchain together. Relying on all this, a digital connection framework is presented for constructing blockchain-related data, and the mechanism of generating digital linkages is examined via the lens of a concrete case.

Zhen Pang [2] argues that a system for exchanging electronic health records is crucial so that individuals get effective and thorough care. Through a formalised system, clinics are required to share patient data with one another, which is beneficial to the whole health care industry. There is a lot of sensitive data in the EHR, thus it is important to take precautions while exchanging records. The suggested approach uses together on including off storage, guaranteeing the reliability of all information. This study employs a strategy for encrypting text that can be searched using several phrases, which improves both speed and precision. As part of the consensus mechanism, it is acceptable tolerating and eventually capturing the Byzantine node. It is proposed that a network configuration monitoring and anomaly based isolation technique be added to the PBFT compromise method to make it more secure. Consequently, the proposed technique may minimise the Byzantine node's effect on the decentralized network by designating a single point as the primary server.

Section 2 of this research article presents an analysis of the relevant literature; Section 3 explains the research approach; Section 4 discusses the experimental assessments; and Section 5 closes with suggestions for further study in the future.

## II. RELATED WORKS

When it comes to fitness statistics, May Ahajri [3] explains how there are a number of reasons to be wary about giving it out to other entities. By giving users more say over how their activity information is used, this research hopes to alleviate some of the privacy-related concerns that have been raised about activity trackers. To address concerns about data confidentiality, the researchers developed a blockchain-based adaptive authorization method. The proposed framework, acceptance criteria, and formalized verification architecture



are the main deliverables of the developed framework. The security modelling methodology instrument and the established blockchain hypotheses are used to assess the shown artefacts as well. Accordingly, the results of the assessment of the vulnerability modelling technique demonstrate that the system accomplishes all of our intended purposes.

As Ying Gao and others [4,5,6,7,8] explained, blockchain coupled Identification driven proxy reencryption may be used to provide a safe data exchange paradigm for software-defined network empowered Ubiquitous cloud technology. For regional traffic relaying, a Software Defined Network deployment was made. The identity-based proxy reencryption system was developed to safely share the encrypted document credentials among stakeholders and other parties after they were exported to a separate remote server. Users may interface with the public ledger in several ways, including browsing for and modifying entries on the ledger, via uploading cryptographic keys to the ledger and using smart contracts. In addition to the excellent performance of the planned smart contracts, experimental findings show that the suggested architecture performs very effectively.

### III. PROPOSED METHODOLOGY

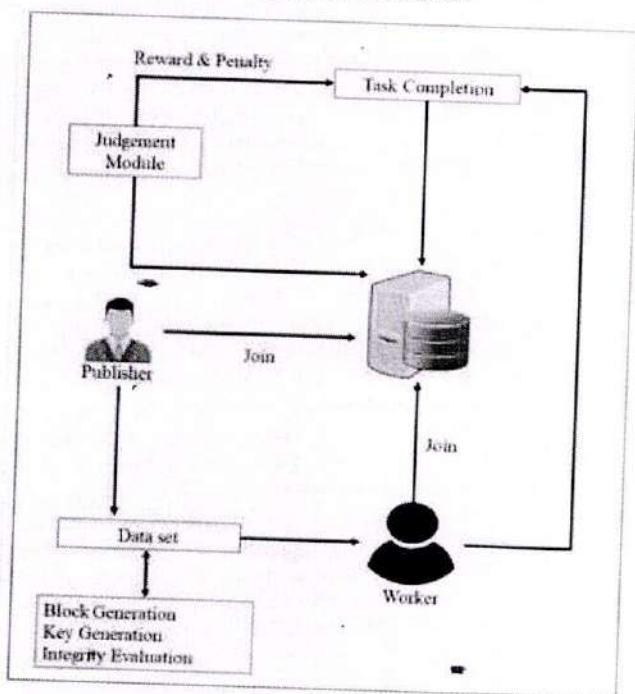


Figure 1: Proposed Methodology

The proposed methodology for the purpose of achieving Trustworthy Freelancing Crowdsourcing that is reliable and accountable in nature has been successfully expanded in the figure 1 above and the steps taken to achieve this system are elaborated below.

**Step 1: Registration and Activation of the System** – The aforementioned approach has been successfully created for the goal of being implemented on a variety of machines. This strategy may also be implemented on a single computer by simulating the behavior of the two additional actors. This is because the system calls for three distinct responsibilities to be filled: first, the decentralized server; second, the job supplier; and third, the worker. The system administrator is responsible for the maintenance of the distributed server via

the creation of a graphical front interface which is achieved through the deployment of the swings platform which is established on the programming language Java.

This dynamic user interface is used by both the task provider and the employees in order to facilitate the registration process for both parties involved in the transaction. Prior to getting allowed to use the service, the employees and attach suppliers must first register by providing information about themselves and respective appropriate qualities. Name, email address, user name, and password are the identifiers that are taken into account throughout the registration process. Also evaluated is the cellular phone contact. After the user's information has been checked for accuracy and approved, the next step is the development of a signature key in conjunction to the relevant enrollment for the role that was selected.

The relevant users may get permitted admission into the program for the intention of enforcing the regulations by using the one-of-a-kind username and password that they were given at the moment of enrollment. This information was supplied to the users. The user attributes that are relevant to the interaction are employed to build a hash key, that is then put into practice in the process of selecting arbitrary characters for inclusion in the formation of the signature key.

**Step 2: Uploading Task and RCC encryption** – The data supplier or publisher makes use of the platform for the objective of transferring the job and the relevant data into the decentralized system for the employees or the data recipients. The methodology of crowdsourcing may be successfully put into action by the job publisher in the form of their delegation of the assignment to the crowdsourced employees. Both the employees and the publisher are interested in obtaining the material, but the publisher particularly needs people who are interested in the job. This makes it possible to realize the crowdsourcing infrastructure in a way that is simultaneously successful and beneficial, which in turn can enhance each of the parties that are engaged. Because of this, the model involves a publisher in order to transmit the job along with all of its information associated to the worker via the usage of a distributed server.

Text files containing the job that is currently posted by the publisher are the ones that are posted to the decentralized system. This text file has a variety of different features, including the title of the job, a summary of the task, the cost of the assignment, and the required security contribution from the worker. This job, which was sent to the decentralized server for posting in the form of a text document, was successfully completed. Even before assignment can be uploaded, necessary for it to be adequately encrypted. This will guarantee that the security is not compromised.

The technique named as the reverse circle cipher is employed in order to achieve the goal of encryption. In order to accomplish the job of transferring the textual file that contains the assignment to the platform in the form of a path of the file as an input. The scheme will go along the input path, and it will get the appropriate text file from the location that has been provided. The document that was retrieved is successfully examined, and the system extracts the different properties and features of the file before converting them into string format. This is helpful because it enables a system to properly parse strings and take advantage of the data for encryption and additional treatment.





The signature key that was generated during the process of registering the actors is the one that is used for encryption purposes. The processing of the key involves removing the characters from the key and transforming those letters into the corresponding ASCII numbers for those characters. The resulting number is obtained by adding all of these ASCII codes combined and then summing the total. The addup number is then found by modifying this quantity by 20, which yields the outcome. This value is very important since it is put to good application in the field order to successfully achieve the encryption. In the beginning, the string is split up into chunks by using the equation 1 that is shown underneath.

$$f(RSB) = \int_0^n SB(i) \Rightarrow SB'(i) \quad (1)$$

Where,

- $R_{SB}$  = Rotated Division List
- $n$  = Number of blocks
- $S_{Bi}$  =  $i^{\text{th}}$  Block
- $S_{Bi}'$  = Rotated  $i^{\text{th}}$  Division

The task provider creates blocks out of the resulting string that is generated by extracting the elements of the text document that is supplied to the user. Each of the following blocks has 10 letters, and each of these blocks is saved separately in the format of a list. Whenever the characters inside the block are turned in accordance with the block's index, the blocks themselves go through a process of rotation. Modifying the index of such block by ten allows for the desired amount of revolutions to be accomplished.

After the blocks have been rotated, the ASCII codes of the letters contained within these blocks will be retrieved and used. After that, the ASCII code of the letters is added to the value that was taken first from signature key inside the step preceding it. This produces a distinct ASCII code for the consequent block that is then allocated to and substitutes the letters in the block, culminating in optimal encryption. These is shown in equation 2 beneath.

$$f(ESB) = \int_0^n \sum_0^k SB(i) \text{ MOD } Ky \Rightarrow ES_{Bi} \quad (2)$$

Where,

- $E_{SB}$  = Encrypted Block
- $n$  = Number of blocks
- $k$  = Numbers of Character in the block
- $S_{Bi}$  =  $i^{\text{th}}$  Block
- $K_y$  = Cipher Key
- $ES_{Bi}$  = Encrypted Block

This resulting list is successfully used to build the text document by recombining the blocks, and the encrypted text document that is produced as a consequence is posted into the decentralized server using socket programming.

### Step 3: Blockchain Creation and Integrity Maintenance –

This represents the most important process of the procedure that has been described. This kind is used so that the integrity of the information that is posted into the distributed server may be maintained. The encrypted file that was collected from the preceding step in this method is saved onto the distributed server so that it may be accessed when necessary. The first

thing that is done when we get to this stage of the process is a verification to see the presence of any documents in the directory that is being utilized for the store.

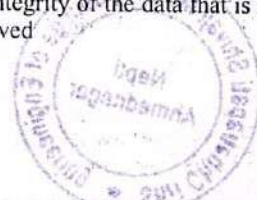
If it is determined that the path does not include any items, then the relevant file will be created in the location, and the elements of such a document will be retrieved. If somehow the path is found to be blank, then only the The md5 hashing component is used so that a hashing operation can be carried out on the information of the files that are located in the specified folder. In order to get the information contained within the file, you must first divide the contents and then generate the relevant hash key. The hash key that is created based on the contents of the file is used in the formation of the head key, which is performed with the help of algorithm 1. This master key is of great assistance in the production of the blockchain. This represents the head key that has been saved into the mysql database in order to perform subsequent integrity checks and evaluations.

If, on the other hand, there are already files on the digital server and the destination is not empty, then the data that is stored on the server has to have its integrity checked. This is because there should always be an efficient integrity maintenance performed each time a file is posted into the distributed server. The reason for this is due to the fact that this is a need. Therefore, in order to perform an integrity check on the files that have been saved, the contents of the files must be extracted and put through an md5 hashing method assessment before the results can be interpreted. The hash key of the files is then passed to the first algorithm for the purpose of creating the head key.

The algorithm 1 resultant head key is then used for the purpose of concatenation with the file contents of the following file. This is done after the resultant head key has been obtained. The contents of this file are afterwards and repeatedly hashed using the MD5 algorithm, which is followed by the formation of the had key. This procedure is carried out in an endless loop for each and every one of the files that are being uploaded to the decentralized server. After this, the head key of the final file, which is the terminal  $k_i$ , is accomplished.

The terminal key that was previously saved in the database table is then compared to the resulting terminal key that was produced as a consequence of this complete operation that was carried out on the files that were uploaded into the distributed server. The server is considered to be insecure if the terminal key that is now stored in the database does not match the terminal key that is created during the whole of the operation. The avalanche effect is shown by the difference in the terminal key. The avalanche effect is a reliable indication that the data have been tampered with, which ultimately results in the distributed server becoming corrupted. Due to the fact that this distributed server's integrity has been compromised, the fresh data will not be posted onto it.

If the terminal key that was created coincides with the terminal key that was saved in the database, this demonstrates that the integrity of the distributed server is being effectively maintained, since there is no sign of an avalanche effect. This suggests that the distributed server has not been tampered with and that it is safe for us to continue to upload data to it in the future since the integrity of the data that is kept on the server is properly preserved.





As soon as it is established that the distributed server has not compromised its security, the newly created file may be successfully submitted to the server. To accomplish this, the information of each of the documents that are now available are extracted, and their head keys are calculated using the hash key. The blockchain cannot be created without these head keys being present first. The combination among these head keys and the hash key is can then use to great advantage in order to accomplish the goal of obtaining the terminal key. The integrity assessment of the collected information that is being saved on the distributed server is determined, in large part, by the terminal key, regarded as the most important key of all. This terminal key is successfully kept within the databases for the feature assessments of authenticity of the information stored in the server in addition to when the subsequent upload a document is now being conducted. This is done during the subsequent upload a document is now being conducted. The following algorithm 3, which explains the blocks formation operation in its whole, may be seen below.

**ALGORITHM 3: Blockchain Formation**

```
//Input : File list FLST
//Output: Terminal Key TERMKEY
blockchainFormation(FLST)
1: Start
2: TERMKEY = ""
3: for i=0 to size of FLST
4:   Path= FLST[i]
5:   FCONT= getFileContent(Path)
6:   FCONT= FCONT + TERMKEY
7:   HK=MD5 (FCONT)
8:   TERMKEY= signatureKey (HK)
9: end for
10: return TERMKEY
11: Stop
```

**Step 4: Task Accessing** – The worker uses the authorized credentials that they established at the moment of enrollment during the initial phase of this method in order to get access to the job. After the worker's credentials have been verified, the system will offer a search tool so that they may find the appropriate job that has been submitted. In order to carry out the search process, you will need to enter the appropriate query through into search field that is associated with the kind of data that is requested. Well before search is executed, the incoming query is "preprocessed" by having its format changed to a string and by going through a conversion procedure. The procedures that are mentioned below will successfully accomplish the preprocessing for you.

**Special Symbol Removal** - The special symbols used in the English language give the grammatical structures. These unique symbols are of no utility to the search process, and they may be removed without causing any complications at all. As a result, the very first phase of this preparation procedure is removing any special symbols that may have been included in the user's query.

**Tokenization** – This represents one of the most important aspects in the preprocessing technique, because it has a discernible bearing on how the system is put into action. This is because tokenization divides the string into sections depending on the words inside the string, which ultimately results in the string being converted into a well-indexed string.

**Stopword Removal** - In the English language, stop words are phrases that are utilized to offer a rhythm to the spoken vocabulary in addition to providing an appropriate connection to various phrases. These words may also be removed to make the language more concise. If you remove this item from the input question, it will not affect the meaning in any way, since it is mostly concerned with aesthetics.

One example that may be used to illustrate stop words is the phrase "going to play," which, after passing through this stage of the preprocessing, gets transformed into the string "go play." This really is one way to explain stop words. This particular input string contains a stop word with in form of the word "to," the removal of which doesn't affect the interpretation of the phrase in any way.

**Stemming** – The vast majority of certain other terms in the English vocabulary are produced from respective parent terms by attaching a variety of suffixes to the end of the stems of those words. This is accomplished so that the grammatical constructions of the words that are being employed may be distinguished from one another. The procedure of stemming involves converting individual words towards their corresponding parent terms in order to create an appropriate enhancement in the interpretation of the data as a result of the decreased size of the individual words.

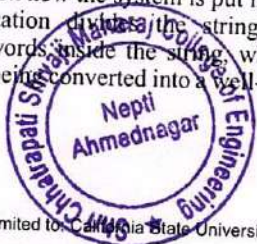
For instance, the word "going" may be shortened to "go" by successfully substituting the letter combination "ing" and therefore lowering the overall size of the term. By following these steps, the processing time may be cut down significantly yet the meaning of the word is not altered in any way.

Once the query has been preprocessed, it is sent to the system, which starts a linear search for said retrieval of the appropriate task based on the entered query.

**Step 5: Reward, Penalty assignment through Entropy and Decision Tree** – Only after job was successfully uploaded into the platform by the task provider, the worker is now capable of accessing this task using the search strategy that was illustrated before. When logging onto the system, the worker is required to submit the appropriate details in order to complete the authentication process. After these credentials have been verified, the worker will have accessibility to the job that has been made available by the task publisher. Prior to the functional assignment of the job, a smart contract will be established between both the worker as well as the task publisher.

