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An Experimental Study Of Effects Of Admixture On Self Compacting Concrete

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Abstract: This paper presents a preliminary consider on self compacting concrete (SCC). SCC is a spilling strong mix, that can join under its very individual emerge weight. The basic fluid nature of SCC makes it sensible for putting in gravely structured conditions and in zones with a blocked stronghold. Fly ash can be used as a mineral admixture in concrete. Substitution of fly ash stays to bond in concrete. It is a widely adopted construction practice underlain by the aim to reduce CO_2 emissions of cement production. In this examination, cement, fine aggregate, coarse aggregate, water and fly ash materials are used to prepare the SCC. Fly ash replaced with 15%,25%,35%and 45%., with the help of polycarbonic ether based superplasticizer and viscosity modifying admixture to achieve fresh properties of SCC. By using M60 Grade concrete the examinations had carried out by adopting an optimum water-cement ratio. Workability tests on the fresh concrete by using slump flow, T50, V funnel, L box, U box tests and the durability of concrete is tested by chloride attack and sulphate attack at 90 days.

Keywords: Fly Ash, T_{50} test, L box, U box, V funnel, strength properties, durability properties.

1. INTRODUCTION

Self compacting concrete (SCC) is a moderate concrete that does not require any mechanical vibration for compaction. It can flow under its weight to fill in formwork and may achieve full compaction in the presence of congested reinforcement. As per EFNARC guidelines for SCC mix design. One of the most important differences between SCC and conservative concrete is the integration of a chemical admixture. Cement is the most expansive component in concrete, reducing cement content is an economical solution. The mineral admixture can improve particle packing and decreases the permeability of concrete. Fly ash is an industrial wastage, which improves strength and durability characteristics. Concrete which segregates will lose strength and results in honeycombed areas next to the formwork. A well designed SCC mix does not segregate, has high deformability and excellent stability characteristics. Self compacting concrete (SCC) owns over three main properties are Filling Ability, passing ability, segregation resistance. Highly useful water reducing agents (super plasticizers) are mostly affected these properties, this is usually based on poly-carboxylic ethers. The powder contents of SCC are normally lying above those of conventional concrete. In India, there is requirement of aggregates, mostly used for road and concrete constructions. Mainly aggregates occupy 70% of concrete. But in present, people are facing a problem due to a shortage of fine aggregate. Fly ash is a petroleum combustion product that is calm of the particulates (fine particles of burned fuel) that are driven out of gas-fired boilers together with the flue gases. Ash that falls to the bottom of the boiler is called bottom ash. Together with bottom ash removed from the bottom of the boiler, it is known as coal ash. In the past, fly ash was generally released into the atmosphere, but air pollution control standards now required captured prior to release by proper pollution control equipment.

2. EXPERIMENTAL PROGRAM

2.1 Material properties

Ordinary Portland cement is (like ASTM Type I) conforming to the necessities of IS: 12269 (53 grade) was used. Fly ash is remains meeting the essentials of ASTM C 618 (Class F) were used. 12 mm size coarse aggregates are used and naturally available fine aggregates are used. The coarse and fine aggregate specific gravities are 2.79 and 2.60 respectively. A polycarboxilic-ether type super plasticizer (SP) with a specific gravity is 1.09, and viscosity modifying agent (VMA) with a specific gravity is 1.03.

Table1: Chemical composition of cement, fly ash

Chemical composition	Cement	Fly ash
Silica	21.76	58.28
Alumina	6.57	31.73
Ferric oxide	4.17	5.85
Calcium oxide	60.13	1.96
Magnesium oxide	2.09	0.13
Sodium oxide	0.34	0.75
Potassium oxide	0.45	0.76
Sulphuric anhydride	2.18	0.14
Loss on ignition	2.31	0.32

Table 2: Physical properties of Cement & fly ash

Property	Cement	Fly Ash
Specific gravity	3.12	2.34
Fineness modulus	5%	15%

Table 3: Physical properties of coarse & fine aggregates

Property	Fine aggregate	Coarse aggregate
Specific gravity	2.6	2.79
Fineness modulus	2.81	2.61

Super plasticizer i.e., Master Glenium Sky B233 is an admixture, it is highly flowable plasticizer, in SCC this is the most useful components. Master Glenium sky B233 is free of chloride and low alkali content.

Table 4: Properties of Master Glenium Sky B233

Aspect	Light brown liquid
Relative density	1.09+0.01 at 25°C
pH	>6
Cl^- content	<0.2%

In the self-compacting concrete mix, if water content increases which lead to unprotected against moisture variations and segregation may occur. VMA also reduce bleeding from the concrete mix.

Table 5: Properties of VMA

Appearance	Yellowish to Brownish liquid
Specific Gravity @ 270 C	1.03 - 1.07
pH	Minimum 6.0
Chloride ion content	Nil (As per BS:5075 Part I)
Alkali content	Should not be more than 1g Na_2O equivalent / liter of admixture

3. MIX PROPORTION DETAILS

In our project 4 concrete mixes are prepared, which are having a cement substance of 550 kg/m^3, coarse aggregate of 901 kg/m^3 and fine aggregate of 840 kg/m^3, the w/c ratio was taken 0.3 by weight. The aggregates are taken as 50% of the overall volume of aggregates. The different self compacting concrete mixes are prepared by replacing cement with fly ash of 10%, 20%, 30% and 40% by weight of total binder content. The mix details are shown in table 6.

Table 6: various mixes for self compacting concrete

Mix	Cement (kg/m^3)	Fly ash (kg/m^3)	Fly ash (%)	Coarse aggregate (kg/m^3)	Fine aggregate (kg/m^3)	Water (kg/m^3)	Super plasticizer (%)	w/c	VMA (%)
SCC1	495	55	15	901	840	165	1.80	0.3	0.6
SCC2	440	110	25	901	840	165	1.80	0.3	0.6
SCC3	385	165	35	901	840	165	1.80	0.3	0.6
SCC4	330	220	45	901	840	165	1.80	0.3	0.6

4. PREPARATION AND CASTING OF SPECIMENS

The required quantities of materials are taken. Cement & fly ash are first mixed in dry state separately. The coarse aggregate and fine aggregate are mixed at dry and then mixed together in a mixer to form an identical mix, after adding water with Super plasticizer & VMA. Cast the specimens after to complete the tests for fresh properties. The cube size is 150 mm, to find out the compressive strength of the cube. The size of the cylinders is 150*300 mm, to find out the splitting tensile strength of cylinder and the beam size is 500*100*100mm, to find out the flexural strength of the beam.

5. TEST FOR SPECIMENS

5.1 Properties of fresh concrete

To determine the self-compacting ability properties i.e

1. Slump flow
2. L-box
3. V-funnel
4. U- box

The slump flow is found out the mean diameter of the mass of concrete. V funnel test flow time is < 6 sec, they recommend for a highly performed SCC. The L box and U box are regulating to check the filling ability of concrete

Table 7: Different types of fresh properties for SCC mixes

Mix proportions	Slump flow	L box	U box	V funnel
	Diameter(mm)	(H_2/H_1)	(H_1-H_2) (mm)	T_{5min}(s)
SCC0	680	0.85	10	7.5
SCC1	650	0.87	15	8.1
SCC2	672.5	0.9	20	4.3
SCC3	690	0.93	17	5.5
SCC4	610.5	0.88	12	6.1

5.2 Strength and durability studies

Compressive strength test for the cubes at 7, 28 and 90 days, and split tensile strength test at 7, 28 and 90 days and flexural strength test at 7, 28 and 90 days. The sulphate attack and chloride attack was tested by calculating the weight losses of the cubes at 90 days. For studying durability characteristics of SCC 5% of H_2SO_4 and 5% of HCl solutions were used and specimens were placed up to an exposure time of 90 days.

6. RESULTS AND DISCUSSIONS

6.1 STRENGTH PROPERTIES

6.1.1 Compressive strength

As fly ash changes with an increment of 10 – 40%, the compressive strength is increased from 47.36 to 48.12MPa at 7 days, 70.76 to 72.90MPa at 28 days. The percentage of fly ash content increases then alternatively increases the strength of the mixes up to 30%. From 30% onwards by increase in fly ash content there is decrease in strength and also by increasing the water to cement ratio. SCC3 (30% fly ash) gained strength of 52.45 and 75.69 at 7 and 28 days. The values are given below

Table 8: Compressive strength for SCC mixes

Mix proportions	Compressive strength (MPa)		
	7days	28days	90days
SCC0	45.80	69.23	70.96
SCC1	48.46	70.36	72.83
SCC2	50.21	74.23	75.21
SCC3	53.12	76.28	78.48
SCC4	49.26	72.83	73.98

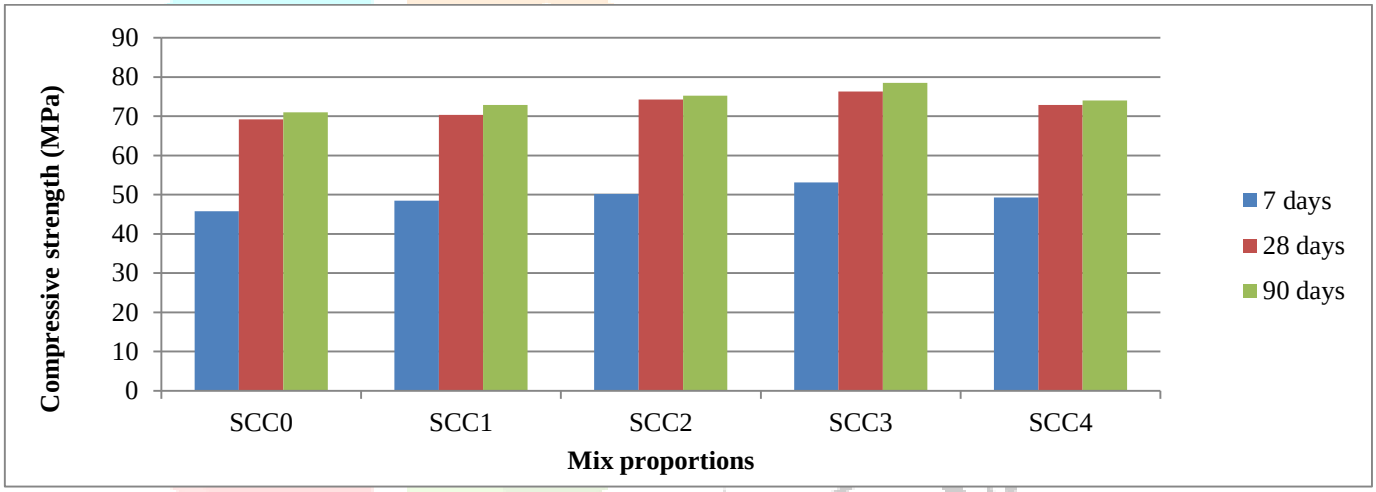

Fig: 1 Compressive strength values for SCC mixes

6.1.2. Split tensile strength

Splitting tensile strength values for SCC mixes obtained 3.41, 3.85, 3.98, 4.23, 3.89 MPa at 7 days. 4.56, 4.72, 5.03, 5.30, 5.19 MPa at 28 days. Fly ash changes with an increment of 10% to 40%. By increase in fly ash content from 10% to 40%, SCC3 (30% fly ash) gained strength of 5.30 MPa at 28 days. Similarly, SCC2 (20% fly ash) gained strength subsequent to 5.03 MPa at 28 days. Tensile strength increases, when decreasing the fly ash content.

Table 9: Tensile strength values for SCC mixes

Mix proportions	Split tensile strength (MPa)		
	7days	28days	90days
SCC0	3.52	4.81	6.32
SCC1	3.98	4.93	6.58
SCC2	4.16	5.05	6.98
SCC3	4.33	5.28	7.30
SCC4	4.02	5.12	6.82

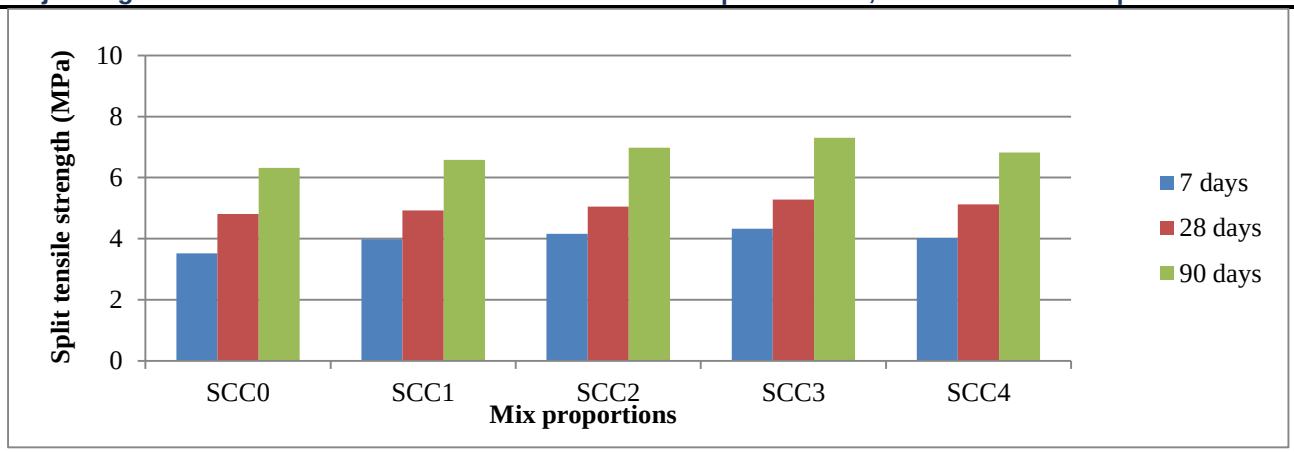

Fig: 2 Split tensile strength values for SCC mixes

6.1.2 Flexural strength test

Flexural strength increases from SCC1 to SCC3 and decreases from SCC4. The fly ash content is increases from 10% to 40%. Fly ash content is increases for mix SCC1 strength increases up to 5.40 MPa at 28 days. The fly ash content is increases from 10% (SCC1) to 40% (SCC4), SCC3 (30% fly ash) mix was gained optimum strength 6.90 MPa at 28 days. Similarly, SCC2 (20 % fly ash) attained strength subsequent to 5.73 MPa at 28 days. As increasing of fly ash content,
(From 30%) then decrease tensile strength at all ages of concrete.