The encrypted task that was supplied by the task provider can indeed be successfully decoded at the distributed server through implementation of this smart contract. After that, the job can be re-encrypted through the implementation of a combined effect of signature keys belonging to both the worker as well as the task provider, and it will then be supplied to the worker.

Because of this, we know that only the appropriate worker may execute the job and successfully decode the information. Because of the smart contract, this ensures that perhaps the worker in question is the only one who can see the job that has been published by the task provider. If the worker attempts to communicate this information with yet another individual, the information can be decrypted effectively because it is





encrypted through the implementation of a conjunction of keys, which the worker has only access to one key. If the worker continues to try to share this information with some other individual, the data cannot be decrypted effectively. If the employee makes an attempt to engage in unethical behavior, the task provider will be able to efficiently and simply identify this behavior.

In the event that any unethical behavior is discovered, the system of reward and punishment will be activated, which may have repercussions for the worker's level.

This distributed transparent and secure data vending platform recognizes a considerable increase in dependability and consistency as a result of the implementation of the decision making approach's if-then constraints, which determine whether the worker should get a reward or a penalty for their performance.

#### IV. USING THE TEMPLATE

After The research framework for an appropriate Trustworthy Freelancing Crowdsourcing strategy through the application of the blockchain based distributed approach has indeed been accomplished in Java programming language through the deployment of the NetBeans development environment (IDE). This strategy was developed using a laptop that has a storage capacity of 500 gigabytes, a memory capacity of 4 gigabytes, and an Intel i5 central processing unit (CPU). Windows was utilized as the operating system. The MySQL database administration is used in order to accomplish the goal of satisfying the necessity for a database.

The suggested technique has been subjected to in-depth analysis to determine how well it performs in relation to a wide range of performance measures. The process that will be followed during the assessment is shown in the following section.

##### 4.1 Encryption and Decryption Time performance

The data that is being transferred into the decentralized server may be effectively secured via the use of the suggested approach, which makes use of encryption and decryption methods. Quantification of the effectiveness of this strategy is required, and this may be done by following the process that is provided further down. The table that follows contains a tabulation of the time that was required encrypting and decrypting the data based on the different quantities of characters that were employed.

Number of Characters	Encryption Time (in ms)	Decryption Time (in ms)
15	4	3
1808	15	17
2805	33	32
3101	46	54
5312	52	59
6103	64	62
6680	67	63
8159	77	78
9521	82	79
9998	96	98

Table 1: Encryption and Decryption time performance

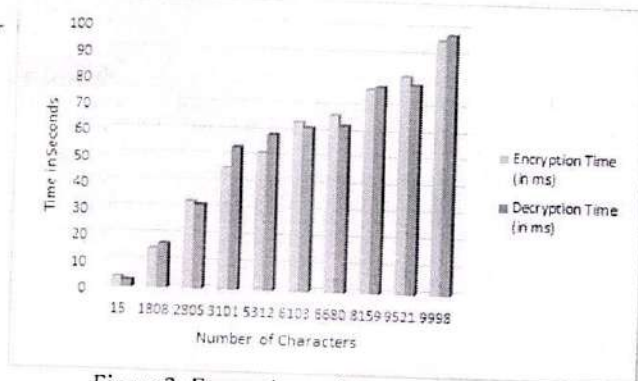


Figure 2: Encryption and Decryption Time

The tabular data were successfully retrieved for the intention of visual analysis in the bar charts which was then presented in the aforementioned figure 2. It should be obvious that the amount of time necessary for the encryption and decryption operation is indeed not exactly related to the number of characters that are supplied. This happens as a result of the premise that the cryptographic procedure that is employed for this method, which is referred to as the Reverse Circle Cipher, is designed and executed in a precise manner. In light of this, the execution of this strategy is quite successful, as evidenced by the performance metrics.

#### V. CONCLUSION AND FUTURE SCOPE

The proposed methodology for the purpose of achieving improved data sharing that is reliable and accountable in nature has been successfully expanded in this research article. The proposed approach achieves an effective framework that allows the data providers to securely provide the data to the data requestors or the workers. This is crucial as there are instances of data misuse and manipulation that can cost the data provider expensively. Therefore, this approach initiates with the data publisher and worker joining the system through the creation of the appropriate login credentials by registration. The both actors can now utilize these credentials to gain access to the system by performing login. The publisher then provides the system with the dataset which is first utilized for block generation, key generation to achieve the blockchain. The data is then transferred to the worker that performs the task which is then subjected to the judgement module by the system. The judgement module also performs the integrity evaluation which is then utilized for providing a reward to the worker or a penalty. This approach has been tested for its performance through the use of experimentation which yielded suitable results.

This method can be achieved on a cloud infrastructure for real-time application, which is one of the potential future avenues for this field of study.

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# Virtual ATM through Fingerprint and Face recognition using Deep Learning

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**Abstract** Fingerprints and facial features of the individual are being used in biometric authentication techniques, which are increasingly extensively used across significant implementations. Despite the fact that there multiple facial recognition systems accessible. A greater number of research should unearth factors that improve efficiency and accuracy. Facial as well as fingerprint identification play an important part in the identifying process since they do not need human assistance, unlike some other biometrics methods. This not only proves the huge potential to create far greater protection for such Virtual ATM transactions, but also explains the reasoning why biometric identification systems have been attracting so much attention. Therefore, for this purpose an effective framework for biometric authentication on Virtual ATMs through the use of biometric features, such as Facial and Fingerprint have been proposed. The presented framework utilizes Live Streaming and Region of Interest along with Channel boosted Convolutional Neural Networks and OTP authentication has been implemented. The framework has been measured using lengthy experimentations to achieve quite reassuring outcomes.

**Keywords:** Virtual ATM, Biometric recognition, Face recognition, Fingerprint Recognition, Channel Boosted Convolutional Neural Networks.

## I INTRODUCTION

Internet has arrived since both the Internet and smartphones devices have become more commonplace. Here has been a meteoric rise in the usage of smartphones over the last several decades, and with that rise has come an influx of new smartphone applications and software programmers. Here, a biometrics ATM technology using machine vision and technology that recognizes faces is a game-changer for productivity. The person's face is a good base for personal identification and verification due to its substantial individual traits and self-stability as a characteristic physiological component intrinsic to the human body. When contrasted with other approaches,

facial recognition is universally welcomed, pleasant, trustworthy, and risk-free.

Numerous different types of equipment have been introduced in India as a result of technical advancement, each with the intention of raising customer satisfaction. The automatic teller machine (ATM) was one item that streamlined banking for financial institutions. The advent of ATMs enabled customers to conduct financial transactions independently. Originally, only customers of a certain bank could utilize an ATM to move money; later, however, all ATMs became connected to a single network, enabling customers of just about any bank to utilize any ATM of their choosing. Due to this, customers of other banks remained able to use the ATMs of other banks to make deposits, withdrawals, and wire transfers. Facial detection is so natural to human people that even newborns can tell family and friends apart. However, computers have a hard time with face detection. In the inaugural automated face identification system, an extracted features is built by labelling the locations of facial landmarks like the eyeballs, eyebrows, chin, etc., and faces are identified by measuring the Euclidean distance between extracted features from different photos. In order to characterize the architectural aspects of facial photographs in a big database, most methods employ feature maps of varying dimensions. While others characteristic face recognition methods simplify the categorization work by treating the face region as a juncture and representing it in a lower dimensions environment that is generated from the multidimensional space input images.

Facial identification is considered one of the most reliable methods of establishing a person's identification, which has been the topic of a great deal of research over the last numerous years. Face recognition from photographs is a popular area of study in biometrics. Among the most useful applications of facial recognition and identification technologies is evaluating images for



interpretation. Mental health professionals, neuroscientists, and machine learning experts have all taken an interest in facial recognition software since advances in the field may provide light regarding how the natural brain processes. Despite the prevalence of biometric identification methods like fingerprint as well as retinal scanners, they still rely on human verification. Nevertheless, it is not necessary while utilizing face pictures for person authentication. Facial recognition technology plays a crucial part in establishing a person's identity since it does not truly entail human cooperation that is a considerable benefit above all other biometrics approaches.

According to research by Chaoyou Fu [1], a novel Double Variational Regeneration Face architecture have been designed to enhance the efficacy of Heterogeneous Face Recognition by generating large numbers of paired diverse images from playback. The very first stage is painstakingly building a double variational encoder that really can train with both associated huge datasets and imbalanced visible information. The addition of this feature greatly broadens the scope of possible identifications from the resulting images. A bilateral identification conservation decline is then applied to the generated images to guarantee that they retain their original consistency. This new set of unidentified images may be utilized to train up the Heterogeneous Face Recognition models using descriptive learning, capitalizing on both the identification persistence and identification dispersion features.

Using face recognition technology, Kanjana Eiamsaard [2] developed the Smart Warehouse Accessibility Management System. Smart Warehouse Accessibility Monitoring Program was validated using a confusion matrix experimental process. The system as a whole performed as expected in terms of accessible surveillance. Crime investigations may be sped up and made more efficient with the help of the Smart Warehouse Accessibility Surveillance System. Upgrading the Smart Warehouse Accessibility Management System to include item identification might allow for constant tracking of stolen goods and immediate notification in the event of a breach.

[3] Feng Liu Explain a novel regression-based approach to face identification and face recognition reconstruction from a single 2D image, allowing for any expression or pose. It takes a 2D image of a face and uses those cues as clues to rebuild the 3D face, subsequently utilizing those revised 3D faces to further enhance the 2D

characteristics. In order to do both tasks simultaneously in real time, the proposed method alternates between employing feedforward landmark regression model and 3D shape coefficient of determination. The proposed approach outperforms state-of-the-art 3D face remediation tools by automatically recreating both pose-and affirmation and expressive 3D shapes from a single face photo of arbitrary postures and expressions.

Section 2 of this research article presents an analysis of the relevant literature; Section 3 explains the research approach; Section 4 discusses the experimental assessments; and Section 5 closes with suggestions for further study in the future.

## II RELATED WORKS

Since there is a limit to the number of Eigen faces that can be used in Principal Component Analysis transformation, Gurlove Singh [4] reports that the method was not more successful than other techniques, which includes traditional and digitalized face recognition. More work is needed to perfect the fully automated front-view facial recognition technology that shows off pinpoint accuracy in demos. There is going to be substantial improvement in the system's precision when used in practice. To achieve a high degree of precision, the mechanism was badly conceived and built. One contributing factor would be that the face detection and recognition platform's component is not always sensitive enough to subtle changes in consistency with respect to dimensionality or orientation.

An end-to-end learning strategy for pose-invariant facial expression recognition and face picture reconstruction using geometric information is described by Feifei Zhang [5]. In order to help in the training of a deep neural binary classifier, it may generate face images with fabricated expressions and postures. Extensive experiments on three most commonly used datasets show the effectiveness of this method. Facial features may also be transmitted using this method.

According to Zhang Jianxin [6], detecting face traits for identification has been among the most difficult tasks. This article's authors offer a novel technique for recognizing people's faces by using the Two-Dimensional Adaptive Directional Wavelet Transform and indeed the Latent Semantic Feature space Methodology. Therefore, for the very first instance, researchers apply the adaptable directional wavelet transform to the face identification issue in two



dimensions. Two-dimensional adaptable directed wavelet decomposition is used to make an iterative forecasting and refresh step that takes into account the local features connecting individual pixels. Both of the forecasting and refresh controls in this study use a set of nine orientations with 8 fading occurrences. The ideal orientation for performing the hoisting wavelet decomposition is determined by applying a thread segmentation technique to the data.

Using Eigen Face, fisher face, and Local Binary pattern approaches from the Open source domain, Limei Fu [7] offers a system for recognizing and identifying people's faces on Linux. The minimization strategies are therefore put out via a validation process, and investigation is utilized to analyses their pros and cons as well as the conditions in where they could be applied. The development of reliable software that recognizes faces is a complex issue. Without using many methods, achieving a respectable identification outcome is difficult. By merging local and worldwide data, facial features may be accurately characterized. Increasing identification effectiveness in tandem with the use of numerous features and classifiers may be achieved via the use of the strategy of combining both.

According to Sergei Shavetov's [8] study, the suggested method is low-cost, user-friendly, and uncomplicated to implement while providing just the basic minimum of protection versus malicious actors. While it may function well in fully automated operation, human supervision throughout the verification process is recommended to prevent any unplanned bypasses of the safeguards. It might be used as a certificate authority, in conjunction with the likes of radio-frequency identification, near-field interaction, and other methods now in use. If the genuine identifier is misplaced or misappropriated, the program will be absolutely certain that the wrong person is prevented from entering, independent of how well the alternative type of validation works.

In [9], Di Wang explains how convolutional neural networks are an important component of reinforcement learning. Particular advantages in computer vision may be derived by using convolutional neural networks, which are based on local circuit associated parameters and other properties. Development at Convolutional Neural Networks is vital since it affects both the efficiency in which the system is trained and the final efficiency of recognition. Drop - out rates value, activation function, and number of modeling layers are investigated as design approaches. Improved

identification accuracy is the outcome of utilizing the original data set to refine the strategy. Given how difficult it is to collect a significant amount of information in practice, the data set utilized in this study has constraints, but it could nevertheless be utilized to help prove the efficacy of the novel process.

According to Bharath Tej Chinimilli [10], Local Binary Pattern Histogram is one of the most well-known methods of face identification. This method is useful for picking out pupils who have accidentally changed their appearance (for example, by wearing glasses or growing facial hair). The small size of the dataset raises certain concerns. It is possible that a new, improved data set will be compiled in an effort to get a more reliable result. The authors potentially improve the Haar cascade algorithms' capacity to recognize new faces if they generate a new training set. The program may sound an audible or visual warning if a cheater is detected in the classroom.

A novel graph-based, multi-Face Enhancement Generative Adversarial Network has been released by Mandi Luo [11], expanding existing datasets for deformation-invariant facial recognition software. Instead of only isolating the personality prognostications, it also utilizes the dissociated representations to alter face attributes, which greatly improves the reliability of biometric identification programs. The authors furthermore provide Graph Convolutional Systems for investigating global connections amongst different face regions, which helps to better preserve the spatial information. Extensive experiments on face recognition and picture reconstruction tasks show that our proposed method is successful in learning a superior identity-preserving capacity from restricted datasets.

To aid with this endeavor, Gou Wei [12] proposes a multi-feature structure for the sentiment classification issue. There are two parts to the data on emotions: video and audio. Traditional technologies is used to extract meaningful from auditory, and 4 main channels are used to retrieve sentiment traits from video sequences, all with the help of the authors. A weighted sum is then used to incorporate the test score, with each network's weight based on how dedicated it is to the best possible result. Researchers found that the conceptual approach performed better than the competition in experimental evaluations of perceptual processing in the environment. M. Geetha [13] recommends using a machine learning-based facial identification approach with a support vector machines framework to keep an eye on students' online test activities. The proposed method aids in expedited





face identification by synthesizing feature maps from image features. A variety of other techniques, such as the Speeded up Robust Functionalities, the Scale Invariant Feature Transform, the Fisher faces, and the binary pattern local histograms, may indeed be utilized to develop more resilient object recognition which can locate faces amid varying lighting circumstances. Implementing other approaches might lead to superior optimum values as well. To improve accuracy, convolutional neural networks may be used.