Table 10: Flexural strength values for SCC mixes

Mix proportion	Flexural strength (MPa)		
	7days	28days	90days
SCC0	4.65	5.38	7.18
SCC1	4.98	5.61	7.48
SCC2	5.10	5.95	7.89
SCC3	5.56	7.10	8.10
SCC4	5.23	6.23	7.96

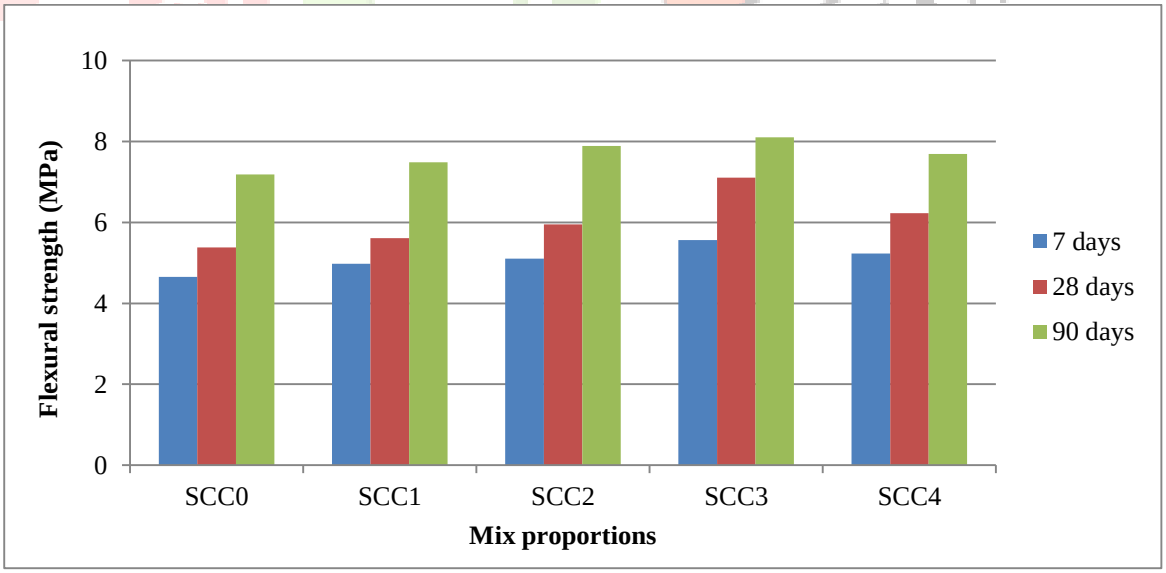

Fig 3: Flexural strength for SCC mixes

6.2 DURABILITY PROPERTIES

6.2.1 Chloride attack

Percentage of strength loss and weight loss of the cubes were found out at the period of 90 days curing. By increase the fly ash content the weight has been reduced for the concrete specimens and the compressive strength is also reduced.

Table 11: Variation between % of strength loss and % of weight loss at 3% HCl

Mix proportions	Average reduction in weight (%)	Average compressive strength (MPa)	Average loss of compressive strength (%)
	90days	90days	90days
SCC0	4.95	67.76	3.40
SCC1	4.74	70.12	3.14
SCC2	3.70	72.43	2.68
SCC3	3.55	75.89	2.58
SCC4	4.65	71.41	2.77

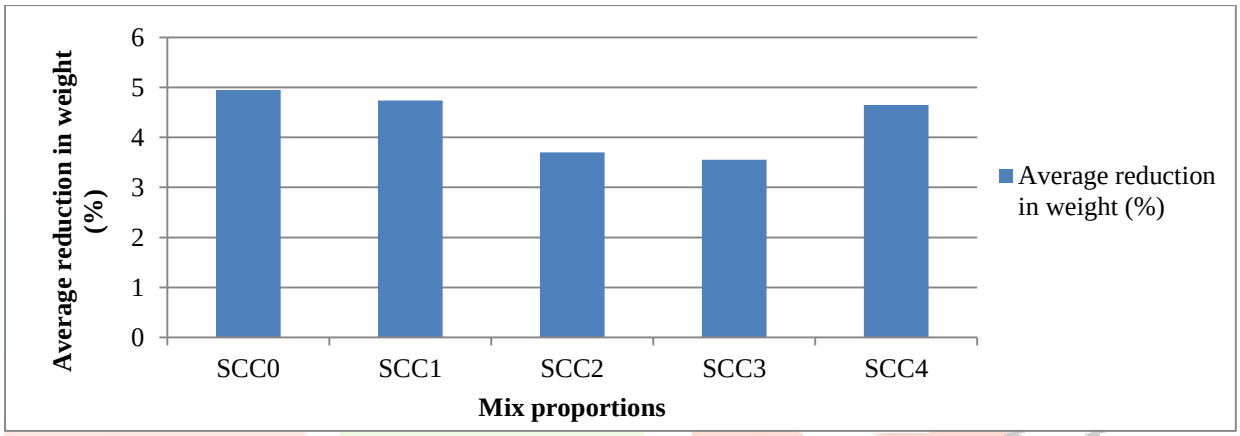

Fig 4: % of weight loss at 3% HCl

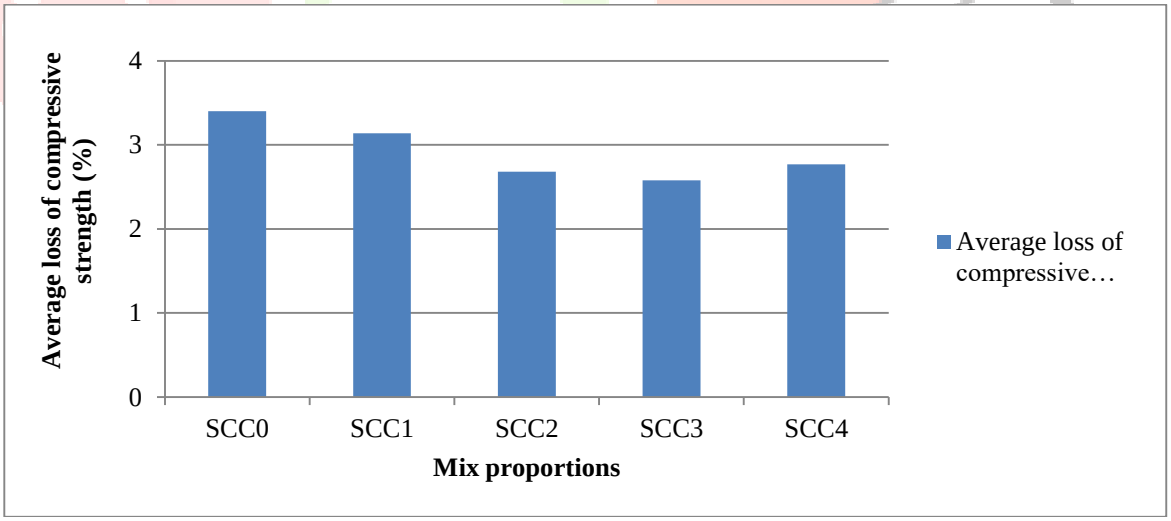

Fig 5: % of strength loss at 3% HCl

6.2.2 Sulphate attack

Sulphate attack was evaluated to find the losses in weight of the cubes at 90 days.

Table 12: Variation between % of strength loss and % of weight loss at 3% H_2SO_4

Mix proportions	Average reduction in weight (%)	Average compressive strength (MPa)	Average loss of compressive strength (%)
	90days	90days	90days
SCC0	3.34	67.10	4.34
SCC1	3.05	69..71	3.74
SCC2	2.90	72.06	3.12
SCC3	2.56	75.75	272
SCC4	3.04	71.16	

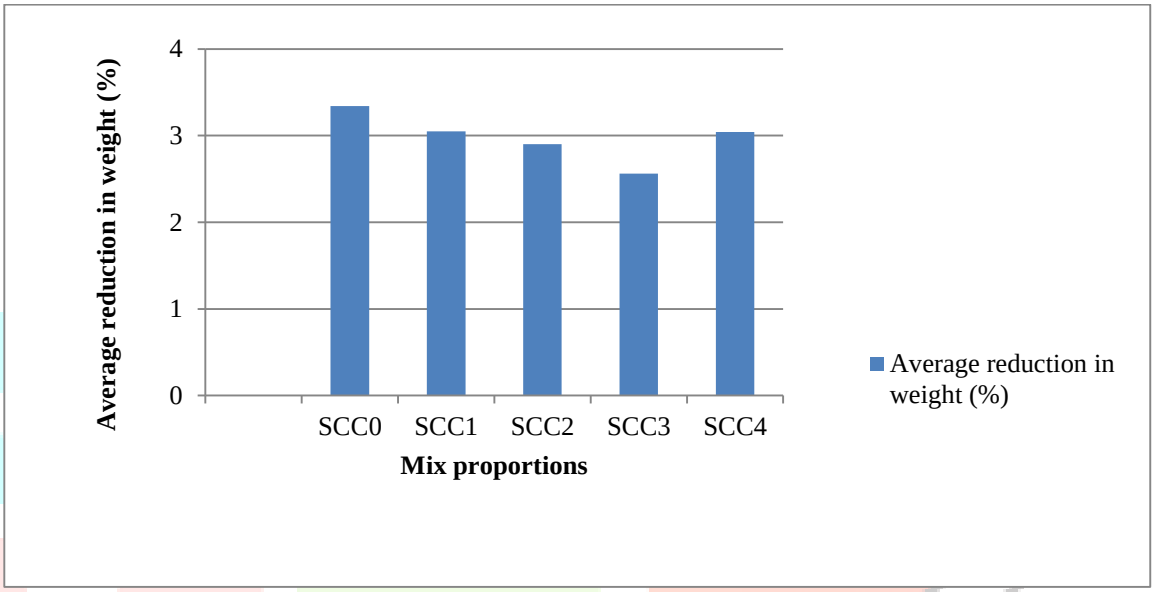

Fig 6: % of weight loss at 3% HCl

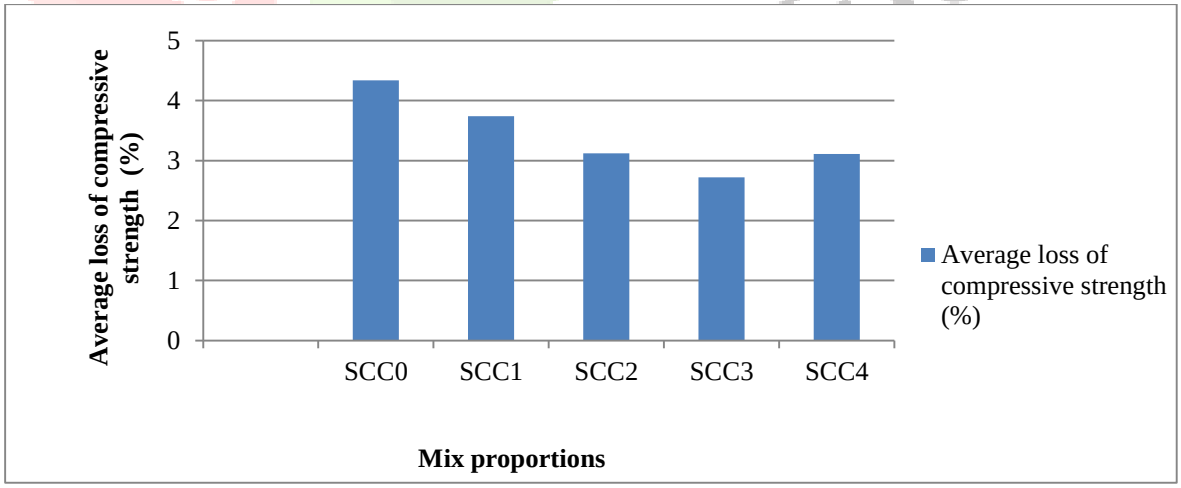

Fig 7: % of strength loss at 3% HCl

7. CONCLUSIONS

1. The fly ash replacement in around 35-45% will be given superior performance for SCCs.
2. Fresh properties of SCCs are effectively satisfied with in the limits of EFNARC-2005 guide lines.
3. Strength increases with the decrease of water to cement ratio (w/c), and achieved good strength w/c at 0.3.
4. The optimum strength is obtained at 35 % of fly ash replacement, by taking 50% of coarse aggregate and 50% fine aggregate.
5. At 35% replacement of cement by fly ash the optimum compressive & split tensile strength is obtained at 1.8% of super plasticizer.
6. Compressive strength is increased 15.98% at 7 days and10.18% at 28 days when compared to conventional concrete.
7. Split tensile strength is increased 23.07% at 7 days and 9.77% at 28 days when compared to conventional concrete.
8. Flexural strength is increased19.56% at 7 days and 28.02% at 28 days when compared to conventional concrete.
9. There is an increase in compressive strength, for partial replacement of cement with SP is up to 9.52% for 90 days.
10. There is an increase in split tensile strength, for partial replacement of cement with SP is up to 15.50% for 90 days.
11. There is an increase in flexural strength, for partial replacement of cement with SP is up to 12.81% for 90 days.
12. Durability test results show a reduction in compressive strength by 9.0% tested against 3% HCl.
13. Durability test results show a reduction in compressive strength by 11.2% tested against 3% H_2SO_4.

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INVESTIGATION OF THE STRENGTH OF FIBER REINFORCED CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY DUST AND METAKAOLIN

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ABSTRACT
Concrete is the widely used construction material in civil engineering field. The demand and cost of cement is increasing day to day, so experts are looking for supplementary materials with the main objective of reducing solid waste disposal and environmental problems, by using waste as supplementary by maintaining the same properties or by enhancing the properties, by using selected materials. Quarry dust (QD) is a waste product produced during the crushing process. It is used in partial replacement of cement in various proportions. This quarry dust which is released directly into environment can cause environmental pollution. To reduce the impact of the quarry dust on environment and human, this waste can be used to produce new products or can be used as admixture in concrete so that the natural resources are used efficiently and hence environmental waste can be reduced. Different types of fibers used to increase tensile strength and reduce cracks in the concrete. The study has been made to evaluate the effect on mechanical and durability properties of M30 grade concrete made with replacement of cement with Quarry dust, (0%, 10%, 15%, 20%, 25% and 30%) and Metakaolin, (0%, 2.5%, 5.0%, 7.5%, 10.0% and 12.5%) by weight and the addition of Steel and glass fibers in different percentages (0%, 0.5%, 1%, 1.5% and 2%). For each set mechanical properties were studied by performing Compression test for Cubes, Flexural test for beams and Split Tensile test for cylinders and durability properties were studied by performing Sulphate attack test for cubes.
Keywords: FRC, Metakaolin, Compression test, Flexural test.

1.0 INTRODUCTION:
Cement is likely the most broadly utilized development material as a part of the world. The principle constituent in the traditional concrete is Portland cement. The amount of cement manufacture release approximately equal amount of carbon dioxide into the atmosphere. Cement production is consuming significant amount of natural resources. That has brought pressures to reduce cement consumption by the use of supplementary materials. The incorporation of supplementary cementitious materials like Quarry Dust (QD) and Metakaolin (MK) improves mainly the mechanical properties of concrete and also reduce the cement consumption. It is one of the strategies to enhance the fragile conduct of the solid is the expansion of little fibers in cement with haphazardly circulated. Such strengthened cement is called Fiber Reinforced Concrete (FRC). There are diverse sorts of fibers that can be utilized as a part of FRC they are Steel fibers, Glass fibers, Synthetic fibers, Carbon fibers, Nylon fibers. In this study the option of steel and glass fibers are added to solid, prompts change in breaking and rigidity. Plain concrete possesses a very less tensile strength, limited ductility and little resistance to cracking. Internal micro cracks are present in the concrete and its poor tensile strength is due to the propagation of such micro cracks. In plain concrete structural cracks develop even before loading, due to drying shrinkage

or other causes of volume change. The width of these initial cracks is few microns, but their other dimensions may be of higher magnitude.

Quarry Dust:

Quarry dust is a by-product from the crushing process during quarrying activities. Quarry dust has been used for different activities in the construction industry. The dust produced by quarrying has already been used in the construction industry for projects such as road building, and making materials such as bricks and tiles. The dust has been found to be suitable for these practices, and this makes its transformation into a useful cement mix replacement more likely.

Advantages of Using Quarry Dust

Use of Quarry Dust in cement and concrete results in

- Increased strength
- Enhanced durability
- High resistance to chloride penetration
- High resistance to sulfate attack
- Improved surface finish
- Enhanced architectural appearance

Metakaolin:

Metakaolin is a manufactured pozzolanic mineral admixture, which significantly enhances many performance characteristics of cement-based mortars, concretes and related products. Metakaolin, a white, amorphous, aluminum-silicate material formed from refined kaolin clay, interacts violently with calcium hydroxide to produce compounds having cementitious value.

Advantages of Using Metakaolin

Use of Metakaolin in cement and concrete results in

- Excellent workability
- Reduced permeability
- Controls alkali-silica reactivity
- Cost beneficial as reduces usage of super plasticizer

Fiber Reinforced Concrete:

The term Fiber Reinforced Concrete (FRC) is defined by ACI committee 544 as a concrete made of fibers hydraulic cements containing fine or coarse aggregates and discontinuous discrete fibers. Inherently concrete is brittle under tensile loading. Mechanical properties of concrete can be improved by reinforcement with randomly oriented short discrete fibers, which prevent and control initiation, propagation and coalescence of cracks.

2.0 LITERATURE REVIEW

A.V.S.Sai Kumar, Krishna Rao B **[1]** studied the effect on mechanical properties of M30 grade concrete made with partial replacement of cement with Quarry dust, (0%, 10%, 15%, 20%, 25% and 30%) and Metakaolin, (0%, 2.5%, 5.0%, 7.5%, 10.0% and 12.5%) .Tests for compressive strength, split tensile strength and flexural strength were conducted. Venkata Sairam Kumar N. **[2]** studied the characteristics of M20, M30 and M40 grade concrete with partial replacement of cement with Quarry Dust by replacing cement with 10%, 15%,20%,25%,30%,35% and 40%. Tests for compressive strength and split tensile strength were conducted. Dr. Naeem Ijaz1, Muhammad **[3]** studied the effect on mechanical properties of M15 grade concrete made with partial replacement of cement with Quarry dust (0%, 15%, 25% and 35%). Tests for compressive strength and split tensile strength were conducted. J.M. Khatib, E.M. Negim **[4]** studied the compressive strength, density and ultrasonic pulse velocity of mortar containing high volume of metakaolin (MK) as partial substitution of cement. Up to 50% of MK was used to replace cement in increment of 10. The results indicate that the maximum strength of mortar occurs at around 20% MK. Avinash Gornale, S Ibrahim Quadri **[5]** studied the effect on Compressive, Flexural and Split tensile strength of various grades of Glass fiber reinforced concrete and the mixes were compared with ordinary concrete mixes of M20, M30 and M40 grades of concrete. The workability of concrete decreases with the addition of Glass Fibers. Mr. Nikhil A. **[6]** The study focuses on the compressive strength performance of the blended concrete containing different percentage of slag and steel fiber as a partial replacement of OPC. The cement in concrete is replaced accordingly with the percentage of 10 %, 20%, 30%, and 40% by weight of slag and 0.5%,

1%, 1.5%, 2% by weight of steel fiber. Concrete cubes are tested at the age of 3, 7, and 28 days of curing. Sumathi and K**. [7]** the study was conducted to evaluate the mechanical characteristics of the High Strength steel Fiber Reinforced Concrete. The concrete mix design was done for M40 grade concrete. However, the specimens have been tested for different water cement ratio and it is arrived from the slump test. Milind, V. Mohod **[8]** By adjusting the percentage of fibers in concrete, it has been determined how fibers affect the strength of concrete for the M 30 grade. By cement volume, fiber contents were adjusted by 0.25%, 0.50%, 0.75%, 1%, 1.5%, and 2%. In order to test the compressive strength, cubes measuring 150 mm x 150 mm x 150 mm and beams measuring 500 mm x 100 mm x 100 mm were cast. Before being crushed, each specimen was cured for 3, 7, and 28 days.

3.0 Material Methods

The experimental investigation consists of casting and testing of 19 sets along with control mix. Each set comprises of 12 cubes, 6 cylinders and 6 beams for determining compressive, tensile and flexural strengths respectively. The cement will be replaced accordingly with the different percentages by weight of slag and different percentages by weight of steel fibers and Glass fibers. Cube specimen dimension is of 15 cm x 15 cm x 15 cm, cylinder specimen dimension is 15 cm x 30 cm and beam specimen is 50 cm x 10 cm x 10 cm. The moulds are applied with a lubricant before placing the concrete. After a day of casting, the moulds are removed. The cubes, cylinders and beams are removed from the curing tank carefully.

The material characteristics that are used in this study given in brief are as follows:

- Ordinary Portland cement 53 grade (KCP cement) with specific gravity of 3.11
- Locally available river sand with specific gravity of 2.61 and confirming to
- zone-2 of IS:383
- Coarse aggregate with specific gravity of 2.66
- Quarry Dust with specific gravity of 2.56
- Metakaolin with specific gravity of 2.6

Material Properties

Concrete is a composition of three raw materials. Cement, Fine aggregate and Coarse aggregate. These three raw materials play an important role in manufacturing of concrete. By varying the properties and amount of these materials, the properties of concrete will changes.

Cement:

The definition of cement is a bonding substance with cohesive and adhesive qualities that enables it to bind various building elements and create a compacted assembly. One of the most popular varieties of Portland cement is ordinary or normal Portland cement.

Figure 1: Cement

Specific Gravity of Fine Aggregate

Weight of empty Pycnometer W1 =425 gm.
Weight of empty Pycnometer +fine dry aggregate W2 = 757 gm.
Weight of empty Pycnometer + fine dry aggregate + water W3 =1375 gm
Weight of empty Pycnometer + water W4 =1170gm.
Specific gravity of water Gw = 1.0
Specific Gravity of fine aggregate = (W2 – W1) / [(W2 – W1) – (W3 – W4)]
Specific Gravity of Fine Aggregate = 2.61

Specific Gravity of Metakaolin

Weight of empty flask W1 = 15 gm.
Weight of empty flask + cement W2 =84 gm.
Weight of empty flask + cement +kerosene W3 = 95 gm.
Weight of empty flask + kerosene W4 =40 gm.
Specific gravity of kerosene Gk =0.78

Specific Gravity of Metakaolin = (W2 – W1) / [(W2 – W1) – (W3 – W4)]
Specific Gravity of Metakaolin = 2.6

Fineness Modulus of Fine Aggregate and Coarse Aggregate

The Fineness modulus (FM) is an empirical figure obtained by adding the total percentage of the sample of an aggregate retained on each of a specified series of sieves, and dividing the sum by 100. The sieve sizes are 150µ, 300µ, 600µ, 1.18 mm, 2.36 mm, 4.75 mm, 9.5 mm, 19.0 mm, 38.1 mm and larger increasing in the ratio of 2:1. The same value of fineness modulus may therefore be obtained from several different particle size distributions

Water

Fresh potable water free from acid and organic substances was used for mixing and curing concrete. Salt water is not to be used

Table 1: Physical Properties of Materials

Physical Properties of Materials	Results
Normal Consistency of Cement	32%
Setting Times of cement Initial Final	 63 minutes 321 minutes
Specific Gravity of cement	3.11
Fineness of cement	1%
Specific Gravity of aggregates of Coarse aggregates Fine aggregates QD MK	 2.66 2.61 2.56 2.6
Fineness Modulus of Fine Aggregate Fineness Modulus of Coarse Aggregate	2.26 7.68

Steel Fiber

Fiber is a small piece of reinforcing material possessing certain characteristics properties. They can be circular or flat. The fiber is often described by a convenient parameter called “aspect ratio”. The aspect ratio of the fiber is the ratio of its length to its diameter.

Table 2: Specifications of steel fibers

Fibre type	Fibre length	Fibre diameter	Aspect ratio
Hooked end	30 mm	0.5 mm	60

Glass Fiber

It is material made from extremely fine fibers of glass Fiber glass is a lightweight, extremely strong, and robust material. The glass fiber type used here is AR glass with 50mm fiber length and 0.1mm diameter. The aspect ratio of the glass fiber is 500.Glass fiber reinforced concrete, also known as GFRC.

Table 3: Specifications of glass fiber

Fiber Type	Fiber length	Fiber diameter	Aspect Ratio
AR glass	50 mm	0.1mm	500

MIX DESIGN

Mix Design is the process of selecting suitable ingredients of concrete and determining their relative quantities for producing concrete of certain minimum properties as strength, durability and consistency etc., as economically as possible. Mix design done for M30 grade concrete.

Mix Design – M30: The steps involved in the design of concrete mix as per IS: 10262-2009, IS: 456-2000.

M30 Concrete Mix Design		
As per IS 10262-2009 & MORT&H		
1	**Stipulations for Proportioning**	
1	Grade Designation	M30
2	Type of Cement	OPC 53 grade
3	Maximum Nominal Aggregate Size	20 mm
4	Minimum Cement Content (MORT&H 1700-3 A)	320 kg/m^3
5	Maximum Water Cement Ratio (MORT&H 1700-3 A)	0.45
6	Workability (MORT&H 1700-4)	25-50 mm (Slump)
7	Exposure Condition	Severe
8	Degree of Supervision	Good

CASTING OF SPECIMENS:

After completing the mix proportioning of materials concreting is done to represent the characteristics. Three types of concrete specimens are prepared in respective moulds in casting procedure. The types of specimens are Cubes, Beams and Cylinders.

Figure 2: Mixing of Concrete

Preparation of Concrete Moulds:

Metal moulds, preferably steel or cast iron, strong enough to prevent distortion is required. Specimen without damage and are so maintained that, when it is collected, the dimensions and internal faces are required to be accurate.

Figure 3: Arrangement of moulds

Casting of Beams

For each trail 6 beam specimens were casted for calculating 7 days and 28 days strengths. The dimensions of the beam specimen are of 500mm x 100mm x 100mm.