### III PROPOSED METHODOLOGY

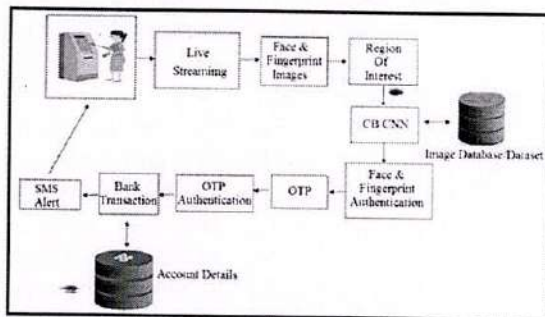


Figure 1: Proposed Methodology

The proposed approach for achieving Card less Virtual ATM system that utilizes biometric authentication in the form of face and fingerprint authentication has been depicted in the figure 1 above and the steps taken to achieve this system are elaborated below.

*Step 1: GUI Building* – For the purpose of demonstration of our methodology, an interactive user interface has been realized using the swings framework on the java programming language. The application for performing bank transactions by the customer has been achieved as an interface that is easy to understand and navigate. The developed and designed interface facilitates the enrollment of the users into the platform by collecting their various attributes and information such as name, date of birth, mobile number etc. along with the user authentication components such as face and fingerprints. The user characteristics such as facial characteristics captured through the facial image of the user taken at the time of registration are stored along with the fingerprints of the user. These characteristics are useful for the realization of the virtual ATM approach that will verify the users based on the facial features and fingerprints. The collected characteristics of the specific users are segregated and stored in an image database that will be

utilized in the further steps for the purpose of training our deep learning model.

*Step 2: Training the CB-CNN model* – The collected images from the user having the users face and fingerprints respectively have been crucial in the realization of the training of the deep learning model selected for this implementation. The model being utilized for the purpose of achieving the training and recognition of the user through the face and fingerprints is the CB –CNN model.

The CB-CNN stands for Channel Boosted Convolutional Neural Networks which are an improvement over the traditional Convolutional Neural Networks. The CB-CNN model utilized boosted color channels for the implementation over the conventional CNN that does not incorporate any boosted channels. The CB-CNN approach can considerably improve the recognition accuracy in comparison to the traditional CNN due to the implementation of the boosted channels.

The Sequential class incorporated into the TensorFlow library allows for the development of sequential neural network architectures. Next, as the first stage of the CB-CNN Design, we add a convolution layer with 32 3x3 kernels and the ReLU activation function, reserving this layer for images of the correct size. It is the only purpose of this layer to ensure that the images are the same size. Afterwards, a Convolution layer with 64 3 x 3 kernels and ReLU activation is introduced. A maxpooling layer with a dropout regularity of 25% and a size of 2 by 2 units has been planned.

Each of the 128 kernels has a size of 3 by 3, owing to the extra fully connected layers. To do this, we have used a special activation function called the ReLU activation function. The maximum pooling layer now has the prescribed size of 2x2. After the third layer is complete, the last layer is implemented with 128 3x3 kernels and the ReLU activation function. We add a second Max pooling layer, adjusting the dropout to 25% and keeping the dimensions at 2 x 2.

After the neural network training is complete, it is flattened using the flatten method, a dense layer of size 1024, and the ReLU activation function. A dropout ratio of 50 is needed at the conclusion of the convolution neural network. Following which a dense layer has been implemented with 7 classes, each of which corresponds with the 7 users that are being utilized for the demonstration of this methodology.



It is common procedure to utilize the Adam optimizer to improve the outcome with 500 epochs for all of the user attributes, including their face and fingerprints, while the player remains within the learning phase. When the training stage is finished, the model imports the learned data from an H5 file and uses it during the testing phase. The structure of the Channel Boosted – Convolutional Neural Network is shown in Figure 2.

Layer	Activation
CONV 2D 32 X 3 X 3	Relu
CONV 2D 64 X 3 X 3	Relu
MaxPooling2D 2 X 2	
Dropout 0.25	
CONV 2D 128 X 3 X 3	Relu
MaxPooling2D 2 X 2	
CONV 2D 128 X 3 X 3	Relu
MaxPooling2D 2 X 2	
Dropout 0.25	
Flatten	
Dense 1024	Relu
Dropout 0.25	
Dense 7	Softmax
Adam Optimizer	

Figure 2: Convolution Neural Network Architecture

*Step 3: User Authentication and Transaction Completion*

The trained model achieved in the previous step is being utilized for the purpose of achieving the authentication of the user for completing the transaction. The registered user interacts with the virtual ATM to provide with the respective details such as face and fingerprint for the purpose of verification. The system captures the face and fingerprint images and provides to the subsequent modules for the purpose of authentication. The images are utilized by system by first subjecting the images to the process of region of interest evaluation. The region of interest isolates the region of the face as well as the fingerprints for the evaluation by the trained model. The images are then subjected to the trained model that verifies the user based on the captured facial and fingerprint images.

Once the user has been verified a One Time Password or an OTP is generated and sent to the user via email. This OTP needs to be authenticated before performing the transaction. As the OTP is authenticated the bank transaction initiates and the system navigates the user to perform the bank transaction efficiently.

IV RESULTS AND DISCUSSIONS

The proposed approach for the virtual ATM through the use of facial as well as fingerprint features of the user. Both the Python and Java programming languages, using the Spyder and NetBeans integrated development environments, respectively, have already adopted the concept. The code was written in both of these contexts. The plan requires using the OpenCV, TensorFlow, and Keras frameworks to do the necessary tasks of deep learning. It was determined that a laptop with an Intel Core i5 CPU, 8 GB of Memory, and 1 TB of storage space worked best for testing the forthcoming implementation.

Accuracy in face and fingerprint detection must be measured with the efficiency of the proposed technique. Error may be used to gauge how trustworthy a technique is; typically, the lower the error, the more trustworthy it will be. A reliable error analysis may be carried out with the use of the root mean square error measure.

Performance Evaluation based on RMSE

The Root Mean Square Error is one of the most useful performance measures for assessing the degree of deviation between a set of similar features. The suggested method will be evaluated based on two metrics: the percentage of successfully identified fingerprints and the percentage of incorrectly identified fingerprints. Here, Equation 1 is given for your convenience in calculating the RMSE.

$$RMSE_{fo} = \left[ \sum_{i=1}^N (z_{fi} - z_{oi})^2 / N \right]^{1/2}$$

Where,

- $\sum$  - Summation
- $(Z_{fi} - Z_{oi})^2$  - Differences Squared for the fingerprints identified correctly and fingerprints identified incorrectly
- N - Number of conducted Experiments.

For various iterations of fingerprint recognition using the proposed technique, we compute the relative mean square error or RMSE values. Fingerprint recognition is tested ten times to ensure accuracy. The proposed method's identification result is saved after each session it is acquired. Then, the information is used to carry out an RMSE evaluation. Careful calculation of the outcomes described in table 1 that would be presented below yields these RMSE readings.





S no.	Number of Iterations	Correctly identified Fingerprints	Incorrectly identified Fingerprints	MSE
1	10	9	1	1
2	10	8	2	4
3	10	9	1	1
4	10	7	3	9
5	10	10	0	0

Table 1: RMSE measurements tabulated.

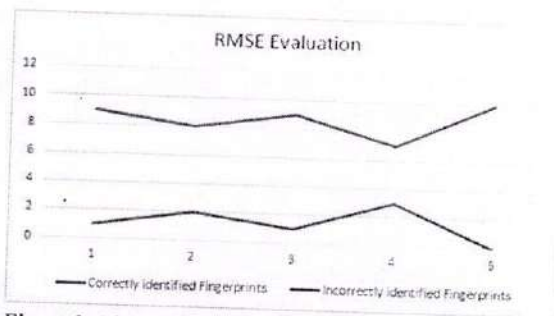


Figure 3: Line Graph for RMSE outcomes

For the purpose of making the diagram in the figure 3 supplied above, we are using the results acquired for the identification effectiveness and the RMSE measurements in the table 1 previously provided. The following table and graph illustrate the method that is meant for the purpose of fingerprint recognition in order to obtain a very small error rate of 1.732.

Performance Evaluation based on Precision and Recall Measures of precision and recall are very useful for assessing the thoroughness with which a certain module of the paradigm has been executed. These two measurements are discussed in the larger framework of our approach. Relative correctness is defined by the module's precision, which includes its reliability across a wide range.

The accuracy of this approach was measured by comparing the number of correct identifications with the total number of tests. Nonetheless, the recall requirements are a useful adjunct to the accuracy assessment in determining the CB-CNN component's overall dependability. This is due to the fact that precision monitoring is not adequate on its own.

The recall is determined in this method by contrasting the proportion of correct to incorrect identifications. In order to quantify this argument, the following equations are provided.

Precision and Recall can be depicted as below:

- ✓ A = The number of accurate face identifications
- ✓ B = The number of inaccurate face identifications

✓ C = The number of accurate face identifications not done

So, precision can be defined as

$$\text{Precision} = (A / (A + B)) * 100$$

$$\text{Recall} = (B / (B + C)) * 100$$

Using the abovementioned formula, the experimental findings are shown in Table 2 below. With these statistical parameters, we can generate the representation illustrated in figure 4.

Table 2: Precision and Recall Measurement Table

No. of Iterations	Accurate Face Identifications (X)	Inaccurate Face Identifications (Y)	Accurate Face Identifications not done (Z)	Precision	Recall
10	10	0	0	100	100
20	17	2	2	89.47368	89.47368
30	27	2	2	93.10345	93.10345
40	35	3	3	92.10526	92.10526
50	44	5	2	89.79592	95.65217

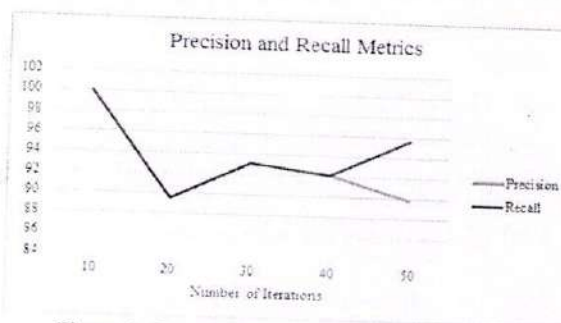


Figure 4: Comparison of Precision and Recall

In this graph, we see the CB-CNN in action, demonstrating its capacity to perform over a broad variety of trial counts and provide accurate face detection in accordance with the input data. The very high accuracy and recall rates of 92.89 and 94.06 percent, respectively, demonstrate the method's reliability. These numbers are quite sizable for the first implementation of such a technique, and the success that has resulted is commendable.

## V CONCLUSION AND FUTURE SCOPE

The proposed approach for achieving Card less Virtual ATM system that utilizes biometric authentication in the form of face and fingerprint authentication has been elongated in this research article. The presented approach utilizes the ATM machine along with the camera for capturing the live feed of the user. The live feed from the ATM camera is being streamed to the system live which is then effectively utilized for the purpose of achieving



face and fingerprints of the user. These are converted into images and provided to the next step for the region of interest estimation. The region of interest isolates the facial features as well as the region of the image containing the face. These are provided to the Channel Boosted Convolutional Neural networks that is connected to the database consisting of user facial and fingerprint images. The CB-CNN approach then effectively authenticates the user based on the images in the database and a One Time Password is sent to the registered user mobile number. This OTP is then entered by the user which is authenticated and the user is allowed to perform the bank transaction on the ATM and a suitable alert is sent to the user via an SMS. The approach has been rigorously evaluated for its performance using RMSE and Precision and Recall which has resulted in highly reassuring measurements. In the future this can be implemented using the Reinforcement learning model to recognize the aging face accurately.

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# Modification In Fixture Design For Telescopic Shaft Which Manufacturing On Milling Machine

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**Abstract:** Telescopic shaft is very important part of machine. It should be accurately machined with the acceptable tolerance. Also the fluctuations of dimensions in work-piece to work piece should be minimum so that it will be easier to assemble in machine. But it has been observed that the required dimensions for the larger end diameter and smaller end diameter for the telescopic shaft are not continuously achievable by using the existing fixture.

In machining fixtures, minimizing workpiece deformation due to clamping and cutting forces is essential to maintain the machining accuracy. Fixture is required in various industries according to their application. This can be achieved by selecting the optimal location of fixturing elements such as locators and clamps.

The fixture set up for component is done manually. For that more cycle time required for loading and unloading the material. So, there is need to develop system which can help in improving productivity and time. Fixtures reduce operation time and increases productivity and high quality of operation is possible. The proposed fixture will fulfilled researcher production target and enhanced the efficiency, reduces operation time and increases productivity, high quality of operation, reduce accidents.

**Keywords:** Telescopic Shaft, Fixture Design, Production Rate.

## 1. INTRODUCTION

The fixture is a special tool for holding a work piece in proper position during manufacturing operation. For supporting and clamping the work piece, device is provided. Frequent checking, positioning, individual marking and non-uniform quality in manufacturing process is eliminated by fixture.

This increase productivity and reduce operation time. Fixture is widely used in the industry practical production because of feature and advantages to locate and immobilize work pieces for machining, inspection, assembly and other operations fixtures are used.

A fixture consists of a set of locators and clamps. Locators are used to determine the position and orientation of a work piece, whereas clamps exert clamping forces so that the work piece is pressed firmly against locators. Clamping has to be appropriately planned at the stage of machining fixture design.

The design of a fixture is a highly complex and intuitive process, which require knowledge. Fixture design plays an important role at the setup planning phase. Proper fixture design is crucial for developing product quality in different terms of accuracy, surface finish and precision of the machined parts in existing design the fixture set up is done manually, so the aim of this paper is to replace with hydraulic fixture to save time for loading and unloading of component.

Hydraulic fixture provides for flexibility in holding forces and to optimize design for machine operation as well as process function ability.







2. EXPERIMENTAL METHODS OR METHODOLOGY

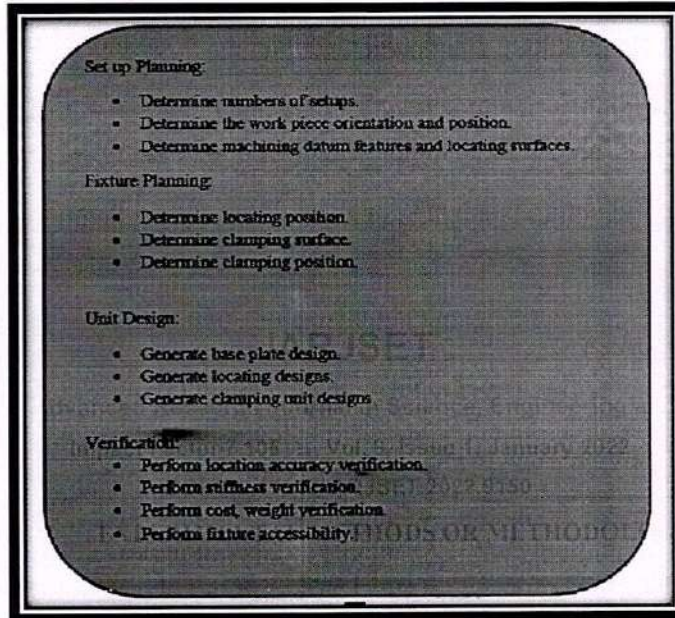


Fig 1. Procedure for Fixture Design

3. IMPORTANT CONSIDERATIONS WHILE DESIGNING FIXTURES

1. Study of workpiece and finished component size and geometry.
2. Type and capacity of the machine, its extent of automation.
3. Provision of locating devices in the machine.
4. Available clamping arrangements in the machine.
5. Available indexing devices, their accuracy.
6. Evaluation of variability in the performance results of the machine.
7. Rigidity and of the machine tool under consideration.
8. Study of ejecting devices, safety devices, etc.
9. Required level of the accuracy in the work and quality to be produced.

3.1 Elements of Fixture

Generally, all fixtures consist of the following elements:

1. Locators

A locator is usually a fixed component of a fixture. It is used to establish and maintain the position of a part in the fixture by constraining the movement of the part. For work pieces of greater variability in shapes and surface conditions, a locator can also be adjustable.

i.Vee Locators

This is quick and effective method of locating the workpiece with desired level of accuracy. This is used for locating the circular and semi-circular type of workpiece. The main part of locating device is Vee shaped block which is normally fixed.