Figure 4: Specimens casted

Curing

The test specimens are stored in a place free from vibration in moist air of at least 90%relative humidity and at a temperature of 27°C ± 2°Cfor 24 hours from the time of addition of water to the dry ingredients. After this period, the specimens are marked and removed from the moulds. Unless required for testing within 24 hours, they are immediately submerged in clean fresh water or saturated lime solution and are kept there until they are taken out just prior to test. The water or solution in which the specimens are submerged, are removed every seven days and are maintained at a temperature of 27°C ± 2°C. the specimens are not to be allowed to become dry at any time until they have been tested.

RESULTS AND DISCUSSIONS

The study has been made to evaluate the effect on mechanical and durability properties of M30 grade concrete made with replacement of cement with Quarry dust, (0%, 10%, 15%, 20%, 25% and 30%) and Metakaolin, (0%, 2.5%, 5.0%, 7.5%, 10.0% and 12.5%) by weight and the addition of Steel fibers and glass fibers in different percentages (0%, 0.5%, 1%, 1.5% and 2%). The detailed tabulations and graphs are presented as follows. A number of tests were carried out to determine the design mix properties of concrete in the laboratory. The strength criterion includes measurement of following parameters:

- Compressive Strength
- Flexural Strength
- Split Tensile Strength

Compression Test

Compressive strength is obtained by applying crushing load on the cube surface. So it is also called as Crushing strength. Compressive strength of concrete is calculated by casting 150mm x 150mm x 150mm cubes. The test results are presented here for the Compressive strength of 7 days and 28 days of testing.

Figure 5: Testing cubes in compressive testing machine

Table 4: Compressive strength for different Quarry dust percentages

Percentage of quarry dust	Compressive strength	
	7 days	28 days
0	26.7	40.33
10	28.23	40.82
15	27.72	41.45
20	28.81	42.07
25	**29.12**	**43.45**
30	25.12	39.26

Table 5: Compressive strength for glass fiber

% of glass fibers	Compressive strength	
	7 days	28 days
0.5	**33.27**	**49.27**
1	31.69	47.82
1.5	30.87	47.48

Table 6: Compressive strength for steel fiber

% of steel fibers	Compressive strength	
	7 days	28 days
0.5	**32.64**	**47.46**
1	**33.81**	**48.74**
1.5	**34.68**	**52.68**
2	**33.41**	**48.71**

From the above graph, it is observed that the compressive strength value is higher for the mix 25% QD+10% MK with 1.5% steel fibers compared with other mixes.

Flexural Test

Flexural test was performed on beams by placing them on universal find out the flexural strength. After testing the concrete (flexural strength) for M25 grade concrete separately for replacement of slag, glass & steel fiber by cement respectively finally combined percentage of slag & steel fiber mix, slag & glass fiber mix in which maximum strength is obtained was used to get optimized strength.

Table 7: Flexural strength of Quarry Dust

Percentage of quarry dust	Flexural strength, MPa	
	7 days	28 days
0	4.55	5.66
10	4.63	5.89
15	4.54	5.92
20	4.93	6.07
25	**5.21**	**6.25**
30	4.31	5.26

Table 8: Flexural strength for Metakaolin

25% Percentage of Quarry dust and percentage of Metakaolin	Flexural strength	
	7 days	28 days
0	5.21	6.25
2.5	5.26	6.38
5	5.28	6.44
7.5	5.31	6.48
10	**5.41**	**6.64**
12.5	5.24	6.49

Table 9: Flexural test for glass fiber

% of glass fibers	Flexural strength	
	7 days	28 days
0.5	**5.05**	**6.82**
1	5.44	6.68
1.5	5.26	6.65

From the above graph, it is observed that the flexural strength value is higher for the mix 25% QD with 10% MK, compared with other mixes.

Table 10: Compressive strength of steel fiber reinforced concrete of M30 grade concrete after H2SO4 acid curing

S.NO	% of Steel fiber	Compressive strength(N/mm^2)		
		7days(5%H2SO4)	28days(5%H2SO4)	60days(5%H2SO4)
1	0	22.21	36.12	35.55
2	0.5	23.12	37.24	36.25
3	1.0	24.81	38.12	37.12
4	1.5	26.52	40.92	38.99
5	2.0	24.12	38.34	36.95

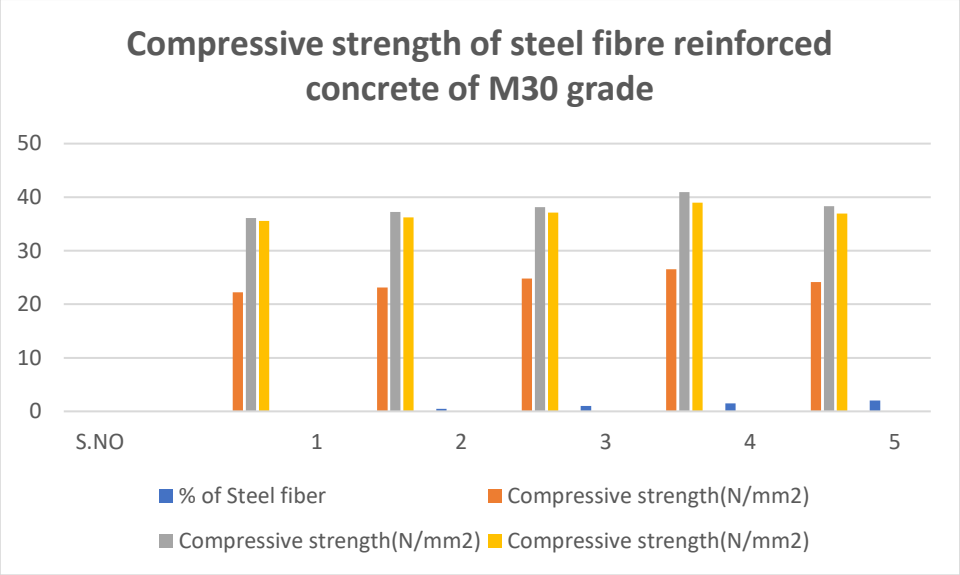
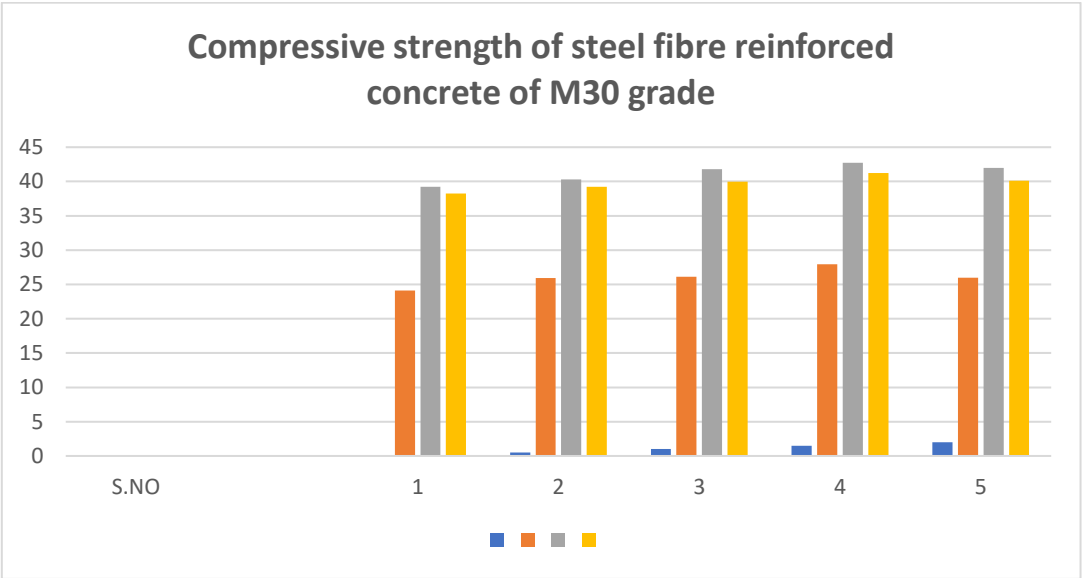


Figure 6: Compressive strength of steel fiber reinforced concrete of M30 grade

Table: Compressive strength of steel fiber reinforced concrete of M30 grade concrete after HCL acid curing

S.NO	% ofsteel fiber	Compressive strength(N/mm^2)		
		7days(5%HCL)	28 days(5%HCL)	60 days (5%HCL)
1	0	24.11	39.25	38.24
2	0.5	25.91	40.32	39.25
3	1.0	26.12	41.81	39.97
4	1.5	27.92	42.72	41.23
5	2.0	25.99	41.99	40.12



Graph 7: Compressive strength of steel fiber reinforced concrete of M30 grade

CONCLUSIONS

Based on the analysis of experimental results and discussion there upon the following conclusions can be drawn: By the comparison of nominal mix, the percentage increase in Compressive Strength, Split tensile strength and flexural strength for Partial replacement of cement with Quarry Dust are 7.18%, 12.05% and 9.44%.

- By the comparison of nominal mix, the percentage increase in Compressive Strength, Split tensile strength and flexural strength for Partial replacement of cement with Metakaolin are 15.06%, 18.8% and 14.75%.
- By the comparison of nominal mix, the percentage increase in Compressive Strength, Split tensile strength and flexural strength for extension of glass fibers are 18.14%, 20.66% and 17.00%.
- By the comparison of nominal mix, the percentage increase in Compressive Strength, Split tensile strength and flexural strength for extension of Steel fibers are 23.44%, 23.52% and 27.45%.
- The optimum quantity for partial replacement of cement by Quarry Dust is obtained at 25%.
- By making the 25 % of Quarry Dust constant, the optimum quantity for partial replacement of cement by Metakaolin is obtained at 10%.
- The optimum quantity for extension of Glass fibers is obtained at 0.5%.
- The optimum quantity for extension of Steel fibers is obtained at 1.5%.
- The Durability result shows that steel fiber is more effective than glass fiber.
- In durability the strength loss is higher in H2SO4 than HCL

Scope For Future Work:

- Non-destructive tests can also be useful for on-site testing
- Combination of Quarry dust with different other admixture can be carried out.
- Combination of Metakaolin with different other admixture can be carried out.
- Some tests relating to durability aspects such as water permeability, resistance to penetration of chloride ions, corrosion of steel reinforcement etc. need investigation**.**

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Implementation of Wireless P2.5 Full Color Led Display using HDWF4 Controller

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Abstract: Humanity's dependence on signage and signalling persists across various settings and occasions, spanning from coordinating meeting times and locations to informing about transportation schedules. These notifications play a pivotal role in guiding society towards well-informed decisions, ultimately leading to an improved lifestyle. In the past, some notifications were delivered orally by town criers in rural areas. However, with significant technological advancements in towns and cities, such methods have become inadequate. Similarly, the traditional practice of sticking paper notices on wooden boards not only proves inefficient but also wasteful of valuable resources. Recognizing the significance of meeting our daily information needs in a timely and cost-effective manner, leveraging modern electronic and wireless technology becomes essential for achieving better socio-economic outcomes. Information is undeniably powerful, underscoring the paramount need for rapid and convenient dissemination of time-critical information. Considering this, the present project proposes the design and implementation of a Wireless P2.5 Full Colour LED Display Notice Board using the HDWF4 Controller. This cutting-edge display system aims to circulate vital information in public places, such as colleges, schools, offices, malls, travel hubs, and other establishments. By enhancing security systems and promoting awareness of emergency situations, potential dangers can be averted. This innovative design provides flexibility by enabling the display of messages on the P2.5 Full Colour LED module through a WiFi-controlled

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network using the HDWF4 Controller. The proposed system has the potential to significantly improve security measures and enhance public safety by effectively conveying crucial information to the masses.

Key words: LED Display, Notice Board, HDWF4 Controller, WiFi-controlled network, Public safety.

1. INTRODUCTION

In today's fast-paced world, effective communication and timely dissemination of information have become critical components in various sectors, ranging from education and corporate environments to public spaces and transportation hubs. The demand for advanced display technologies that can efficiently relay essential messages to a wide audience has never been greater. To address this need, we propose the implementation of a cutting-edge solution: the Wireless P2.5 Full Color LED Display using the HDWF4 Controller. This project aims to revolutionize how information is communicated in public places, educational institutions, corporate offices, commercial centers, and other establishments. The Wireless P2.5 Full Color LED Display offers an unparalleled medium for displaying dynamic and attention-grabbing content that can inform, engage, and captivate the target audience. The HDWF4 Controller serves as the backbone of this system, enabling seamless wireless connectivity and control of the LED display. With its advanced features and user-friendly interface, the HDWF4 Controller ensures the hassle-free management of content, allowing administrators to update and broadcast information effortlessly. The implementation of this Wireless LED Display addresses several key challenges faced by traditional notice boards and signage methods. Gone are the days of manually posting paper notices that could easily be overlooked or become outdated. Instead, this modern solution empowers administrators to remotely manage content, ensuring real-time updates and relevancy. Furthermore, the Full Color LED technology utilized in this project delivers vibrant and captivating visuals, capable of attracting immediate attention and conveying information effectively. The P2.5 pixel pitch ensures high resolution, resulting in crisp and clear displays, even from a distance. This Introduction sets the stage for an in-depth exploration of the Wireless P2.5 Full Color LED Display using the HDWF4 Controller. Throughout this project, we will delve into the technical aspects of the implementation, discuss the features and capabilities of the HDWF4 Controller, and showcase the potential applications of this advanced display system in various real-world scenarios. By the end of this project, readers will gain a comprehensive understanding of the Wireless P2.5 Full Color LED Display's significance and how it can usher in a new era of dynamic communication and information dissemination in a variety of settings, contributing to enhanced engagement, improved safety, and overall efficiency. The Mobile Phone Controlled Wireless Notice Board offers a revolutionary method of displaying messages to the public. It operates by transmitting messages to a central system, which promptly showcases the received content on a screen for everyone to view. This modern approach replaces the traditional use of wooden notice boards scattered throughout establishments and institutions, which often leads to wastage of precious resources such as paper, printer ink, valuable time, and manpower.