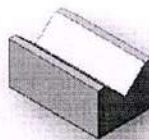


Fig. 2 VEE Shaped Locator



**2. Clamps**

A clamp is a force-actuating mechanism of a fixture. The forces exerted by the clamps hold a part securely in the fixture against all other external forces acting on to the component.

**3. Supports**

A support is a fixed or adjustable element of a fixture. When severe part displacement/ deflection is expected under the action of imposed clamping and processing forces, supports are added and placed below the work piece so as to prevent or constrain deformation. Supports in excess of what is required for the determination of the location of the part should be compatible with the locators and clamps.

**3.2 General Requirements of Fixture**

In order to maintain the work piece stability during a machining process, an operational fixture has to satisfy several requirements to fully perform its functions as a work holding device. The following constraints must be observed while designing a viable fixture.

**1. Geometric constraint**

Geometric constraint guarantees that all fixture elements have an access to the datum surface. They also assure that the fixture components do not interfere with cutting tools during a machining operation. In addition to these requirements, a fixture design should have desirable characteristics such as quick loading and unloading, minimum number of components, accessibility, design for multiple cutting operations, portability, low cost, etc.

**2. Contained deflection**

Work piece deformation is unavoidable due to its elastic/plastic nature, and the external forces impacted by the clamping actuation and machining operations. Deformation has to be limited to an acceptable magnitude in order to achieve the tolerance specifications.

**3. Deterministic location**

The work piece is constrained by locators so that it is presentable for the machining operation. Locating errors due to locators and locating surfaces of the work piece should be minimized so as to accurately position the work piece within the machine coordinate frame.

**4. MATERIAL AND ITS SPECIFICATIONS**

D2: A cold work tool steel. D2 is a high chromium tool steel specifically designed to provide a high abrasive wear resistance and a high hardenability. The grade is delivered in annealed condition to keep a good machinability. After machining it requires a hardening to achieve its service properties. The adjustment of hardness should be done to get the best compromise between toughness and wear resistance. This grade can be used for cutting and deformation tools submitted to high abrasive wear. It can be used when 2% carbon steels (D3 type) shows an excessive sensitivity to cracking or chipping.

Main applications are stamping tools, punches and dies, forming dies, shear blades and cutters, ceramic molds.

**5. CALCULATIONS**

- Dimensions of fixture
- Internal diameter 10.01 mm
- External diameter 20 mm
- Stress = force/area
- Young's modulus of material is 205 GPa
- Force applied approximate 48 to 50 KN
- Length of rectangular section is 50.20 mm
- Thickness of base plate is 10 mm

**CONCLUSION**

The efficiency and reliability of the fixture design has enhanced by the system and the result of the fixture design has made more reasonable. To reduce cycle time required for loading and unloading of part, this approach is useful. If modern CAE, CAD are used in designing the systems then significant improvement can be assured. To fulfill the multifunctional and high performance fixturing requirements optimum design approach can be used to provide comprehensive analyses and determine an overall optimal design. Fixture layout and dynamic clamping forces optimization method based on optimal fixture layout could minimize the deformation and uniform the deformation most effectively. The proposed







fixture will fulfilled researcher production target and enhanced the efficiency, Hydraulic fixture reduces operation time and increases productivity, high quality of operation, reduce accidents. Traditionally, fixture design is a manual process and demands an expert's Knowledge and skilled engineering. In this report, a literature survey of fixture design and automation over the past decade is proposed with the introduction on the fixture applications in industry and the significant works done in the design field, including their approaches, requirements and working principles are discussed. Finally, some prospective research trends are also discussed.

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## SURVEY ON SUPPLY CHAIN MANAGEMENT USING BLOCKCHAIN TECHNOLOGY

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DOI : <https://www.doi.org/10.56726/IRJMETS31267>

### ABSTRACT

With the advancement of blockchain in every field, it is also used in the agri-food supply chain. As the food supply chain is such a network where no one knows from where and what quality of food is transported and how long it takes to reach its destination. The blockchain helps to keep track of the complete chain with the help of distributed ledger. Each transaction, the quality of food, and the time required to reach its destination are saved. Supply chain management carries out all the processes from raw material to the final product. The supply chain is divided into several stages from the farmer to the customer. Although the blockchain food supply chain provides immutability of data and records in the network. In the proposed system, all transactions are written to blockchain which ultimately up-loads the data to the Interplanetary File Storage System (IPFS), along with the auction system for the buying and selling of the food items directly from the farmer. The storage system returns a hash of the data which is stored on the blockchain and ensures an efficient, secure, and reliable solution. Our system provides smart contracts and their algorithms to show the interaction of entities in the system.

**Keywords:** Block Chain, Ethereum Block Chain, Smart Contract, Distributed Ledger, Interplanetary File Storage System (IPFS).

### I. INTRODUCTION

Traceability plays an important role in food quality and safety management. Tracing product-associated processes across advanced offer chain networks has become an integral part of current offer chain management. At a similar time, customers area unit currently a lot of curious about the nutrient quality. it's difficult to trace the source of information and maintain its traceability throughout the availability chain network therefore Blockchain technology is employed that ensure traceability, trust, and delivery mechanism within the Agri-Food offer chain. A blockchain could be information that's shared across a network of computers. Once a record has been extra to the chain it's troublesome to vary. The records that the network accepted area units extra to a block. Every block contains a novel code known as a hash. It conjointly contains the hash of the previous block within the chain.

Supply Chain Management (SCM) could be a cluster of processes and sub-processes dispensed for remodeling material into a final product, maximizing client price, and achieving a rectifiable competitive advantage. It's conjointly understood as a network of entities that area unit a part of the system from production to mercantilism. The total offer chain network is split into many stages. Processes concerned in these stages typically take months to finish. In such a scenario, if the ultimate product lacks in quality, it becomes very troublesome to trace the basic explanation for the matter. That the planned system overcomes fraud .it work on a traceability theme and mercantilism and delivery mechanisms. Conjointly provides a web Auction system.

#### GOALS AND OBJECTIVES:

- To do an extensive study by literature survey on blockchain-based Agri-Food supply chains and provides an end-to-end solution.
- To work on traceability schemes and trading and delivery mechanisms.
- To Design an autonomous transaction system.
- To implement advanced blockchain technology to improve the classification accuracy.

### II. METHODOLOGY

These entities are part of the data layer and are described as follows:

- **Farmer:** A farmer is the first entity in the Agri-Food supply chain and is the first one to invoke a smart contract for trading to give the information of the amount of crop produced and their sell price. He sells the produced crop to the processors for further processing of raw products to sellable finished products.



- **Processor:** A processor buys raw food from the farmers. He is responsible for eliminating extra material from the crops and converting them into a finalized product through various processes. The processor sells this finalized product to distributors.
- **Distributor:** A distributor maintains a big warehouse by buying finalized products from processors and is responsible for selling them to the retailers in wholesale.
- **Retailer:** A retailer buys the finished traceable products from distributors and sells them to customers in smaller quantities as required by the consumers.
- **Consumer:** A consumer is an end user who buys and consumes products from retailers or directly from the farmer using an auction system.

### III. MODELING AND ANALYSIS

The model for agri- food supply chain is as follows:

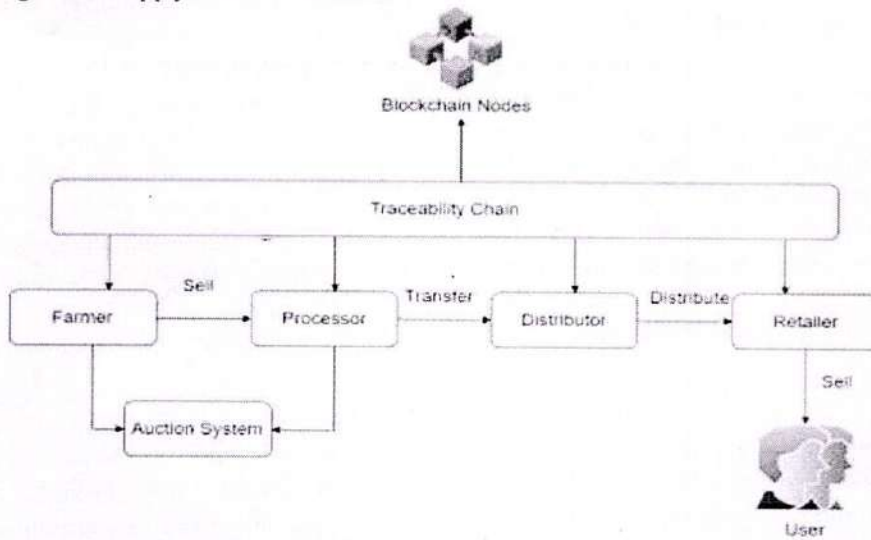


Figure 1: System Architecture of model

### IV. RESULTS AND DISCUSSION

1. Blockchain-Based Agri-Food Supply Chain provides traceability, accountability, and security.
2. Improve the classification accuracy.
3. Give end-to-end solutions for blockchain-based Agri-Food supply chain.
4. End users can add suggestions for the particular process according to their preferences.

#### Mathematical Model:

The mathematical model for the system is as-

$$S = \{I, F, O\}$$

where,

I : Set of inputs

F : Set of functions

O : Security and Supply Chain

$F = \{F1, F2, F3\}$

F1 : Farmer

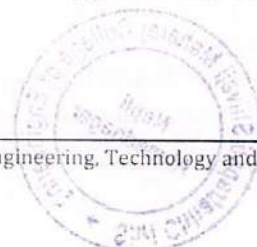
F2 : Processor

F3 : Retailer

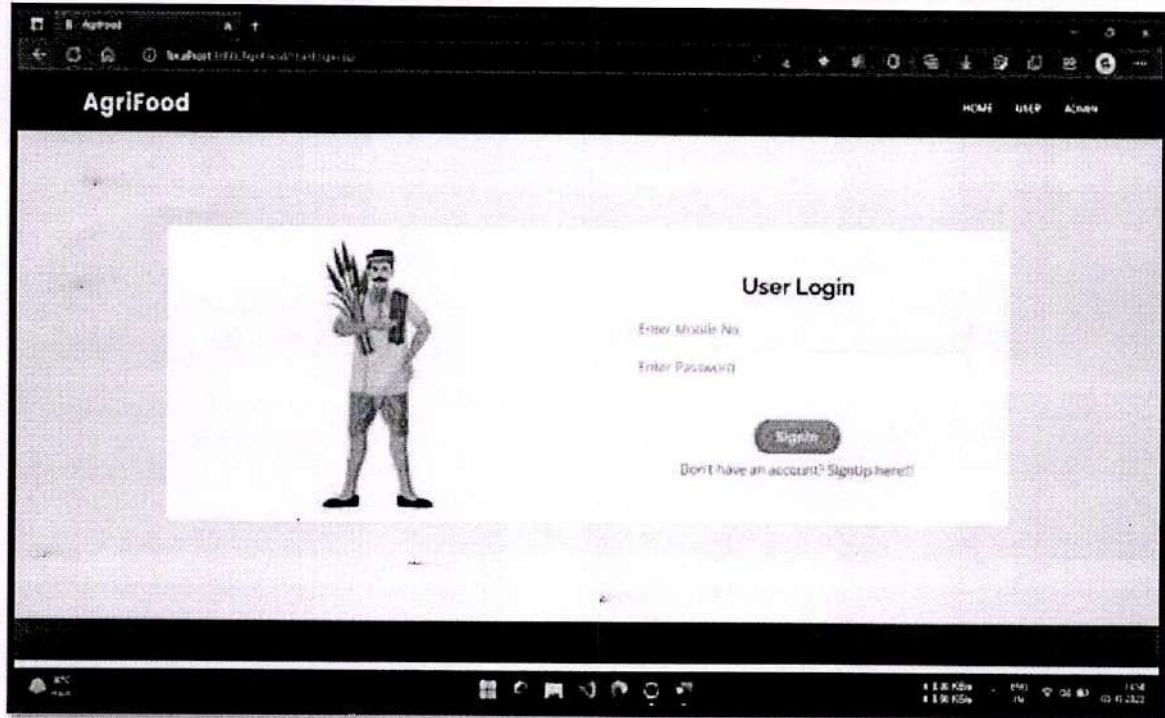
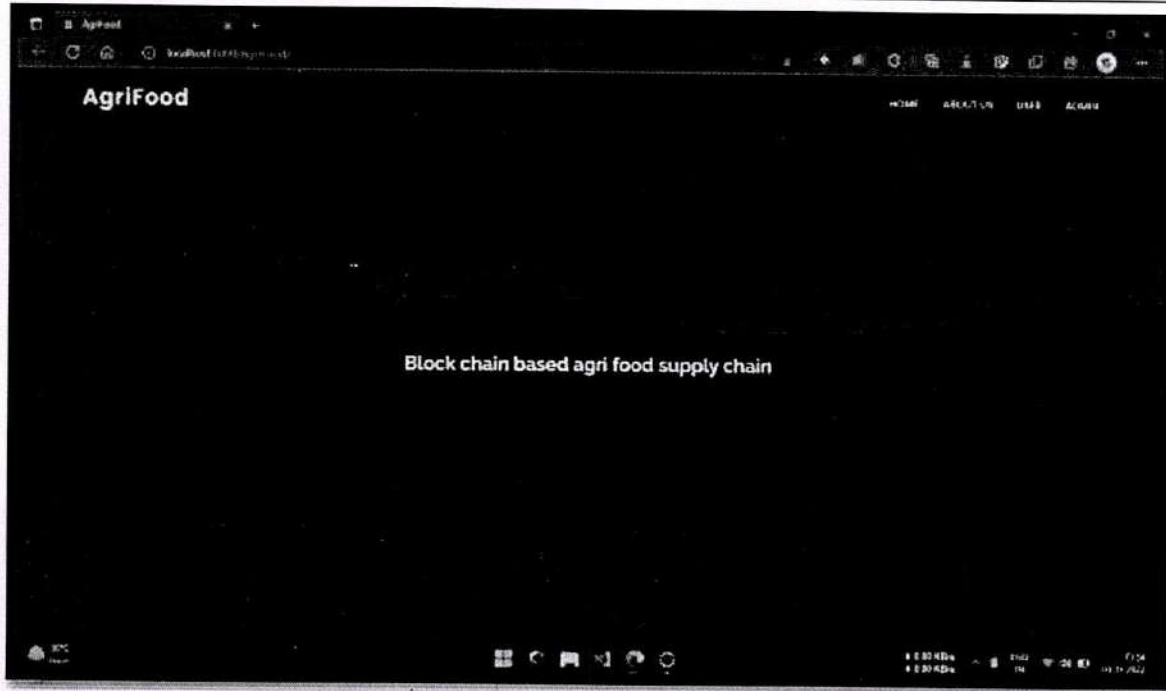
F4 : Consumer

#### REGISTER PAGE

There are two different login, one for admin and another for users such as farmers, processors, retailers & customers.











## V. CONCLUSION

The supply chain industry has gained numerous benefits to grow and move towards decentralization and achieve a trustless environment for all processes. However, despite the trustless nature of blockchain, it is hard to fully maintain trust between the seller and buyer of the product. This is because the entities may act maliciously and the buyer can doubt their credibility. So the reputation system is proposed to maintain the credibility of the Agri-Food supply chain entities and the quality ratings of the products it also maintains the immutability and integrity of the transactions as these transactions are based on blockchain.

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## WASTE FOOD DONATION APP

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DOI : <https://www.doi.org/10.56726/IRJMETS31280>

### ABSTRACT

An important goal in our world today is to eliminate food waste by reutilizing available food sources within local communities such as leftover food items in restaurants, stores and food distribution centers that may be approaching the expiration of food and any perishable items not used in entirety within their desired period. This application use of android technology to reduce waste food and allow users to donate leftover food to needy people. It affects the people everywhere like in our homes ,at restaurants in production and even in transportation. This app developed a common combination by connecting to a donor and a head from the NGO where the donor describes all the food information which contain food type, location where the food is available, cooking and expiry date/time of food.

**Keywords:** Android Application ,Android, NGO, Food Wastage Management, Tracking.

### I. INTRODUCTION

The idea behind over project can be use by many people who wish to donate things to needy organizations. As per the knowledge the technology is going advances and growing day by day. Over main motto is to help needy people .Food pollution is a problem in densely developed nations like India. Also too much food gets tossed out from weddings, canteens, pubs, social and family get-togethers and events.

The food donation application serves as an interface between consumers searching for a channel to donate without wasting the food. Therefore a mobile-based application has been created in which individuals can donate food products according to their capacity, and the application often enables organizations to apply their requests. The proposed scheme is currently aimed at eliminating the significant waste that normally exists in India, which is food. The framework is required to upgrade and optimize the same system, which will further add to the application's reliability and usefulness.

This application can help needy people for food. With help of this application restaurant can serve food to many people. NGO's can also contact restaurants for providing food in shortage of food. This can feed many poor and needy people

### II. METHODOLOGY

Many people face starving because of food shortage. Food shortages in developing countries are common. The people most affected are smallholder. There are several ways and means to help the needy but nothing works better than making a contribution to an organization dedicated to helping poor communities to battle against poverty. People living in NGO also faces food shortage issues. This application can help needy people to eat food. With help of this application restaurant can serve food to many people. NGO's can also contact restaurants for providing food in shortage of food. This can feed many poor and needy people.

### III. MODELING AND ANALYSIS

The System Architecture of model for waste food management is as follows:





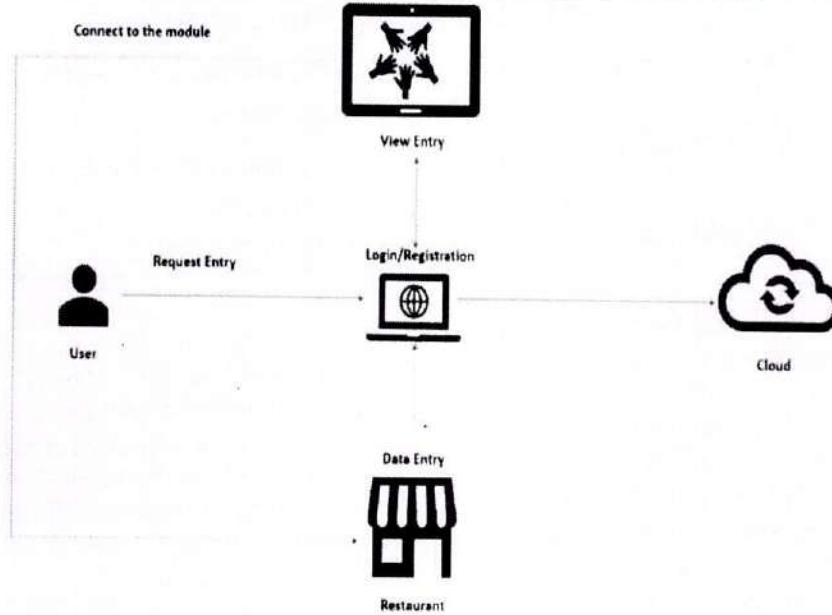


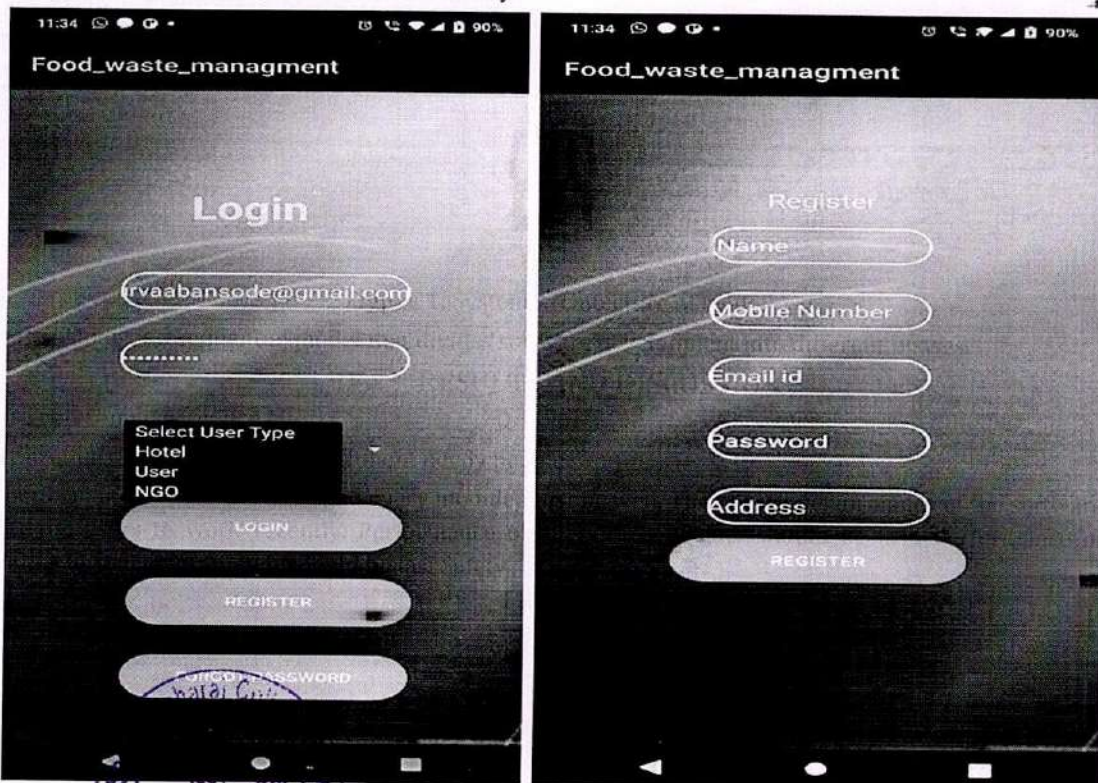
Figure 1: System Architecture of model

Waterfall Model is a sequential model that divides software development into different phases.

#### IV. RESULTS AND DISCUSSION

1. Use of technology reduce efforts.
2. Utilization of extra food to nourishment needy people.

The performance of the functions and every module must be well. The overall performance of the software will enable the users to work recently. Performance of encryption of data should be fast. Performance of the providing virtual environment should be fast Safety





## V. CONCLUSION

Addressing the issues of hunger as well as food waste, thereby targeting the to poverty, hunger, health etc. Mobile application technology is helpful for food waste management. Our proposed solution should reduce food wastage by facilitating food sharing in local community using mobile technology. Our application provides simple way to connect those who have remaining extra food and those who need food.

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IJCS PUBLICATION (IJCSPUB.ORG)

## INTERNATIONAL JOURNAL OF CURRENT SCIENCE (IJCSPUB)

An International Open Access, Peer-reviewed, Refereed Journal

# POST TRACKING APP FOR FINDING SHORTEST PATH

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**Abstract:** The purpose of this paper is to design and implement a mobile app that assist post man with letter delivery and tracking. Postman should deliver post packets from one address to another using shortest path which is show on the app.

The postman can use this software to determine shortest route to various location at the same time and deliver services on time

**Index Terms** –tracking of location, Delivery ,Android App

### I. INTRODUCTION

Postman are in charge of manual letter delivery. However, with the advancement of cutting edge mobile application and technologies ,postman can now have an app that supports letter delivery and tracking, this is the impetus behind this. Serving delivery drivers by hand can be time consuming and error pruning .We proposed a solution in the form of postman app

### Structure Details:

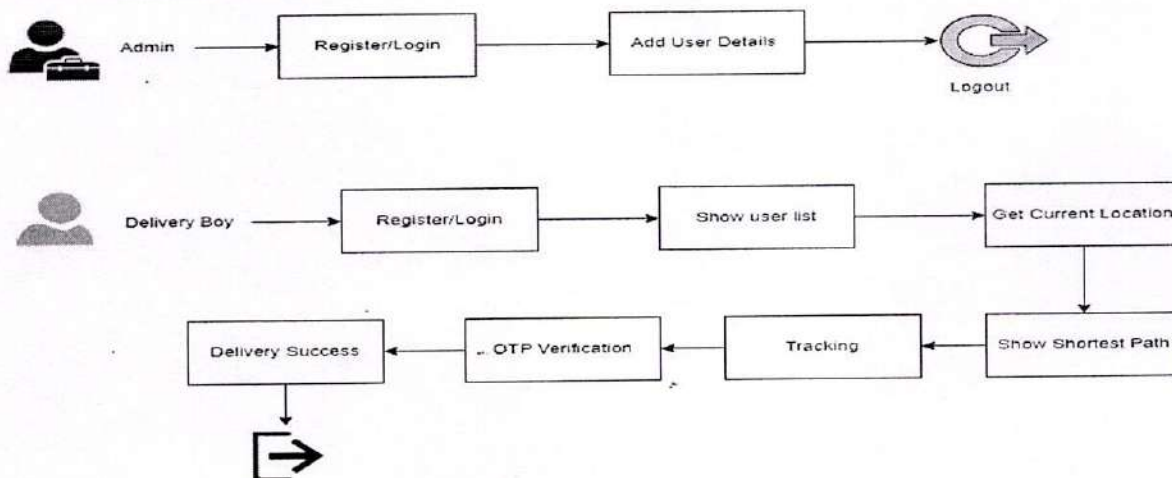


Figure: System Architecture



Above figure represents architecture of the system .we have total five modules in the system ,that is Admin ,Delivery boy, Location track, Shortest path ,Delivery Status etc. There are two main module . Admin and Delivery boy .Admin allocates the post or parcel to particular delivery boy. .Delivery boy login first ,then checklist of parcel which has deliver .Both admin and delivery boy has to be login with valid email id and password.

#### IV. RESULTS AND DISCUSSION

##### 4.1 Results





19:37 50 100% 80 100%

### Post-Tracking App



## Register

**REGISTER**

19:39 50 100% 80 100%

### Post-Tracking App

**UPLOAD**

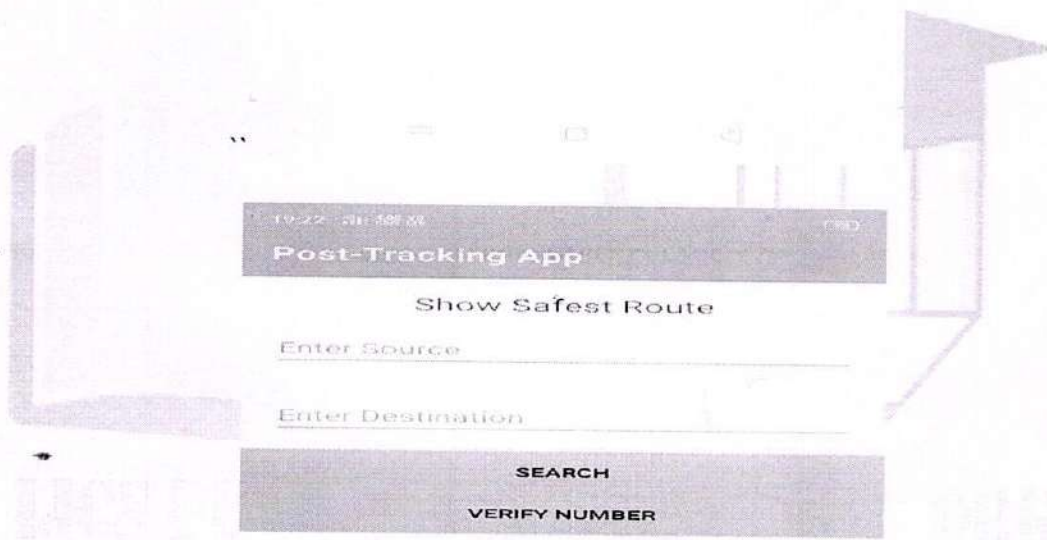
**successfully Login**







User name: Shejal  
Number: 7721891353  
Address: at post goregaon tal parner  
Price: 300  
Description: parcel







## II. ACKNOWLEDGMENT

I Would like to acknowledge and give my warmest thanks to my supervisor prof.Gade.N.B who made this work possible. Her

Guidance and advice carried our team through all the stages of writing my project.I would like to thanks my group member for brilliant ideas and suggestion.

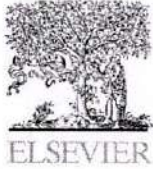
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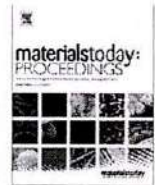
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## Materials Today: Proceedings

journal homepage: [www.elsevier.com/locate/matpr](http://www.elsevier.com/locate/matpr)

## Experimental investigation on performance of cotton seed biofuel blended with diesel on variable compression ratio diesel engine

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Cotton seed oil  
Variable compression ratio  
Blend  
Transesterification

### ABSTRACT

The reasons for the fuel energy crisis are the rapid increase in the global population and changing human lives. Fossil fuel is a leading factor involved in atmospheric pollutants. However, biofuel plays an important role in boosting engine efficiency and lowering emissions. Present research work contributes to enhancing the performance of diesel engines. In this work, cottonseed oil is used and converted into biofuel through the transesterification process. Raw cotton seed oil comes under the category of vegetable oils, both edible and non-edible. The calorific value and viscosity of biodiesel fuel are two distinct characteristics. The biofuel blends with diesel in variable proportions by volume of 20%–40 % are used. The performance was monitored, analysed and verified against pure diesel and biofuel using CB20, CB30, and CB40. The performance obtained using biofuel with varying loads at different fuel blends on the VCR engine improves BTE and BSFC. When the CR is changed from 18 to 22, the BSFC decreases by 0.310 to 0.290 kg/kwh, while the BTE increases by 0.72 percent.

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Selection and peer-review under responsibility of the scientific committee of the 2nd International Conference and Exposition on Advances in Mechanical Engineering.

### 1. Introduction

Biodiesel is an emerging field globally and locally. It is noted that the government of India continuously encourage the use of biofuel in the 2100 s. Over the last decade, the adoption of biodiesel as a renewable, alternative and sustainable fuel has grown in an attempt to understand engine efficiency and emission consequences. Biodiesel is produced by the esterification conversion process. The cotton seed oil is selected for the generation of biodiesel by the esterification process. Cotton seeds are inedible oil, so if they are left for biodiesel production, there will be no fuel conflict with food, particularly in developing countries like India. A comparative study of the effects of biodiesel engines, including efficiency, energy, durability, pollution, regulated and unregulated emissions, and associated impact factors, has been carried out by many researchers. The application of biodiesel significantly reduces emissions of PM, HC, and CO, as well as lowers energy consumption, increases fuel consumption, and increases NOx emissions without any desired changes in conventional diesel engines, thus helping reduce carbon reserves. As a result, blending

biodiesel with petroleum products instead of petroleum diesel minimises air pollution and puts a lower burden on narrow resources without affecting engine performance or economy. When petroleum diesel is fully replaced by biodiesel, more research can be done on engine tuning, modification, engine performance in low temperatures, new equipment, and measuring methods. To kick off the modification, the influence of several CR 16:1, 17:1, and 18:1 on different engine parameters was investigated. [1].