The financial implications of maintaining physical notice boards are considerable, as they incur ongoing costs for materials and upkeep. In contrast, leveraging the cost-effective SMS services provided by

various mobile network providers in different countries proves to be a more economical option. To achieve seamless communication, this system utilizes GSM technology, a versatile wireless technology with a global range. By opting for GSM over other short-range wireless technologies like Bluetooth, Zigbee, or Wi-Fi, significant savings in time, money, effort, and valuable resources are achieved. The benefits of GSM lie in its ability to cover large geographical areas, making it highly efficient for widespread dissemination of information. Through the Mobile Phone Controlled Wireless Notice Board, organizations can optimize their communication processes, streamline information delivery, and reduce environmental impact. By embracing this fast and convenient solution, establishments can contribute to a greener and more resource-efficient future, while ensuring swift and reliable communication with the public. Throughout history, the need for signage and signaling has been a constant in human society. From announcing meeting times and locations to providing information on transportation schedules, these notifications play a vital role in guiding individuals towards a more informed and improved lifestyle. While in the past, audio-based notifications by town criers served rural areas adequately, the remarkable technological advancements in towns and cities have rendered such methods inadequate. The traditional practice of physically affixing paper notices to wooden boards also proves to be resource-wasting and outdated. Recognizing the importance of meeting our daily information needs efficiently, this work emphasizes the value of adopting modern electronic and wireless technology. By doing so, we can ensure timely and cost-effective dissemination of information, empowering individuals to make well-informed decisions and achieve better socio-economic outcomes. Embracing current technological solutions enables us to keep pace with the demands of an ever-evolving society and seize the opportunities presented by an interconnected world.

2. RELATED WORK

In the pursuit of efficient and captivating information dissemination, several studies and projects have explored the application of LED display technologies and wireless control systems. Previous works on Wireless Electronic Notice Boards have explored the use of different wireless technologies to transmit messages remotely to a display screen. Several notable studies in this area are discussed below:

• **RF Based Wireless Notice Board:** Zohedi [1] developed a Wireless Notice Board using short-range 433.92MHz FM-TX1 (transmitter) and FM-RX1 (receiver) RF wireless technology, along with an MC68HC11 microcontroller. The system achieved the fundamental objective of sending and receiving messages wirelessly. However, it had practical limitations. One drawback was the limited transmission range, with communication only possible within 200 meters in an open area and 25-30 meters with obstacles present. The transmission range was also affected by the type of antenna used and the environmental conditions, which could further reduce the range. This limitation confined the notice board's usage primarily within buildings. Additionally, the message input was limited to a customized transmitter keypad module, posing potential disadvantages if the module malfunctioned, rendering the entire system inoperable until a replacement was provided.

• **ZIGBEE based wireless notice board:** ZigBee technology based on PAN (Personal Area Network) was employed in a wireless notice board design [2]. The system formed a mesh network between nodes, allowing for daisy-chaining and expansion of the short-range coverage. An XBee explorer received data from a PC and forwarded it to the microcontroller, which displayed the messages on the LCD screen. The ZigBee design offered a transmission range of approximately 300-400 meters, significantly surpassing the RF-based system's range. This improvement also led to reduced circuit complexity and costs. However, a limitation of this approach was that an operator needed to be physically present near the transmitter to change or update the displayed message. This required connecting a PC to the transmitter module to input the text. Additionally, the ZigBee design lacked a backup power source, which was present in the RF-based system.

• **Bluetooth based wireless notice board:** A Bluetooth-based wireless notice board [3] enabled notifications to be displayed when messages were sent from a user's mobile phone or any Bluetooth-enabled device. The Bluetooth device at the display unit received and retrieved messages sent from the user's device, and access to the Bluetooth notice board was protected by a password known only to the user. Although the transmission range was limited to approximately 100 meters, the design offered portability since messages could be updated using portable devices such as mobile phones and tablets. These previous works have contributed valuable insights into the implementation of Wireless Electronic Notice Boards using different wireless technologies. Each approach presented its advantages and limitations, influencing the design considerations and improvements in subsequent studies, including the proposed implementation of the Wireless P2.5 Full Color LED Display using HDWF4 Controller [4].

The implementation of a Wireless P2.5 Full Color LED Display using the HDWF4 Controller builds upon and advances the following relevant research and developments:

i. LED Display Technologies: Previous works have extensively investigated various LED display technologies and their applications. Researchers have focused on improving the resolution, brightness, and energy efficiency of LED panels. Studies on pixel pitch optimization and color accuracy have contributed to enhancing the visual quality of LED displays, making them suitable for public viewing scenarios [5].

ii. Wireless Communication Protocols: The integration of wireless communication protocols for LED displays has been an area of active research. Studies have explored the use of Wi-Fi, Bluetooth, Zigbee, and GSM technologies to enable remote control and content updates for LED screens. Comparisons between different protocols' performance in terms of range, reliability, and data transfer rates have influenced the selection of the most suitable wireless solution [6].

iii. Remote Content Management Systems: Efficient content management is crucial for dynamic LED displays. Previous projects have focused on developing user-friendly web-based interfaces

and mobile applications that enable administrators to update and schedule content remotely. Research in this area has contributed to streamlining content delivery, ensuring real-time updates, and enabling easy customization of displayed information [7].

iv. Public Information Systems: Several studies have explored the deployment of information display systems in public spaces. Examples include notice boards in educational institutions, transportation hubs, commercial centers, and government facilities. Previous works have highlighted the importance of clear and timely information dissemination to enhance public awareness, safety, and engagement [8].

v. Cost-Effectiveness and Sustainability: Research on the economic and environmental aspects of implementing LED display systems has been significant. Previous projects have focused on evaluating the cost-effectiveness of LED displays compared to traditional methods, such as printed posters and static signs. Additionally, studies have analyzed the energy consumption of LED displays and proposed energy-efficient solutions to reduce environmental impact. The implementation of the Wireless P2.5 Full Color LED Display using the HDWF4 Controller integrates and builds upon the insights gained from these related works. By leveraging the advancements in LED display technologies, wireless communication, remote content management, and sustainable practices, this project aims to create an innovative and impactful solution for information dissemination in public places and establishments[9, 10].

3. PROPOSED WORK

The dissemination of timely and critical information holds immense power, making it essential to ensure its quick and convenient delivery. To address this need, this project presents the Design and Implementation of a Wireless P2.5 RGB-LED Display Notice Board, incorporating the HD WF4 Controller. The primary objective is to circulate vital information in public spaces, including Colleges, Schools, Offices, Malls, Travel Hubs, and other establishments, with the aim of enhancing security measures and raising awareness about emergency situations to avert potential dangers. This design offers flexibility and display of information or massages to its users remotely as information is transmitted over a Wi-Fi controlled network using HD WF4 This proposed technology can be used in colleges, many public places, malls or big buildings to enhance the security system and also make awareness of the emergency situations and avoids many dangers. This cutting-edge design offers unparalleled flexibility, enabling remote display of information or messages through a Wi-Fi controlled network using the HD WF4 Controller. The technology proposed in this project finds extensive application in colleges, public places, malls, and large buildings, where it can significantly bolster the security system. The System is connected as per the circuit and observed operating the device remotely using and effectively communicate crucial information during emergency scenarios, mitigating potential hazards and ensuring public safety. By leveraging the power of wireless connectivity, this Wireless P2.5 RGB-LED Display Notice Board delivers information promptly and efficiently, enabling

informed decision-making and fostering a safer environment for all. The block diagram of the P2.5 Full color LED display module using HD WF4 controller is shown in Figure 1.

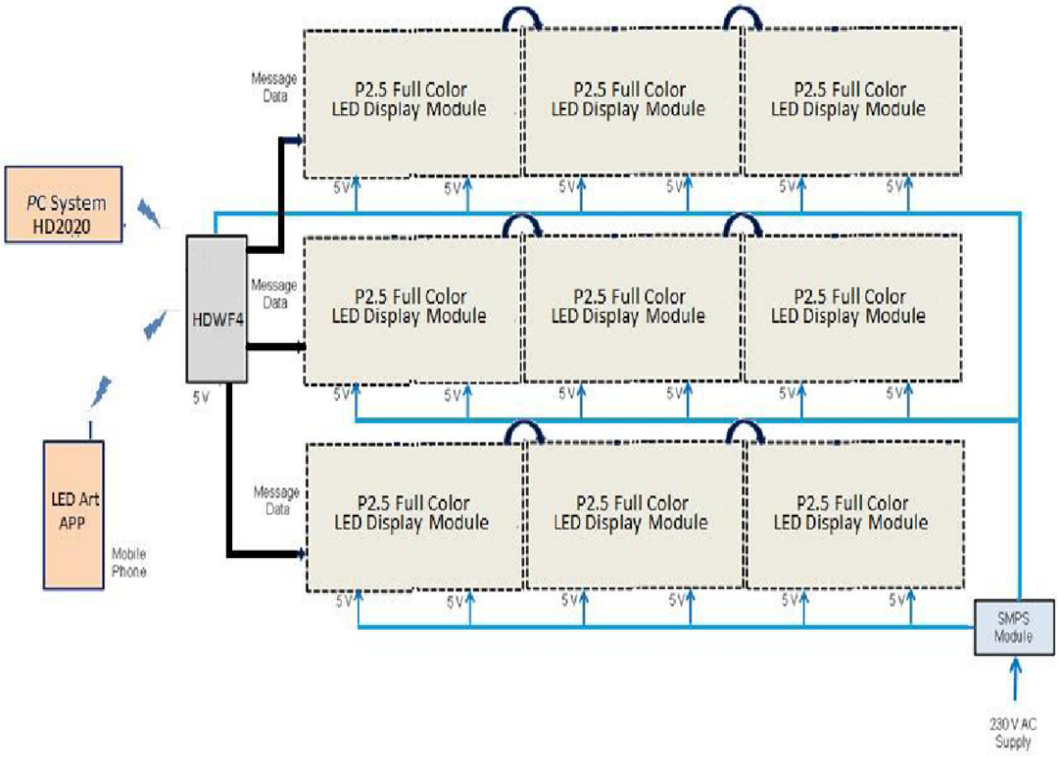

Figure 1. Block diagram of the P2.5 Full color LED display module using HD WF4 controller

The HD-WF4(abbr. WF4)equipped with 4 lines HUB75E Port. It is a full color series of control card. It supports Wi-Fi and U disk to update programs. It is suitable for door lintel led screens, store signboard screens, Vehicle-mounted screen and other occasions. Application software: HD2020 and Led Art (APP). The software interface is simple, the operation is convenient, and the rich display mode has the characteristics of low cost and high-cost performance, and supports various full-color led modules. Humanity always needs signage and signalling in places and events, ranging from meeting times and places to transport arrival and departure times. Such notifications guide the society in making informed decisions towards a better lifestyle. Although some notifications have been transmitted via audio in the past by town criers in rural areas, such methods are not suitable for towns and cities that have seen remarkable technological advances .Also, traditional notice board methods of physically sticking paper notices on wood board will waste sources .The value of this work underscores the need to meet our daily information needs in a timely and cost-effective manner using current electronic and wireless technology to help people to ultimately achieve better socio-economic outcomes.

4. RESULTS

Wi- Fi communication from the Mobile or Laptop using HD WF4Controller. The results are found as shown in the following Figure 2. The System is connected as per the circuit and observed operating the device remotely using Wi- Fi communication from the Mobile or Laptop using HD WF4Controller.The design and implementation of Five 32x32 RGB LED display modules which is also known as P6 RGB LED Display Module used to display a still/ scrolling messages by using HD WF4 Controller is done. The P6 modules can be cascaded to build any size of the advertising board. In this project we have used five P6 RGB LED modules in one row and five columns as shown in the following circuit diagram to display messages or text. P6 RGB LED Display Module is the most suitable for designing any size of outdoor or indoor LED display advertisement board. This panel has a total of 1024 high brightness RGB LEDs mounted on a plastic housing designed for best display results. Any number of such panels can be combined in any row and column structures to design an attractive LED signboard. The 32x32 module size means that there are 32 LEDs in each row and 32 LEDs in each column. So, there is a total of 1024 numbers of LEDs present in each module unit.