The engine's performance suffers marginally when biodiesel is used partially or entirely rather than diesel; however, the environmental cost is greatly reduced. [2,3]. Diesel performance testing was carried out on a variety of RM mixes, including 100 percent rapeseed and 100 percent Mahua Biodiesel (MU), as well as blends BL20, BL40, BL60, and BL80. As per the results, BL20 is the best blended and most similar to diesel fuel [4]. The Gas Chromatography-Mass Spec. analysis of waste cottonseed oil was studied. The primary fatty acids in cottonseed oil were discovered. [5]. During the test, the fuel was tested in a variable compression ratio engine utilising B10 and B20 blend proportions, and also the compression ratio of the engine was altered between 15:1 and 18:1 while torque was increased from zero to maximum load. The ignition timing, combustion characteristics, maximum air tem-

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**Nomenclature**

CB	Pure Cottonseed biofuel	NOx	Oxides of nitrogen
CB100	100 % Cotton seed biofuel	BSFC	Brake specific fuel consumption
CB 20	is made up of 20 % CB and 80 % diesel	HC	Hydrocarbon
CB30	consists of 30 % CB and 70 % diesel	CO	Carbon monoxide is a poisonous gas
CB40	is made up of 40 % CB and 60 % diesel	CO <sub>2</sub>	stands for carbon dioxide
CB30	consists of 30 % CB and 70 % diesel. DE Engine: Diesel engine	VCR	Variable Compression ratio
BTE	Brake Thermal Efficiency	O <sub>2</sub>	Oxygen
BP	Brake Power		

perature, and emission parameters of biodiesel are all investigated. [6–8].

The esterification of palm oil is combined with Nilagiri oil in proportions of 5 %, 10 %, and 15 %. The tests were carried out on a VCR diesel vehicle using 220 bar inlet pressure and a compression ratio of 19:1 with diesel fuel and alloys, and PKO85% + EuO15% for diesel alloys experimentally modified for combustion and emission reduction at full load conditions. [9]. Algal oil methyl ester combined with diesel fuel was tested on the diesel engine at various loads and CR. According to the findings, the AB30 combination had the least exhaust gas emissions. Due to the unsaturated fatty acid moiety, it cuts HC and CO gas emissions by about 35.13 and 30 %, respectively. However, it increases NOx emissions by 25–30 %. The addition of oxygen to biodiesel and its blends resulted in 9–20 % more CO<sub>2</sub> and 8–20 % more O<sub>2</sub> gas emissions, respectively. [10] They experimented with blends B10 and B20 with varied compression ratios (17 and 18) and discovered that the B20 blending and CR 18 gave the best results [11]. Using the whole-look response surface method, the Minitab-14.0 application was utilised to model and explore response parameters. Data regression, statistical methods, and specific product coefficients for created models were all studied and presented for model validation. Confirmation experiments were carried out to validate the outcomes by choosing input parameters: load = 9.8 kg, CR = 18.0, and blend = 20 %. BTE of 26.78 percent, brake specific energy of 0.285 kg/kW h, CO 0.0058 percent, HC 113.84 ppm, and NOx of 904.6 ppm were obtained from scientific modelling using a D-optimal test with a composite desirability of 0.9097 [12].

In the present experimental test, 5 % ethanol has been added to diesel in the biodiesel of Jatropha, soybean, date, and cotton seeds. Tests were conducted as per IS 1448 standards, and tests showed that the mixing of ethanol with a compound decreases kinematic lubrication, pour point, and cloud point. For various loads on the engine, performance studies showed better BP (brake power), improved BSFC, and higher BTE [13]. The biofuel engine exhaust recirculation on the cottonseed B20 diesel engine was only utilised to minimise NOx [14]. Emissions seem to be decreased despite the fuel being used at a higher CR level of 18 and an operating pressure of 240 bar, while emissions of NOx increase with rising IP [15]. When compared to diesel with M30 fuel, the biodiesel with a better cetane number was made using Mahua non-edible oil and utilised up to a 15–30 mix percentage. It improved thermal performance by 8–10 % while lowering fuel economy by 9–12 % [16]. The results demonstrated that the type of catalyst had less of an influence on the physical qualities of the produced biodiesel, like density, flash, cloud, viscosity, and high heating value, when biodiesel was manufactured from waste oil utilising two kinds of catalysts. Later tests were performed on a six-cylinder engine in volume ratios of B10, B25, and B40 mixed with marginally better engine efficiency, combustion behaviour, and exhaust gas emis-

sions as a result. It can also help enhance engine efficiency and reduce load-exhaust emissions [17].

The impacts of oil palm fuel blend were investigated, and it was discovered that increasing the blend ratio can improve the combustion process, ensuing in lower CO and HC discharges and improved engine performance. However, because of the high oxygen concentration in biodiesel, this scenario produces a lot of NOx [18]. The impact of blend as well as CR just on the combustion parameters of the engine was tested by altering loading from zero to one hundred percent [19,20]. In every combination of speed, loading, and injection time, diesel released more heat than Jatropha biodiesel and cotton seed biodiesel [21,22].

Bio energy's commercialization has provided a viable solution to the dilemma of petroleum shortages and their environmental consequences. Biodiesel is a biodegradable, renewable, and oxygenated alternative to primary fuel diesel. Despite the fact that numerous studies have shown that greenhouse gas emissions can help reduce emissions, promote green economies, and improve income distribution, there are some drawbacks to their use. The main reason is a lack of knowledge regarding the impacts of biofuel on diesel engines. Biodiesel has resulted in a decrease in engine power in addition to a rise in fuel usage. Early research has shown that biodiesel is now more likely to become oxidized, which can cause stiff gums and sludge that can clog the fuel system and make engines last less long.

## 2. Methodology and materials

This section deals with the methodology and materials.

### 2.1. Material

The liquefied fuels employed in the experiment included huge amounts of biofuel and diesel, as well as cottonseed oil for biodiesel manufacturing, both of which were locally sourced. Apex Innovation Pvt. Ltd. in India gave them Potassium Hydroxide (KOH) and Analytical Quality Methanol Merck, which was 99.5 %. The fatty acid profile of cotton seeds, is shown in the given Table 1, evaluated at Nikhil Analysis and Research Pvt. Ltd. in Sangli.

**Table 1**  
Cotton seed oil fatty acid composition.

Fatty Acidulous name	Construction	Weight %
Myristic Acidulous	C14:0	00.53
Palmitic Acidulous	C16:0	10.33
Stearic Acidulous	C18:0	03.64
Oleic Acidulous	C18:1	32.82
Linoleic Acidulous	C18:2	39.29





**Table 2**  
Measured parameter uncertainty.

Parameters	Accuracies	Uncertainty
Load	$\pm 0.15$ N	$\pm 0.15$ %
Power	-	$\pm 0.15$ %
Air flow rate	$\pm 1.0$ cm <sup>3</sup> /h	$\pm 0.15$ %
Fuel consumption	$\pm 2.0$ g/h	$\pm 0.10$ %
BTE	-	$\pm 2.0$ %
Engine speed	$\pm 10$ rpm	$\pm 0.5$ %
Temperatures	$\pm 1$ °C	$\pm 0.10$ %

**Table 3**  
Engine Specifications.

Sr. No.	Parameter	Specification
1	Product	VCR diesel engine system to make with one cylinder and four strokes.
3	Engine	661 cc, stroke 110 mm, diameter 87.5 mm, CR 17.5, modified to VCR engine. Type 1-cylinder, four stroke, power 3.5kw, d = 87.5 mm, 1500 rpm, 661 cc, L = 110 mm. The CR runs from 12 to 23.
4	Software	Engine performance analysis programme "EnginesoftLV."
5	Fuel tank	With a glass fuel measuring column, it has a capacity of 15 lit.
6	Piezo sensor	The capacity is 5000 PSI when using a low-noise wire.
7	DAD	16-bit, 250KS/s NI USB-6210
8	sensor for Crank angle	With a TDC pulse, the resolution is 1° and the speed is 5500 RPM.
9	Load indicator unit for Piezo powering	Digital, 0-50 kg range, 230VAC supply Model AX-409 by Cuadra.

## 2.2. Method

The tests were display out by individual cylinder engines with a higher compression ratio (VCR) engine (CR18, CR20, and CR22) producing 3.5 kW at a constant speed of 1500 rpm. At variable charges of 0 %, 25 %, 75 %, and 100 % by using the diesel blends CB100, CB20, CB30, and CB40, BSFC, BTE, and CR, effective analysis was carried out. Uncertainty analysis of measured parameters is shown in Table 2.

## 3. Experimental setup

The research was performed with a different compression ratio, a water cooled individual cylinder engine attached to a dynamometer equipped with all the necessary equipment, including a Kirloskar computer interface diesel engine. The VCR diesel engine's detailed specifications are listed in Table 3. System EngineSoft LV uses "engine performance analysis software with computerised data editing systems, collecting, storing, and analysing data during experiments using various measurement sensors As shown in Fig. 1 and Fig. 2.

The experiment with different load values of 0 %, 25 %, 50 %, 75 %, and 100 % with variable compression ratios ranging from 18 to 22 is carried out. The load measuring device used for this experimental operation consists of an eddy current type dynamometer, a strain gauge type load cell, and a loading unit.

## 4. Test performance parameter

During the experimentation variable load, compression ratio and biodiesel blends for desired output are given in Table 4 and 5. The additional measurable parameters are Arm Length (mm): 210, Air Temperature, Fuel Density (Kg/m<sup>3</sup>), CV of Fuel (kj/kg), & Type Of fuel: Diesel, Orifice Coefficient of Discharge: 0.60, Pulses Per Revolution: 360, Orifice Diameter: 20.00 mm.



Fig. 1. Transesterification process experimental setup.



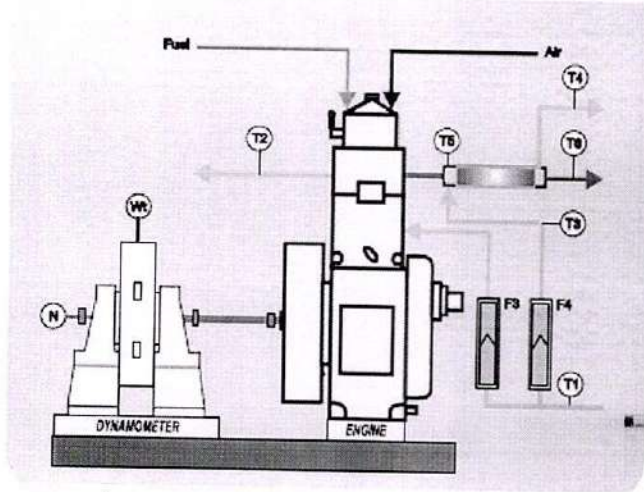
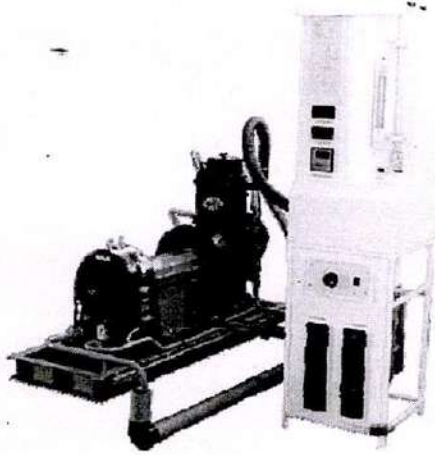


Fig. 2. Schematic representation of VCR test rig.

Table 4  
Properties of fuel.

Fuel properties	Standard	Diesel	CB100	CB20	CB30	CB40
Density @25 °C (gm/cm <sup>3</sup> )	ASTM D287	0.83	0.881	0.8402	0.8453	0.8504
Gross Calorific Value Cal/gm	ASTM D 4809	42,965	40,162	42,404	42,124	41,844
Flash Point °C	ASTM D 93-58T	70	154	86.8	95.2	103.6
Specific Gravity	ASTM D287	0.83	0.881	0.8402	0.8453	0.8504
Fire Point °C	ASTM D 93-58T	76	165	93.8	102.7	111.6
Cloud Point °C	ASTM-D 97	-6	0	-4.8	-4.2	-3.6
Pour Point °C	ASTM-D 97	-10	-4	-8.8	-8.2	-7.6
Kinematic Viscosity in cst @ 40 °C	ASTM-D 445	2.8	6.43	3.526	3.889	4.252
FFA %	>2.5	-	0.53	-	-	0

Table 5  
Shows the test parameters.

Sr. No.	Input Test Parameters			Parameters for the output test
	Load in Kg	Compression Ratio	Biodiesel Blend	
1	0	CR18	CB20	Performance Parameters 1. BTE 2. BSFC 3. IP 4. BP 5. BMEP
2	3	CR 20	CB 30	
3	6		CB 40	
4	9		CB 100	
5	12		CR 21	

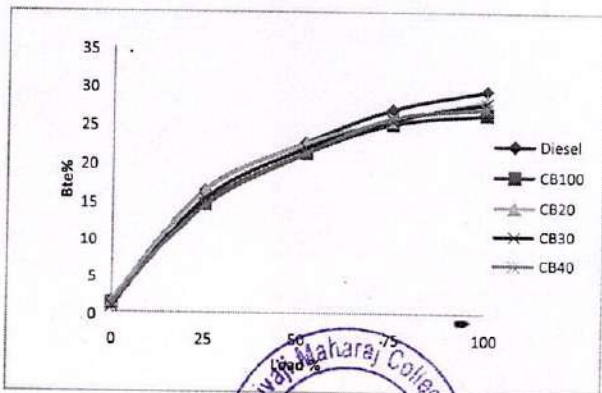


Fig. 3. Shows the influence of mix present on BTE at same CR 18.

## 5. Result and discussions

### 5.1. Engine performance

The fundamental goal of this research is to observe, experimentally, the efficiency and effectiveness of cotton seed biofuel and diesel fuel under variable operating conditions. The experiment was carried out and the following results were obtained.

### 5.2. Effect of engine brake thermal efficiency

At various loads, the effect of the biofuel mixture on performance was noted. Fig. 3 clearly depicts these impacts. The ratio of BP to heat provided to the engine by fuel combustion at CR 18 is used to calculate BTE.

Due to the reduced calorie content of biofuel, the thermal efficiency is 1 to 3 % lower than pure diesel in all running conditions with variable load. The plot curve in Fig. 3 illustrates that efficiency rises as load rises. When the percent of biofuel in diesel is





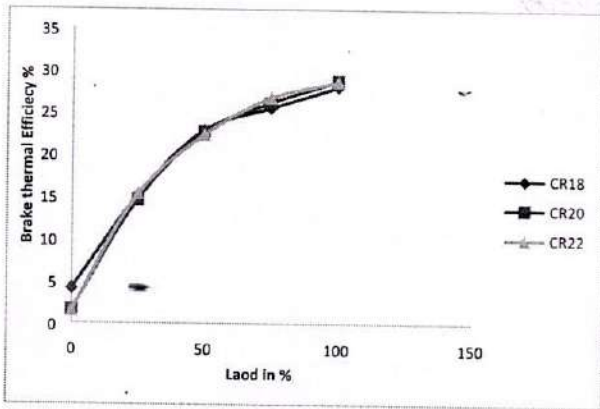


Fig. 4. Effect of brake thermal efficiency w.r.t. Load for CR 18, 20 and 22 (CB40).

increased, it is discovered that the BTE is slightly reduced due to biodiesel's lower heating value. Above a 40 % load, the CB100's mean brake thermal efficiency is 2.12 percent lower than pure diesel, while the CB20, CB30, and CB40 are 0.96, 1.24, and 1.62 percent worse, respectively.

Some reference studies claim that biodiesel fuel compounds have less engine power than plain diesel. But the drop in efficiency could be caused by the higher viscosity of biofuel and the fact that its density changes over time.