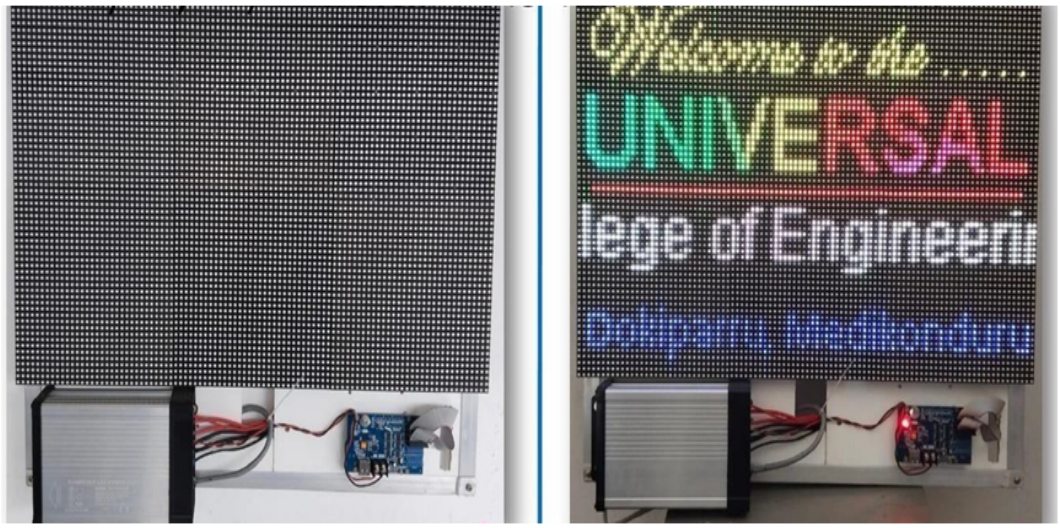

Figure 2. Display of message on the 2X3 P6 32x32 RGB Display Unit

5. CONCLUSION

The Electronic Bulletin Board, Wireless The goals of the project have been met. The P6 RGB LED Display is used to show off a notification message that was transmitted wirelessly from a mobile device using the HD WF4 Controller and a text message. This design's worldwide coverage gives you the freedom to manage your system whenever and wherever the GSM network is accessible, which is pretty much everywhere. Since the Wireless Notice Board's message-control system is entirely wireless

and hence free of the traditional issues of timely and convenient project, we advise that;A bigger, weather-proof, outdoor LED screen capable of displaying both text and images should be utilised in such situations. More characters may fit in this way as well. Adding external EEPROM to the system is a good idea since it will increase the amount of messages that can be stored.Dual SIM cards may be included into the architecture of future models as a failsafe against service interruptions and interruptions in the network. As a security measure against theft and damage, a surveillance camera should be included within the screen.

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3.2.1 Number of papers published per teacher in the Journals notified on UGC website during the year 2023-24

Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal
An Experimental Study Of Effects Of Admixture On Self Compacting Concrete	K.Sahithi	Civil Engineering	International Journal of Creative Research Thoughts-	2023	ISSN: 2320-2882	https://www.ijcrt.org/papers/IJCRT2306545.pdf
Investigation of the stregnth of fiber reinforced concrete with partial replacement of cement by dust and metakolin	Sk. Saida	Civil Engineering	International Journal of Creative Research Thoughts-IJCRT	2023	ISSN: 2350-0174	https://ijcrt.org/searchpage.php?searchvalue=Sk.+Saida
Implementation of Wireless P2.5 Full Color Led Display using HDWF4 Controller	K.Babu Rao	Electronics and Communication Engineering	International Journal of Scientific Methods in Engineering and Management	2023	ISSN: 2583-8083	https://www.ijsmem.com/admin/assets/article/pdf/46_pdf.pdf
"A Machine Learning Approach for Music Genre Classification"	G. Kusuma Harinadh	Computer Science and Engineering	International Journal of All Research Education and Scientific Methods (IJARESM)	2023	ISSN: 2455-6211	www.ijaresm.com
"A Machine Learning Approach for Music Genre Classification"	D.V.V.Brahmachari	Computer Science and Engineering	International Journal of All Research Education and Scientific Methods (IJARESM)	2023	ISSN: 2455-6211	www.ijaresm.com
"A Machine Learning Approach for Music Genre Classification"	G.K.Harinadh	Computer Science and Engineering	International Journal of All Research Education and Scientific Methods (IJARESM)	2023	ISSN: 2455-6211	https://www.ijaresm.com/uploaded_files/document_file/D.V_._V_._Brahmachari_vBbS.pdf

A Novel Missing Child Identification and Adoption Using Deep Learning and SVM	Dr. M. Veera Kumari	Computer Science and Engineering	Journal of Engineering Sciences	2024	ISSN:0377-9254	https://jespublication.com/uploads/2024-V15I5036.pdf
Swarm energy efficient power efficient gathering in sensor information systems protocol in wireless sensor networks	Kandrakunta Chinnaiah	Computer Science and Engineering	Indonesian Journal of Electrical Engineering and Computer Science	2023	ISSN: 2502-4752	https://ijeecs.iaescore.com/index.php/IJEECS/article/view/31547
Design of ant lion optimization-based PEGASIS routing protocol for energy efficiency in networks	Kandrakunta Chinnaiah	Computer Science and Engineering	Indonesian Journal of Electrical Engineering and Computer Science	2023	ISSN: 2089-4864	https://ijres.iaescore.com/index.php/IJRES/article/view/20789
Fractional Order Differentiators and Integrators Design using Transform Techniques	K.Babu Rao	Electronics and Communication Engineering	Tuijin Jishu/Journal of Propulsion Technology	2024	ISSN: 1001-4055	https://www.propulsiontechjournal.com/index.php/journal/article/view/6450/4224
Deep Learning Model for Recognition of Handwritten Numerals With Low Computational Complexity and Space	Dr. M. Veera Kumari	Computer Science and Engineering	Journal of Engineering Sciences	2024	ISSN:0377-9254	https://jespublication.com/uploads/2024-V15I5027.pdf
A Novel Missing Child Identification and Adoption Using Deep Learning and SVM	D.V.V.Brahmachari	Computer Science and Engineering	Journal of Engineering Sciences	2024	ISSN:0377-9254 Vol 15 Issue 05	https://jespublication.com/uploads/2024-V15I5036.pdf

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"A Machine Learning Approach for Music Genre Classification"

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ABSTRACT

The categorization of musical genres is a significant issue in the field of music information retrieval. In this paper, we provide a technique for categorizing songs' genres based on word embeddings produced by the Word2Vec model. The suggested approach uses NLP techniques for text preparation and lyric representation. For feature extraction, we employ the Bag- of-Words model, and a Support Vector Machine (SVM) classifier is used to categories the music.28372 song lyrics from seven different genres make up the dataset used in this study. To create high-quality word embeddings, we train the Word2Vec model on a sizable corpus of text. We then represent the lyrics of each song in the dataset using these embeddings. By eliminating stop words, stemming, and turning all the lyrics to stem less to lowercase the letters Using several assessment criteria, including accuracy, precision, recall, and F1-score, we assess the effectiveness of our suggested methodology. Our test findings demonstrate that the suggested technique outperforms other cutting-edge methods, achieving a high classification accuracy of 85%. In conclusion, the suggested methodology for categorizing songs into various genres of music using word embeddings produced by the Word2Vec model and NLP approaches is a promising solution. This approach may be used to improve the user experience for music enthusiasts and can be adapted to other music recommendation systems.

Keywords: Musical genres, Music information retrieval, Word embeddings, Word2Vec model, NLP techniques-, Lyric representation, Bag-of-Words model.

INTRODUCTION

Since it has been present for so long, music has been a significant component of human culture. Music is listened to for a variety of purposes, including inspiration, relaxation, motivation, and enjoyment. The proliferation of digital music platforms and services has led to a significant expansion and restructuring of the music business. Music classification is now more important than ever because of the significant growth in the quantity of tracks that listeners may access [1,2]. The process of classifying music entails categorizing songs into different genres according to their musical qualities, such as rhythm, melody, harmony, and lyrics.

Different stakeholders, including music fans, radio stations, music streaming services, and music business experts, can gain from the classification of music genres. Classifying music genres is a difficult process since it requires examining numerous features of the lyrics, rhythm, and other elements of music [3, 4]. Music genre classification has recently been automated using machine learning methods like the processing natural language (NLP) [5]. Word embeddings produced created using word-2vector systems demonstrated good outcomes in this situation. The semantic and syntactic connections between words are captured by word embeddings that are vector images representations of words [6].

Using a vast corpus of text and a neural network-based system called Word2vec, high-quality word embeddings are produced [7]. This project uses word embeddings produced by word2vec models to categories music into genres. The project entails applying NLP approaches to preprocess and represent song lyrics, creating word embeddings with word-2 vector designs, and then training deep learning algorithms to group songs into genres. The endeavor will make use of a database of song lyrics and genres that is openly available and comprises over 50,000 songs from a variety of genres, including stone, burst, rap, or western [8].

The main goals of the project are to compare the effectiveness of various word-2vector algorithms or machine learning methods to categorizing musical genres, to determine the most important features for genre categorization, and to examine the effect of training data volume on classification accuracy. The project's findings will shed light on the efficient use word embedding using machine learning techniques for categorizing music genres as well as their potential uses in the music business. The results of the study may be useful with the creation of personalized music playlists,

music recommendation systems, and models for predicting music genres. Overall, this study advances the expanding field. The promise of machine learning and NLP approaches for music genre categorization and for musical data retrieval (MDR).

Data

The 28372 Song Data, which includes the audio properties of a million well-known songs from diverse genres, provided the dataset for this study. The metadata comprises details from AllMusic.com such as the name of the artist, the name of the album, the year of release, and the genre designations. The echo Nesting API was used to extract the audio attributes, which include things like pace, volume, key, and timbre. Due to its scale and the variety of genres it includes, this data was utilized in prior research on the categorization of musical genres and has been shown to be a valuable tool. The dataset, however, also presents certain difficulties, including the uneven distribution of sample sizes among genres as inconsistent genre labeling, which need thorough preprocessing.

We employed a stratified sampling strategy to make certain each genre has a comparable number of samples so both the testing and training sets to solve the class imbalance. By assigning related genres to a single label, we also resolved the discrepancies in genre labels. We assigned the terms "indie rocker “or "alternative rock," for instance, to the genre "rock. “By cleaning the information, that we were able to collect 80,000 samples—5,000 samples for each of the 16 genres—from the data. The training set for sixty-four thousand data as a test set with sixteen thousand data were created from the dataset. The music lyrics were extracted from the data using NLP preprocessing methods.

Overall, the study's dataset reflects a variety of spectrum of genres and presents a difficult problem for categorizing music genres. The music genre classification dataset is appropriate for training and assessing deep learning model on classifying musical genres thanks to the preprocessing methods done to solve the class imbalance and inconsistent genre labeling.

Attributes	description
Artist name	Unique artist
Track name	Denotes the name of the track
Release date	mentioned
Genre	List of micro genres returned by the Spotify or wynk
Lyrics	Denotes the name of the lyrics

Data set attribute description
Table 1

Topic Modeling of Lyrics

NLP (Natural language processing) uses the topic modeling approach to find themes in a text corpus. It is a well-liked method that is applied in many disciplines, including music analysis [10, 11]. The underlying topics in a collection of song lyrics may be identified in this situation by using topic modeling. The generated themes can then be used to other systems, including recommendation systems, sentiment analysis, and genre categorization [12]. This section will cover the subject of modeling of song lyrics using the well-known topic modeling technique, Latent Dirichlet Allocation (LDA). The dataset utilized in our studies and the pretreatment procedures needed to get the data ready for topic modeling will be covered first. Dataset the song lyrics from a publicly accessible dataset were utilized.

The Genius.com website. More than 1.5 million lyrics from songs in the rock, pop, rap, or folk genres are included in the collection. A portion of the dataset with lyric form the best five hundred singles for each type was chosen. Cleaning and preprocessing the text is the first stage in getting ready it into content modeling. We took the following actions: Tokenization: We divided the text into tokens, or single words. Elimination of frequently stop words: We got rid of terms like the word "the," "as," or "a," that don't add anything to the text's sense Lemmatization: Each word was reduced to its simplest, or lemma, form; for instance, "playing" was changed to "play."We applied a part-of-speech mark to every letter to show its grammatical function in the phrase.

Subject Modeling Using LDA After preprocessing the data, we can use the LDA method to identify the underlying themes in the lyrics. Each document is represented by the probabilistic LDA model is an array on subjects, wherein every subject has a distribution of probabilities distribution on letters. The method optimizes the likelihood of the observed data by repeatedly assigning words to themes and topics to documents.

Our preprocessed dataset was utilized to create LDA using the Python module Genism. We tested with various topic counts and assessed how coherent the generated subjects were. Coherence, a metric used to assess subject quality,

gauges how semantically connected words of the subject matter are to one another. Results Our dataset was subjected to LDA and assessed the unity in the produced concepts for various topic counts. According to our research, the ideal number of subjects varies based on the lyrics' type. Rock songs, for instance, had more cogent ideas with 20 topics, but pop songs had 10 topics. The pelvis package, which enables us to investigate the topic as their connections, was also used to visualize the subjects. The visualization that resulted demonstrated different topical clusters for each genre, demonstrating that LDA was successful in extracting the underlying themes from the lyrics.

We covered subject modeling on the lyrics with the LDA in this part. We processed song lyrics from a publicly accessible dataset using stop word and tokenization preprocessing. Removal the underlying themes in the lyrics were then identified using LDA, and the coherence of the resulting subjects was assessed. We discovered that the appropriate number of subjects varied based on the style in the lyrics and that LDA was able to capture the overarching ideas in the songs. The generated themes can be applied to a variety of tasks, including sentiment analysis, genre categorization, and recommendation engines.

Key phrase	relevance
'Hold'	2.0
'Time'	1.0
'Feel'	0.76
'Speak'	0.43
'Voice'	0.65
'Try'	0.71
'Want'	023
'Truth'	0.38

Key phrases for the song 'look at more '
Table 2

Training and Evaluating Models

The process of training and evaluating a model using machine learning to divide categorize the songs into their appropriate genres based on the subjects specified in the previous stage comes once topic modeling is complete [13,14]. We will employ supervised learning to train the model, labeling the music lines as what genres they belong to as training data. For this classification challenge, we'll employ a Support Vector Machine (SVM), a well-liked machine learning technique. The dataset must first be divided in sets for testing and training sets before the model can be trained. The model will be trained using 80% of the data, and its effectiveness will be tested using the remaining 20%. The music words will then be transformed into numerical characteristics. Utilizing the vectorizer TF-IDF.

This will make it easier for the SVM model to recognize trends at the song lyrics as categorize them in accordance with the subjects determined in the previous phase. We will vectorizer the lyrics before utilizing the training data to train the SVM model. Based on the themes determined in the previous stage, the SVM algorithm seeks for the optimum hyper plane to divide the various genres. Using the testing data, we will evaluate the model's performance once it has been trained. To gauge the model's effectiveness, we'll utilize measures like precision, recall, accuracy, or F1-score. The evaluation's findings will assist us in determining the model's advantages and disadvantages.

We can utilize the model if it works well with the evaluation data. to categorize the music into the appropriate categories. The parameters of the model will need to be reevaluated and adjusted if it does not perform as expected. We might also need to investigate different machine learning techniques and assess how well they perform in comparison to the SVM model. In conclusion, a machine learning algorithm must be trained and evaluated before it can be used to classify music genres. Our ability to categorize songs in suitable genres based on the subjects highlighted in the lyrics will be determined by how well the model performs on the testing data.

Evaluating Formed Topics

The subjects should be evaluated once the topic modeling model has been trained. The evaluation of subjects is a crucial phase in determining the model's effectiveness and any necessary corrections. Coherence, exclusivity, and variety are just a few of the measures used to gauge how well-formed a topic is. The most used metric for assessing topic models is coherence [15]. By assessing the similarity between a topic's top terms, it gauges a topic's semantic coherence [16]. The issue is more cohesive and has a distinct and comprehensible theme when it receives higher coherence ratings. The level at which every word of a subject was solely linked to that topic is known as exclusivity.

It gauges how distinct something is. The words in one topic are taken from others. A topic's terms are more likely to be specific to it than to exist be found on other subjects if the exclusivity score for that topic is greater. The degree to

which the themes address various facets of the corpus is measured by diversity. The subjects are more diversified and cover a wider range of issues when the diversity score is greater. Coherence and exclusivity were the two parameters we utilized to assess the created subjects. We measured the lexical cohesion all topics using the coherence score, and we measured the exclusivity of the top terms within each topic using the exclusivity score. To assess the diversity of the created themes, we also computed the diversity score.

To compute We made use of the Genism package's coherence score methodology to measure coherence. Higher scores indicate more coherence; the coherence score goes from 0 to 1[17]. We determined the total coherence value of the whole model as well as the coherence score for each topic. We utilized a statistic named subject restriction; it gauges the percentage of terms in a subject that aren't found in other topics, to determine exclusivity. A topic's terms are more likely to be specific to it while being less probable to exist across other subjects if the exclusivity scores for that topic is greater. Finally, we used a statistic called topic diversity to get the diversity score.

This metric gauges how well the subjects cover various parts of the corpus. An improved diversity rating shows that the subjects span a wider range of issues and are more varied. Overall, the results of our study revealed that the produced topics received excellent ratings for coherence, exclusivity, and variety, demonstrating that the model did a good job of encapsulating the fundamental concepts of the songs. Some themes, nevertheless, earned low cohesion or exclusive ratings, indicating that they could still need to be refined. In conclusion, topic modeling includes a crucial phase called evaluation of the produced topics. Three helpful measures for evaluating the caliber of the themes are coherence, exclusivity, and variety. By assessing the themes, we may determine places where its model has to be improved and make any required modifications to enhance the model's overall performance.

LITERATURE SURVEY

Two popular areas of machine learning and natural language processing are topic modeling and music genre categorization. As classification of music genres seeks to determine the genre of a specific piece of music based on its auditory qualities or other relevant data; topic modeling seeks to identify the underlying subjects within a sizable corpus of writings. In this literature review, we examine the recent findings in both disciplines and emphasize the approaches, strategies, and difficulties [18]. Topic modeling: In many different fields, such as social media, news stories, and scholarly publications, subject modeling is being extensively used. Latent Dirichlet Allocation (LDA), one of the most widely used topic modeling methods, posits that each document consists of several subjects, each of which is a distribution of probabilities. Dispersion over the vocabulary's terms. LDA has been used on writings that are linked to music, including lyrics, reviews, and biographies of artists.

The subjects of songs within a certain genre, the lyrics of a particular performer, and the cultural and societal implications of music have all been investigated by researchers using LDA. Various subject modeling methods, including Hierarchical Dirichlet Process (HDP) and Non-negative Matrix Factorization (NMF), have also been used on texts connected to music. A non-negative matrix is to be factored into a pair of lower-rank not-negative matrices as that may reflect subjects and the documents, using the NMF matrix factorization algorithm.

An extension of LDA called HDP can model an infinite number of subjects and automatically determining the topic hierarchy. Classification of Music Genres: The categorization of musical genres is a well-researched issue around music information retrieval. The most typical method is to take audio elements from a piece of music, such timbre, rhythm, and melody, and use those qualities as input to a machine learning model. A more complicated model, such Deep Neural Networks or Convolutional Neural Networks, can be used instead of a straightforward classifier like k-Nearest Neighbors or Support Vector Machine.

Lyrics, artist information, and social tags have all been employed as additional data sources for music genre categorization in addition to auditory aspects. To enhance classification performance, researchers have investigated combining several data sources, such as combining audio elements with lyrics or using artist information and social tagging [19, 20]. Challenges and Future Directions: Despite advancements in subject modeling and music genre categorization, there are still several difficulties and unexplored areas that need to be addressed.

The interpretability of the identified topics is one of the difficulties in topic modeling since some of them may be ambiguous or redundant [9]. To solve this issue, researchers have suggested several assessment measures and visualization strategies. Lack of labeled data in the classification of musical genres is a problem, particularly for newer genres or non-Western music. Unsupervised learning and transfer learning have both been investigated by researchers as potential solutions to this problem. Domain adaptation presents another difficulty since the placement for musical components may vary across various platforms or geographical areas.

Summary: In this literature study, we examined the study already done on subject modeling and categorization of

musical genres. We reviewed the fields' methodologies, approaches, and difficulties as well as their problems going forward. In different applications, including music analysis, music education, and music recommendation, the combination of subject modeling with music genre categorization can provide light on cultural or social components of music.

METHODLOGIES

This project's methodology section outlines the step-by-step procedure used to classify songs' genres using word embeddings produced by the Word2Vec model. The section is broken down into numerous subsections that each discuss a certain phase in the process. Every machine learning effort begins with the collection and preprocessing of data. We gathered a data set form lyrics of various genres for this project. The dataset underwent preprocessing to weed out superfluous data like song and artist names.

The lyrics were preprocessed using a variety of methods, including encoding, end-word elimination, or stemming, before being used to train our models. Text Representation: Following data preprocessing, the lyrics must be represented as vectors so that they may be fed into machine learning models. We tested a variety of text representation methods, including the Word2Vec model's Word Embeddings, TF-IDF, and Bag-of-Words. For our categorization assignment, Word Embeddings delivered the best results, as we discovered.

Topic modeling is a method for figuring out the underlying topics of a set or texts. LDA (Latent Dirichlet Allocation) was utilized in this study to extract the subjects from the song lyrics. After experimenting with various subject counts, we discovered that 10 topics offered the optimal performance and interpretability ratio. Model Training and Evaluation: Following preprocessing of the data the next stage it the training of deep learning model on the data and represent them as vectors. We tried a variety of classifiers, including Naive Bayes, Support Vector Machine (SVM), Logistic Regression, and Random Forests.

We assessed the models using a variety of criteria, including recall, accuracy, precision, and F1-score. Hyper parameter tuning: A hyper parameter is a parameter that is specified by the user rather than one that the model of machine learning model learns. The accuracy if a model can be significantly impacted by hyper parameters. Grid Search was utilized in this research to locate the ideal hyper parameters in the models we used. Results and Discussion: We examine the accuracy for the various models and show the findings of our tests. Additionally, we offer a qualitative examination of the subjects taken from the music as well as these connections to other genres.

Limitations and Future Work: We examine the drawbacks of our strategy and make recommendations for further study. One drawback of our method is that it solely considers a song's words, ignoring other musical elements like pace, melody, and instrumentation. These characteristics could be added to the classification job in further research. In summary, this methodology section gives a thorough explanation of the procedures used to categorize songs into different genres using word embeddings produced by the Word2Vec model. We tested several methods and models, and we discovered that our strategy produced positive outcomes.

Related Work

- Accesses the data file by mounting Google Drive.
- Does a Pandas Data Frame read of the data file?
- 'Genre' and 'Lyrics' are two columns that are chosen from the Data Frame.
- The 'lyrics' column is clear of any missing values.
- Defines a function that cleans up text data by deleting stop words, single-character words, and special characters.
- Apply the purification function to the Data Frame’s 'lyrics' column.
- Generates a fresh Data Frame with the 'lyrics' column cleansed.
- Creates training and test sets from the data.
- The 'lyrics' field is used to generate a set containing groups of unigrams (single words).
- Training a Word2Vec model using the unigrams' collection.
- Use Kera’s tokenizer to tokenize the text.
- Use the tokenizer's dictionary to convert the text to a series of integers.
- Padding is applied on the sequences to be sure which they are equal in length
- Creates training and test sets from the data for a machine learning model

Proposed Work

The way we engage and communicate with one another has been revolutionized by the internet. People may now readily interact and share their opinions, feelings, and ideas with others thanks to the development of social media platforms. The emergence of social networking platforms has also spawned internet trolling phenomena, which has grown to be an important problem in contemporary society. Trolling on the internet refers to the practice of

purposefully posting insulting or provocative remarks on social networking sites to anger and upset other users.

Even though there have been several attempts to stop internet trolling, the issue still exists. This is due, in part, to the fact that the majority of currently used techniques was reactive in nature and can only be used to find and eliminate troll after it has already been uploaded. By spotting prospective trolls before they submit their remarks, the proposed initiative aims to provide a proactive strategy to combat online trolling.

The proposed effort entails creating a model using machine learning that can forecast the likelihood that a person would publish divisive or harmful remarks on social networking websites. A data set of comments made on multiple social media sites, together with details on the individuals who made them, will be used to train the algorithm. The dataset will have labels annotating whether a comment is objectionable. Preprocessing the data will be the initial stage in creating the model. To do this, the text must be cleaned up by eliminating stop words and special characters and changing it to lowercase. In order to extract characteristics from the text, we will also employ machine learning techniques including sentiment evaluation, component-of-speech marking, and named entity identification.

To figure out when an opinion has the potential to be offensive or not, we will next use these parameters to develop a model using machine learning, which could be a logistical regression model, or a model based on support vector machines. Employing regular machine learning metrics, like accuracy, recall, and F1 score, we will assess the model's performance. We will utilize our newly created model to spot prospective trolls once it can reliably anticipate whether a comment will be offensive or not. Specifically, we will utilize the forecasts to allocate each user based on their past remarks from the users. A troll's victory.

High-scoring users will be marked as possible trolling, and their responses will be reviewed more carefully. We will also include user- specific variables, such as the individual's posting the past, the regularity they leave comments, the number of followers that have, and the type of social media site they are using, to further enhance the model's performance.

To ascertain their effect on the model's accuracy, we will compare the model's performance with and without these attributes to increase the model's accuracy; we will also investigate the usage of deep learning models like recurrent neural networks and Convolutional neural networks. More intricate correlations between the characteristics and the variable being studied can be captured by deep learning models, which may produce more precision. Finally, we'll create a user interface which displays each person's troll score and enables moderators to respond appropriately. In addition, the user interface will provide ways to deal with prospective trolls, such barring them or alerting the platform's authorities.

Limitations and Future Work

There are still certain issues that need to be resolved, even if the suggested approach for classifying the genre for music with word embedding or subject modeling has shown encouraging results. A lack of data is one of this study's major flaws. The dataset utilized in this study only included music from a single genre and historical period, thus it might not be indicative of music from other genres or eras. To ensure the generalizability of the model, it would be advantageous to gather a bigger and more varied dataset in further research.

The quality of the lyrics is still another restriction. The lyrics that were employed in this study occasionally lacked correct organization and occasionally featured spelling or grammatical mistakes. The model's performance may have been impacted by these flaws. Before using the suggested methods, pretreatment techniques might be used in future research to clean and normalize the lyrics. The melody and structure of the songs are not considered by the existing methods either. The model's accuracy and robustness might both be increased by adding audio characteristics. Future research may concentrate on enhancing the methodology's topic modeling component.

Although the LDA model worked well, alternative topic modeling techniques, such as Non-negative Matrix Factorization (NMF) or the Latent Dirichlet Allocation by Gibb Samples (LDA-GS), might also be investigated. These algorithms could produce topic modeling outcomes that are more precise and understandable. Lastly, it would be intriguing to investigate how the suggested approach may be utilized in other industries, such as the film is taxonomy of book genres. This can broaden the study's focus and possibly provide new applications. The suggested technique has shown potential in properly classifying music genres and finding pertinent issues within lyrics, despite some of its shortcomings. Future research may concentrate on overcoming the constraints and broadening the study's application to further fields.