### 5.3. Effect of compression ratio

The experiment is performed at various compression ratios ranging from 18 to 22. Fig. 4 shows that for different biodiesel mixes, the BTE increases by about 2 to 6 percent. The decrease in heat loss causes an increase in BTE, and power increases as the load rises. Theoretically, increasing the compression ratio leads to more appropriate mixing of air and fuel during the engine's working

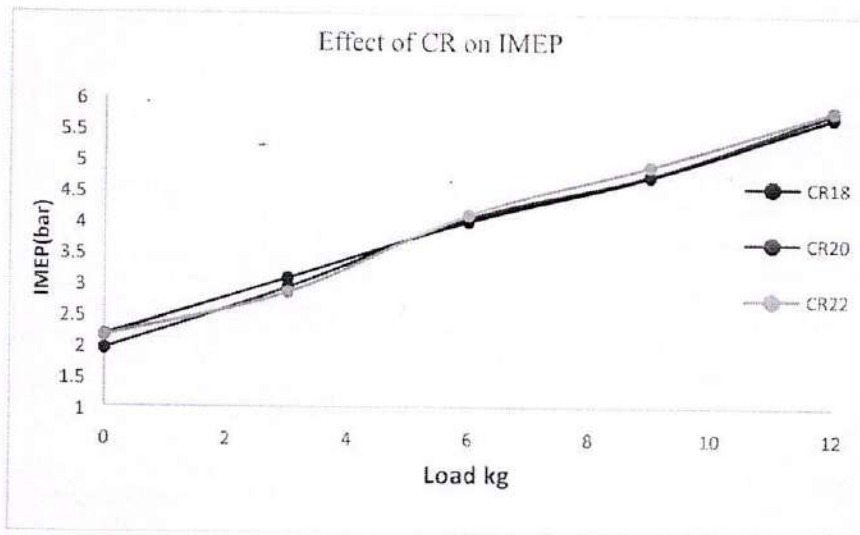


Fig. 5. Indicated mean effective pressure vs compression ratio.

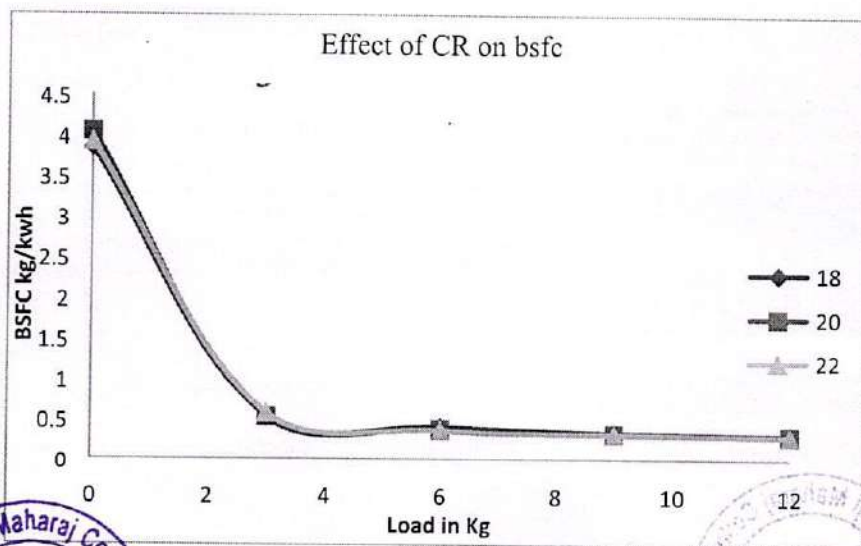


Fig. 6. Break specific fuel consumption w.r.t. CR.





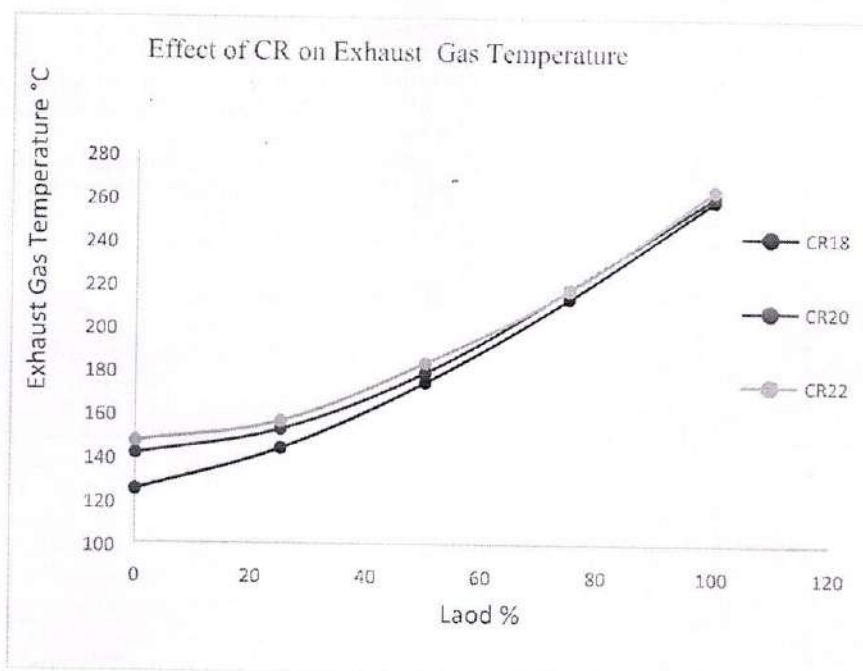


Fig. 7. Exhaust gas temperature w.r.t. CR.

stroke, in addition to increased in-cylinder pressure, which shows that the shorter combustion delay time.

As the increase in compression ratio betters combustion efficiency and combustion occurs at top dead centre, peak pressure in the cylinder increases at the end, the indicated mean effective pressure goes on increasing. Experiments showed that the average effective pressure is higher when the compression ratio is higher at 50 % to 100 % load as shown in Fig. 5.

#### 5.4. Effect of brake specific fuel Consumption.

Fig. 6 depicts the variation in BSFC as a function of load for various CR. The BSFC decreases as the compression ratio rises, whereas the BTE rises at complete load. BSFC is 0.299 kg/kWh at a higher compression of 22, and 0.31 kg/kWh at a CR of 18. The optimum BSFC is 0.3775 kg/kwh at CR 20, whereas it is 0.399 kg/kwh and 0.388 kg/kwh at compression ratios 18 and 20, correspondingly.

With a larger compression ratio, the delay period is minimised and combustion occurs at the top dead centre, resulting in the arising temperature of exhaust gases. Exhaust gas temperatures were reported at 258.83 °C, 260.85 °C, and 263.64 °C at full load with compression ratios of 18, 20, and 22 respectively as shown in Fig. 7.

## 6. Conclusion

The research mentioned looked at the generation of biofuel using crude cotton seed biofuel blends mixed with diesel fuel and the influence of other performance aspects, such as oil, as well as the effects of various performance characteristics, such as biofuel blends with pure diesel fuel. The following is a brief of the experiment's findings:

- Transesterification is used to create biofuel from non-edible cottonseed oil. At 55°C using a mixture of 20 % methanol and 0.5 percent NaOH produced up to 76 % biofuel.

- Due to the reduced heating value of biofuel, BTE is lower than pure diesel. Above 40 percent load, CB100's average BTE drops by 2.12 percent, while CB20, CB30, and CB40's average BTE drops by 0.96, 1.24, and 1.62 percent, respectively.
- The BTE decreases by 2.12, 1.62, 1.24, and 0.96 percent as the percentage of biofuel in the blend increases for biodiesel blends CB100, CB40, CB30, and CB20, respectively.
- The compression ratio at the higher side of the average BSFC decreases from 0.399 kg/kwh to 0.388 kg/kwh as the temperature of the engine exhaust rises from 258.830 to 263.640°Celsius.

Finally, with a compression ratio of 20, BTE is the greatest and BSFC is the minimum.

#### CRediT authorship contribution statement

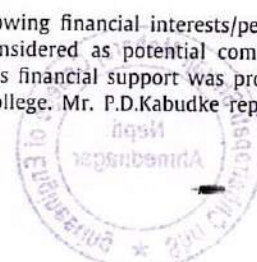
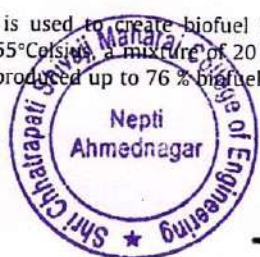
**P.D. Kabudke:** Funding acquisition, Project administration, Supervision, Visualization, Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing. **Y. R. Kharde:** Project administration, Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Writing – original draft, Writing – review & editing, Visualization, Supervision. **R.A. Parkhe:** Software, Resources, Project administration.

#### Data availability

Data will be made available on request.

#### Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Mr.P.D.Kabudke reports financial support was provided by Pravara Rural Engineering College. Mr. P.D.Kabudke reports a





relationship with Pravara Rural Engineering College that includes: employment. Mr.P.D.Kabudke has patent NA pending to NA. NA.

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**EMOTION BASED MUSIC & MOVIE RECOMMENDATION SYSTEM****Harshal Gunjal\*<sup>1</sup>, Tejas Kharde\*<sup>2</sup>, Anandu Nair\*<sup>3</sup>,****Tanaya Sase\*<sup>4</sup>, Yashanjali Sisodia\*<sup>5</sup>**

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DOI : <https://www.doi.org/10.56726/IRJMETS31218>**ABSTRACT**

The development in era has led to massive use of internet. people use social networking websites nearly every day. these websites help humans to specific themselves to the web society. human beings use diverse posts to specific themselves, those posts are not anything however short casual texts having effective, poor or impartial emotions. song is an essential aspect of human life. human beings opt to pay attention to track greater regularly than any other hobby. With the net era, a big amount of song content containing tune of diverse genres has emerge as without difficulty to be had to millions of users round the sector. tune collection in view that decades and comprising of diverse genres of music is available. The primary issue that the users face is to select suitable track from such massive collection. in addition, a huge series of movies comprising of various genres is also to be had. song and film recommender will recommend tune and films to the person based totally on their mood in conjunction with an emotion symbolizing their mood. The mood of the consumer can be derived by performing survey of the consumer emotion. a good way to provide better pointers, k-means algorithm is used for grouping of song. KNN algorithm will be used for classifying the lyrics into numerous categories (satisfied, sad, completely happy, indignant, surprised, sound asleep, excited, etc.).

**Keywords:** Music Recommendation, Emotion Detection, Survey Analysis, Machine Learning, K-Means, Etc.

**I. INTRODUCTION**

The paper proposes a Music and Movie recommendation system. The system is based on Emotion of the user. Music is very important part of our life. Peoples listen music to release the stress. Movies are also an important part of our life. Peoples watches the movies everyday to release the stress and learn something new from it. The main problem is that the users sometimes unable to choose appropriate music or movies according to their mood or emotion. The emotion can be of any type like happy, sed, angry, surprised, excited, sleeping, fear and so on. The model has two datasets one for music and one for movies. The data is to be classified or divided into various categories. For that the system uses K-means algorithm for grouping of data objects into different clusters. Then, the K-nearest neighbor algorithm is used to classify data into different classes and recommend user an appropriate song or movie as per their choice. The system is also used for mental health awareness and depression therapy.

**II. METHODOLOGY**

The system is used for Music or Movie recommendation based on the user's emotion. Emotion is taken using a survey of the user. The system uses 2 datasets one for music and one for movies. The random data is to be classified into different categories. For clustering the data into different classes, K-means algorithm is used. For classification of data and recommendation K-nearest neighbor algorithm is used. In this system 2 technologies are used:

**Machine Learning:**

Machine learning is a type of Artificial intelligence that allows software applications to become more accurate at predicting the outcomes without being explicitly programmed.

**MySQL Database:**

MySQL is a type of database management system which is used to work with the structured data. The data is stored in form of rows and columns i.e. in tabular format.



**Algorithms:**

**K-Means Algorithm:**

This is an unsupervised learning algorithm. It is used for working with unlabeled data. It divides the given data into k number of clusters or data groups.

**K-Nearest Neighbor Algorithm:**

This is a supervised learning algorithm. It is used for working with labeled datasets. It is used for classification of data into 2 or more categories or classes.

**III. MODELING AND ANALYSIS**

**System Architecture:**

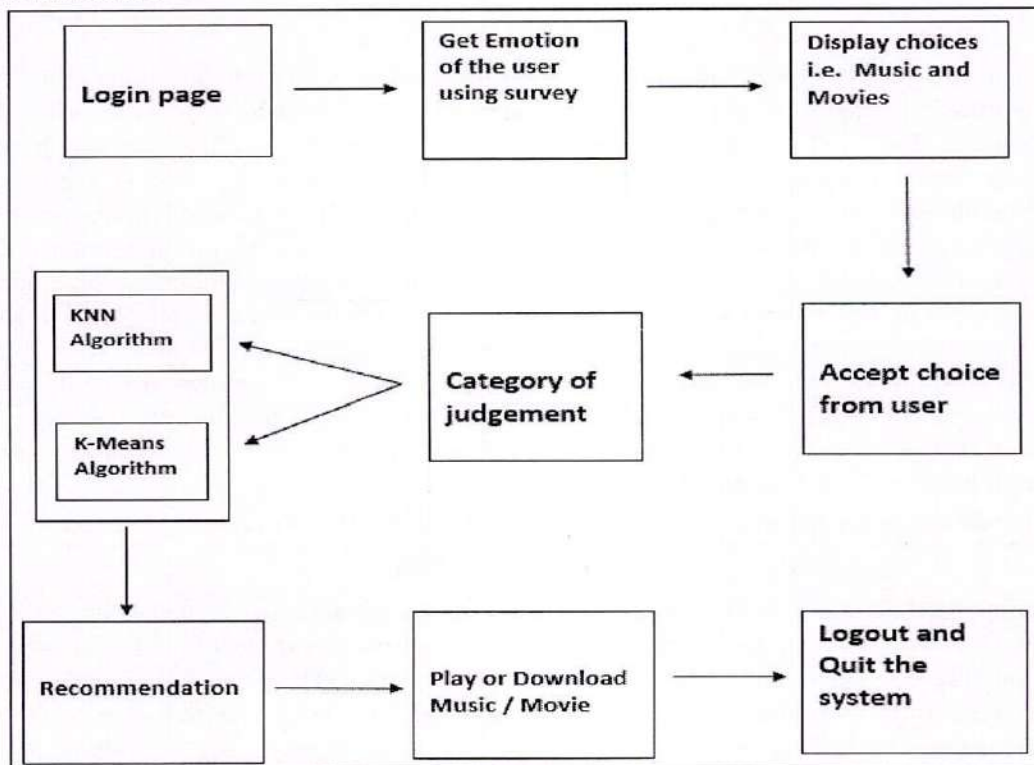


Figure 1: System Architecture

**IV. RESULTS AND DISCUSSION**

In system we used this mathematical model. We are designing Registration page, Login page and also Home page.

**Mathematical model:**

Let S be the whole system  $S=\{I,P,O\}$

I-input

P-procedure

O-output

**Input(I):**

$I=\{\text{Emotion of the user}\}$

Where,

Emotion -> Emotion

**Procedure(P):**

$P=\{\text{When the user interacts with the system, his emotion is captured by the system to generate output}\}$

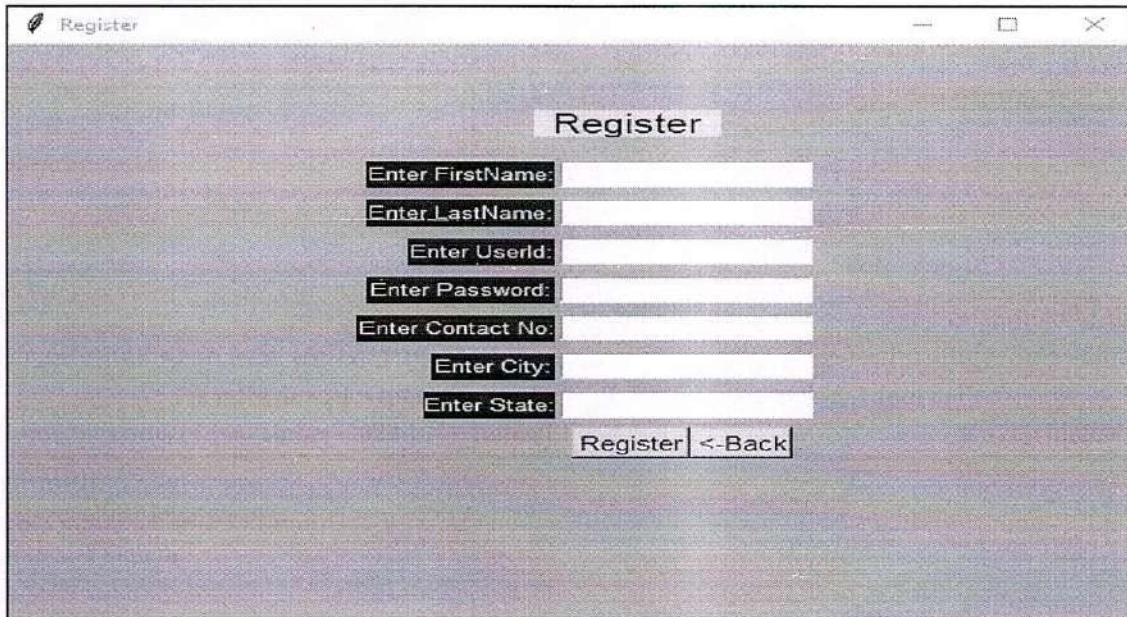




**Output(O):**

O={List of Music or Movies}

**Sign in and Sign up:**



The screenshot shows a web browser window titled "Register". The page has a light blue background and a central "Register" heading. Below the heading are several input fields with labels: "Enter FirstName:", "Enter LastName:", "Enter UserId:", "Enter Password:", "Enter Contact No.", "Enter City:", and "Enter State:". At the bottom of the form are two buttons: "Register" and "<-Back".

**Figure 2:** Registration page



The screenshot shows a web browser window titled "Login". The page has a light blue background and a central heading "Emotion based Music & Movie Recommendation System". Below the heading are two input fields with labels: "Enter UserName:" and "Enter Password:". At the bottom of the form are three buttons: "Login", "Clear", and "NewUser!Register". There is also an "Exit" button at the bottom right of the page.

**Figure 3:** Login page

**V. CONCLUSION**

On the idea of the state that person Emotion had been identified, the recommendation algorithm was carried out to automatically propose song for users. movie and hobbies advice are also provided. The algorithm proposed increases the person's emotion recognition, in order that the advocated song can better meet the customers listening wishes. Song and movie recommendation machine will lessen human efforts with the aid of looking the big media series containing many songs and films of numerous genres. suggestions to the person



can be supplied in keeping with their mood. The mood of the consumer may be determined by way of their survey. as a result this machine will offer higher person pleasure in less time and efforts as they may be automatically provided a advice for music and films primarily based on their temper. The proposed recommendation system works on songs and films in English language. This device may be further prolonged to suggest songs and films in Hindi language or different local languages since the customers can higher specific themselves the usage of their local languages. The emotion category can be further improved to take into account greater complicated emotions as hatred, tension, jealousy, excitement, and many others.

#### ACKNOWLEDGEMENTS

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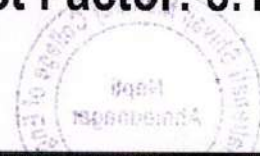
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# Detection of Bone fractures with Enhanced Performance with Better Combination of Filtering and Neural Networks: A Review

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**ABSTRACT:** Automated fracture detection is an essential part in a computer-aided tele-medicine system. Fractures often occur in human's arbitrary bone due to accidental injuries such as slipping. In fact, many hospitals lack experienced surgeons to diagnose fractures. Therefore, computer-aided diagnosis (CAD) reduces the burden on doctors and identifies fracture. We present a new classification network, Crack-Sensitive Convolutional Neural Network (CrackNet), which is sensitive to fracture lines. In this paper, we propose a new two-stage system to detect fracture. Firstly, we use Faster Region with Convolutional Neutral Network (Faster R-CNN) to detect 20 different types of bone regions in X-ray images, and then we recognize whether each bone region is fractured by using CrackNet. Total of 1052 images are used to test our system, of which 526 are fractured images and the rest are non-fractured images.

**KEYWORDS:** Machine Learning, CNN

## I. INTRODUCTION

One of the first methods for determining the form of a bone is an X-ray. Images of the bones in the body, such as the hand, wrist, arm, elbow, shoulder, etc., are captured on a bone x-ray. The term "fracture" refers to a break in a bone's normal alignment, which happens when the bone is unable to tolerate external forces. The accurate diagnosis of patients can be improved by automatic fracture identification using x-ray pictures. The segmentation algorithm is used for fracture detection to find the edges, which distinguish between the object and background and also show where the boundaries overlap. The collecting of thousands of medical photographs each day in medical institutions has led to a significant increase in the use of medical images. There is a growing requirement for data management and reliable access due to the increase in medical pictures. It's still challenging to identify the proper boundaries in noisy photos. For boundary detection in noisy pictures, it provides a new edge following technique. Use of the suggested method shows how it can be used to various medical picture instances. The suggested method uses information from fracture detection on x-ray images to identify object boundaries in noisy images. Edge orientation, noise environment, and edge structure are some of the factors that are taken into consideration while choosing an edge detection operator. However, as they are unable to accurately determine the borders of objects in noisy images, performance evaluation of image segmentation findings remains a difficult issue. The limits of some objects may be established by a gradual decrease in intensity due to factors like refraction or inadequate focus. The approach used by edge-based approaches is to first use an edge detection operator to find the object borders, and then use edge information to extract the boundaries. Noise, which causes random level variation from pixel to pixel, is the issue with edge detection.

The correct diagnosis of bone fractures must meet exceedingly high standards in the contemporary social milieu, and it is currently primarily determined by the doctor's manual reading. A huge number of X-ray films to read not only makes one tired from reading but also establishes the divergence. On the other hand, it is simple to misdiagnose during the diagnosis process due to diverse clinicians' experiences and interpretation standards. By using computer-aided diagnosis (CAD) to achieve automatic classification of bone fracture images, before the doctors read the X-ray images, the automatic classification of the fractures, and then the classified images are given to the doctor for diagnosis, not only can this reduce the number of doctors who must read and overcome people's eye inertness and defects that are insensitive to grayscale, but it can also improve the diagnostic efficiency and accuracy of radiologists.







2	Bone Fracture Detection Through the Two-stage System of Crack-Sensitive Convolutional Neural Network	Yangling Ma, Yixin Luo	2020	Many hospitals are short on skilled surgeons who can identify fractures. Computer-aided diagnosis (CAD) lessens the workload for medical professionals and detects fracture non-depression.	We introduce Crack-Sensitive Convolutional Neural Network (CrackNet), a new classification network that is sensitive to fracture lines.	We can convert this two-stage system to a one-stage method in the future. Instead of training in two steps, faster R-CNN and CrackNet are trained concurrently.
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**Motivation**

The bones serve as the body's framework and as places of attachment for the muscles. People are becoming more and more prone to bone fractures as society develops. Fractures can disrupt bone blood flow and cause other problems, but they can also harm both the surrounding soft tissues and the affected bones collectively. Fracture problems can also develop if the identification and treatment of the fractures are delayed. The occurrence of bone fractures has seriously harmed people's bodies, so it is important for people to make an accurate and successful diagnosis of bone fractures.

**Names of Conferences / Journals where papers can be published**

Sr.No	Paper Title	Author	Year	Problem solved in this paper : Existing Problem Statement	Technique used to solve problem : Existing Problem Solution	What will be future work : Future Scope
1	Computer-Aided Fracture Detection Of X-Ray Images	R.Aishwariya1, M.Kalaiselvi Geetha2, M.Archana3	2020	The task of determining the correct boundary in noisy images is still challenging.	of a new method of detecting boundaries in noisy images via edge following. With the use of the data on which fracture identification on x-ray pictures is based, the suggested technique can identify object boundaries in noisy images.	Furthermore, they work or accuracy.







5	Computer-Assisted Bone Fractures Detection Based on Depth Feature	Feng Yang	2020	In this paper, The grayscale images in the MURA data set were converted to RGB images, and the data set was resized to the same proportions. The depth features of the bone pictures were subsequently extracted using a convolutional neural network (CNN).	convolutional neural network (CNN), support vector machine (SVM), extreme learning machine (ELM) and random forest (RF)	Further ideas can be investigated to improve the system performance and accuracy.
6	Detection of Bone Fracture using Image Processing Methods	Anu T C, Mallikarjuna swamy M.S. and Rajesh Raman	2015	In this study, bone fracture analysis is done using X-ray/CT scans. This project's goal is to create an effective system for image processing that quickly and accurately classifies bone fractures using data from x-ray and CT images.	X-ray/CT images, pre-processing, segmentation, edge detection and feature extraction methods	Future studies will fully integrate CT scans and classify the type of fracture that is present.







3	An overview of deep learning in medical imaging focusing on MRI	Yanan Yang	2019	The proposed framework is designed deep learning in medical imaging focusing on MRI.	objects in an image are segmented by use of segmentation technique (thresholding, edge-based segmentation, and an active contour model)	This paper will work on accuracy improvement.
4	Brain Tumor Detection and Identification Using K-Means Clustering Technique	Malathi R and Dr.Nadirabanu Kamal A R	2015	This study proposes an effective tumour detection approach based on K-Means clustering to segment brain MRI images.	K-Means clustering.	This frame-work to further improve the recognition performance.







various image sizes further demonstrate that our approach is more effective than clever edge detection. 3 kind of classifier, like ANN, BPNN, and SVM in which BPNN gives better classification of 86% when compared to other classifiers.

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7. A Survey of Deep Learning for Lung Disease Detection on Medical Images: State-of-the-Art, Taxonomy, Issues and Future Directions, Stefanus Tao Hwa Kieu<sup>1</sup>, Abdullah Bade, Mohd Hanafi Ahmad Hijazi,\* and Hoshang Kolivand, 2020.







7	A Survey of Deep Learning for Lung Disease Detection on Medical Images: State-of-the-Art, Taxonomy, Issues and Future Directions	Stefanus Tao Hwa Kieu ,, Abdullah Bade, Mohd Hanafi Ahmad Hijazi, and HoshangKoliv	2020	In this work, Their survey falls short in terms of taxonomy presentation and trend analysis of recent work. This paper's goals include providing a taxonomy of the most advanced deep learning-based lung disease detection systems,	An overview of deep learning for spotting lung diseases in medical photos is provided in this research. deep learning algorithms are used.	This section outlines potential future research that should be taken into account to enhance the effectiveness of lung disease diagnosis using deep learning.
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**II. EXISTING WORK**

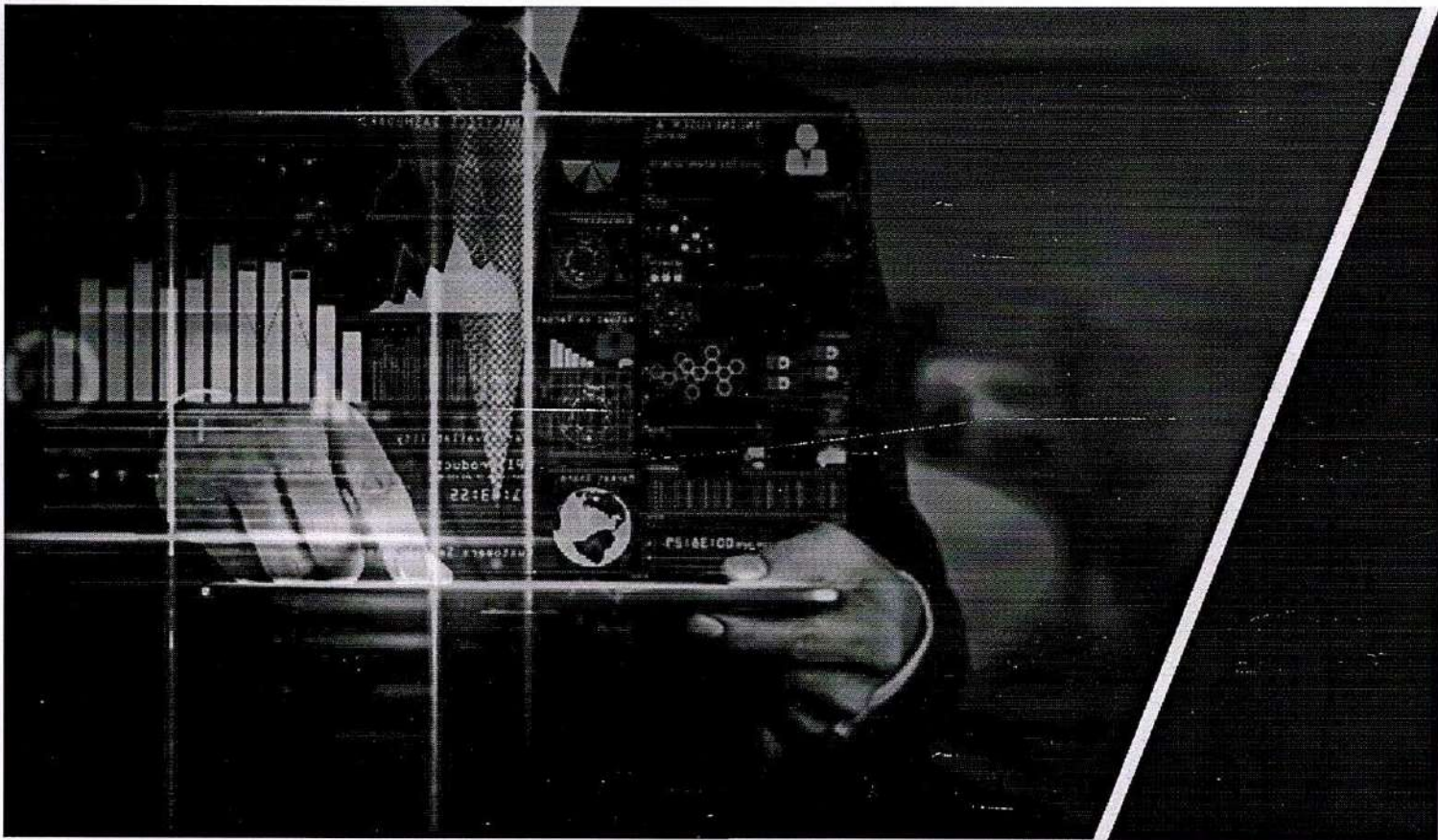
The popularity of computer-aided diagnosis (CAD) systems nowadays is due to the fact that they enable doctors and other medical experts to diagnose diseases more effectively than they could otherwise. Similar to this, bone fractures are a frequent issue brought on by stress, accidents, and osteoporosis. The importance of bone fracture identification using computer vision in CAD systems is increasing since it can assist doctors' workloads by weeding out the simple cases. Among the X-ray, MRI, and CT Scan possibilities for detecting bone fractures.

**III. CONCLUSION**

In this study, a brand-new edge-following boundary detection method was developed, and it was then used to solve an object segmentation issue in medical photos. Our edge following method uses both the edge map data and a vector image model. The suggested method was used to identify object boundaries in various noisy image types where ill-defined edges were present. For the sake of the established ground realities, a number of artificially noisy photos were produced and tested. The proposed technique, canny edge detection, is superior, as evidenced by the results of identifying object boundaries in noisy images. The results of the running time on







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