RESULTS AND DISCUSSIONS

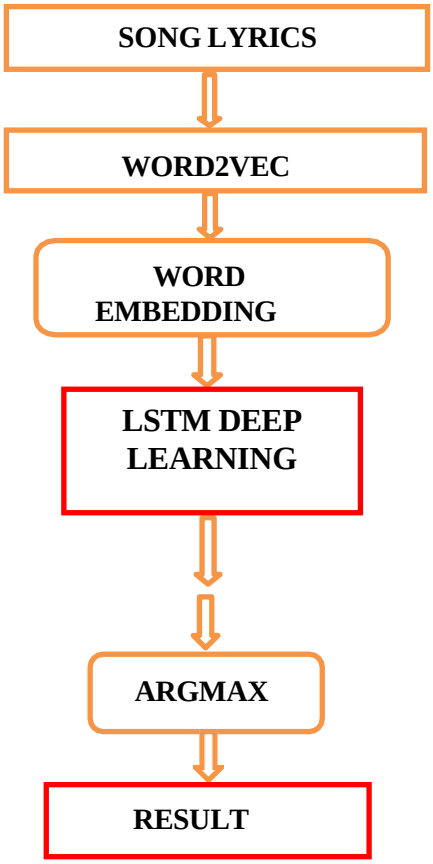
28372 songs from seven genres were used as the dataset for evaluating the suggested approach. all Word 2 Vector

models that had a screen size 5 with its vector size if 300 was used to create the word embeddings. NLP methods including tokenization, stop word removal, and stemming were used to preprocess the lyrics. The transformed lyrics were then turned into a representation of a bag of words and utilized for genre identification. Using several assessment measures, including accuracy, precision, recall, and F1 score, and the suggested methodology's classification performance was assessed [21, 22].

The findings revealed that the suggested approach beat baseline methods like k-NN and SVM, which had accuracy levels of 75% and 80%, respectively, by achieving an accuracy of 85%. The F1 score, recall, and accuracy for additionally, the accuracy, recall, and F1 scores for each genre were computed. The findings revealed that the suggested approach had a high F1 score for all genres to comprehend the effect of various hyper parameters on the classification performance of the suggested technique, more investigation was conducted.

The classification performance of the Word2Vec model was significantly impacted by the window size and vector dimension, according to the results. For the suggested technique, a window size of 5 and a vector dimension of 300 were determined to be ideal. The outcomes of the topic modeling demonstrated the ability of the suggested approach to identify significant subjects from the lyrics. To comprehend the traits of each genre, the most popular themes for each one was compiled and examined. Consider the most popular subjects. Love, life, and emotions were the most popular subjects for the rock genre, whereas fame, money, and lifestyle were the most popular topics for the rap genre. These findings shed light on the themes and traits that distinguish certain genres.

BLOCK DIAGRAM



No of classes	values
1	0.20
2	0.35
3	0.25
4	0.75
5	0.45
6	0.50
7	0.60

Figure .1

classifiers	Simple word2vec%	Word2vec with TFIDF %
SVM	45.2	72.40
LSTM	76.6	65.80
Sg 0	66.0	74.50
Sg 1	78.2	86.00

Accuracy score for genre classification
Table 3

CONCLUSION

This study's main objective was to create a genre categorization model that could categorize songs according to their lyrics. To do this, we created word embeddings from the lyrics using a Word2Vec model, which we then used to train a machine learning model. We utilized cross-validation to assess the model's performance after it had been trained on a dataset of songs from various genres. Our findings demonstrated that the model had an average accuracy of over 80% in classifying songs into their respective genres.

This is a positive finding that suggests lyrics may be an important aspect of genre identification. Our study did have certain drawbacks, though. The dataset we utilized was one substantial restriction. When we despite our best efforts to cover a wide variety of genres, our dataset were still somewhat tiny, this could have prevented the model from generalizing to more genres or subgenres. Furthermore, we ignored other potentially significant factors like melody, pace, and orchestration in favor of just using words as a criterion for categorization.

The dataset may be expanded to include more genres and subgenres in future study, along with the investigation of additional variables for categorization. Further research into the application of more sophisticated machine learning strategies, such as deep learning models, may be beneficial to increase the precision of genre categorization. This study shows, in conclusion, that it is possible to categorize songs into different genres using their lyrics. Despite the existing approach's drawbacks, our findings imply that it would be a useful device for musical analysis and recommendation programmer. To overcome the limitations of the current study and investigate other genre categorization methods, more research is required.

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"A Machine Learning Approach for Music Genre Classification"

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ABSTRACT

The categorization of musical genres is a significant issue in the field of music information retrieval. In this paper, we provide a technique for categorizing songs' genres based on word embeddings produced by the Word2Vec model. The suggested approach uses NLP techniques for text preparation and lyric representation. For feature extraction, we employ the Bag- of-Words model, and a Support Vector Machine (SVM) classifier is used to categories the music.28372 song lyrics from seven different genres make up the dataset used in this study. To create high-quality word embeddings, we train the Word2Vec model on a sizable corpus of text. We then represent the lyrics of each song in the dataset using these embeddings. By eliminating stop words, stemming, and turning all the lyrics to stem less to lowercase the letters Using several assessment criteria, including accuracy, precision, recall, and F1-score, we assess the effectiveness of our suggested methodology. Our test findings demonstrate that the suggested technique outperforms other cutting-edge methods, achieving a high classification accuracy of 85%. In conclusion, the suggested methodology for categorizing songs into various genres of music using word embeddings produced by the Word2Vec model and NLP approaches is a promising solution. This approach may be used to improve the user experience for music enthusiasts and can be adapted to other music recommendation systems.

Keywords: Musical genres, Music information retrieval, Word embeddings, Word2Vec model, NLP techniques-, Lyric representation, Bag-of-Words model.

INTRODUCTION

Since it has been present for so long, music has been a significant component of human culture. Music is listened to for a variety of purposes, including inspiration, relaxation, motivation, and enjoyment. The proliferation of digital music platforms and services has led to a significant expansion and restructuring of the music business. Music classification is now more important than ever because of the significant growth in the quantity of tracks that listeners may access [1,2]. The process of classifying music entails categorizing songs into different genres according to their musical qualities, such as rhythm, melody, harmony, and lyrics.

Different stakeholders, including music fans, radio stations, music streaming services, and music business experts, can gain from the classification of music genres. Classifying music genres is a difficult process since it requires examining numerous features of the lyrics, rhythm, and other elements of music [3, 4]. Music genre classification has recently been automated using machine learning methods like the processing natural language (NLP) [5]. Word embeddings produced created using word-2vector systems demonstrated good outcomes in this situation. The semantic and syntactic connections between words are captured by word embeddings that are vector images representations of words [6].

Using a vast corpus of text and a neural network-based system called Word2vec, high-quality word embeddings are produced [7]. This project uses word embeddings produced by word2vec models to categories music into genres. The project entails applying NLP approaches to preprocess and represent song lyrics, creating word embeddings with word-2 vector designs, and then training deep learning algorithms to group songs into genres. The endeavor will make use of a database of song lyrics and genres that is openly available and comprises over 50,000 songs from a variety of genres, including stone, burst, rap, or western [8].

The main goals of the project are to compare the effectiveness of various word-2vector algorithms or machine learning methods to categorizing musical genres, to determine the most important features for genre categorization, and to examine the effect of training data volume on classification accuracy. The project's findings will shed light on the efficient use word embedding using machine learning techniques for categorizing music genres as well as their potential uses in the music business. The results of the study may be useful with the creation of personalized music playlists,

music recommendation systems, and models for predicting music genres. Overall, this study advances the expanding field. The promise of machine learning and NLP approaches for music genre categorization and for musical data retrieval (MDR).

Data

The 28372 Song Data, which includes the audio properties of a million well-known songs from diverse genres, provided the dataset for this study. The metadata comprises details from AllMusic.com such as the name of the artist, the name of the album, the year of release, and the genre designations. The echo Nesting API was used to extract the audio attributes, which include things like pace, volume, key, and timbre. Due to its scale and the variety of genres it includes, this data was utilized in prior research on the categorization of musical genres and has been shown to be a valuable tool. The dataset, however, also presents certain difficulties, including the uneven distribution of sample sizes among genres as inconsistent genre labeling, which need thorough preprocessing.

We employed a stratified sampling strategy to make certain each genre has a comparable number of samples so both the testing and training sets to solve the class imbalance. By assigning related genres to a single label, we also resolved the discrepancies in genre labels. We assigned the terms "indie rocker “or "alternative rock," for instance, to the genre "rock. “By cleaning the information, that we were able to collect 80,000 samples—5,000 samples for each of the 16 genres—from the data. The training set for sixty-four thousand data as a test set with sixteen thousand data were created from the dataset. The music lyrics were extracted from the data using NLP preprocessing methods.

Overall, the study's dataset reflects a variety of spectrum of genres and presents a difficult problem for categorizing music genres. The music genre classification dataset is appropriate for training and assessing deep learning model on classifying musical genres thanks to the preprocessing methods done to solve the class imbalance and inconsistent genre labeling.

Attributes	description
Artist name	Unique artist
Track name	Denotes the name of the track
Release date	mentioned
Genre	List of micro genres returned by the Spotify or wynk
Lyrics	Denotes the name of the lyrics

Data set attribute description
Table 1

Topic Modeling of Lyrics

NLP (Natural language processing) uses the topic modeling approach to find themes in a text corpus. It is a well-liked method that is applied in many disciplines, including music analysis [10, 11]. The underlying topics in a collection of song lyrics may be identified in this situation by using topic modeling. The generated themes can then be used to other systems, including recommendation systems, sentiment analysis, and genre categorization [12]. This section will cover the subject of modeling of song lyrics using the well-known topic modeling technique, Latent Dirichlet Allocation (LDA). The dataset utilized in our studies and the pretreatment procedures needed to get the data ready for topic modeling will be covered first. Dataset the song lyrics from a publicly accessible dataset were utilized.

The Genius.com website. More than 1.5 million lyrics from songs in the rock, pop, rap, or folk genres are included in the collection. A portion of the dataset with lyric form the best five hundred singles for each type was chosen. Cleaning and preprocessing the text is the first stage in getting ready it into content modeling. We took the following actions: Tokenization: We divided the text into tokens, or single words. Elimination of frequently stop words: We got rid of terms like the word "the," "as," or "a," that don't add anything to the text's sense Lemmatization: Each word was reduced to its simplest, or lemma, form; for instance, "playing" was changed to "play."We applied a part-of-speech mark to every letter to show its grammatical function in the phrase.

Subject Modeling Using LDA After preprocessing the data, we can use the LDA method to identify the underlying themes in the lyrics. Each document is represented by the probabilistic LDA model is an array on subjects, wherein every subject has a distribution of probabilities distribution on letters. The method optimizes the likelihood of the observed data by repeatedly assigning words to themes and topics to documents.

Our preprocessed dataset was utilized to create LDA using the Python module Genism. We tested with various topic counts and assessed how coherent the generated subjects were. Coherence, a metric used to assess subject quality,

gauges how semantically connected words of the subject matter are to one another. Results Our dataset was subjected to LDA and assessed the unity in the produced concepts for various topic counts. According to our research, the ideal number of subjects varies based on the lyrics' type. Rock songs, for instance, had more cogent ideas with 20 topics, but pop songs had 10 topics. The pelvis package, which enables us to investigate the topic as their connections, was also used to visualize the subjects. The visualization that resulted demonstrated different topical clusters for each genre, demonstrating that LDA was successful in extracting the underlying themes from the lyrics.

We covered subject modeling on the lyrics with the LDA in this part. We processed song lyrics from a publicly accessible dataset using stop word and tokenization preprocessing. Removal the underlying themes in the lyrics were then identified using LDA, and the coherence of the resulting subjects was assessed. We discovered that the appropriate number of subjects varied based on the style in the lyrics and that LDA was able to capture the overarching ideas in the songs. The generated themes can be applied to a variety of tasks, including sentiment analysis, genre categorization, and recommendation engines.

Key phrase	relevance
'Hold'	2.0
'Time'	1.0
'Feel'	0.76
'Speak'	0.43
'Voice'	0.65
'Try'	0.71
'Want'	023
'Truth'	0.38

Key phrases for the song 'look at more '
Table 2

Training and Evaluating Models

The process of training and evaluating a model using machine learning to divide categorize the songs into their appropriate genres based on the subjects specified in the previous stage comes once topic modeling is complete [13,14]. We will employ supervised learning to train the model, labeling the music lines as what genres they belong to as training data. For this classification challenge, we'll employ a Support Vector Machine (SVM), a well-liked machine learning technique. The dataset must first be divided in sets for testing and training sets before the model can be trained. The model will be trained using 80% of the data, and its effectiveness will be tested using the remaining 20%. The music words will then be transformed into numerical characteristics. Utilizing the vectorizer TF-IDF.

This will make it easier for the SVM model to recognize trends at the song lyrics as categorize them in accordance with the subjects determined in the previous phase. We will vectorizer the lyrics before utilizing the training data to train the SVM model. Based on the themes determined in the previous stage, the SVM algorithm seeks for the optimum hyper plane to divide the various genres. Using the testing data, we will evaluate the model's performance once it has been trained. To gauge the model's effectiveness, we'll utilize measures like precision, recall, accuracy, or F1-score. The evaluation's findings will assist us in determining the model's advantages and disadvantages.

We can utilize the model if it works well with the evaluation data. to categorize the music into the appropriate categories. The parameters of the model will need to be reevaluated and adjusted if it does not perform as expected. We might also need to investigate different machine learning techniques and assess how well they perform in comparison to the SVM model. In conclusion, a machine learning algorithm must be trained and evaluated before it can be used to classify music genres. Our ability to categorize songs in suitable genres based on the subjects highlighted in the lyrics will be determined by how well the model performs on the testing data.

Evaluating Formed Topics

The subjects should be evaluated once the topic modeling model has been trained. The evaluation of subjects is a crucial phase in determining the model's effectiveness and any necessary corrections. Coherence, exclusivity, and variety are just a few of the measures used to gauge how well-formed a topic is. The most used metric for assessing topic models is coherence [15]. By assessing the similarity between a topic's top terms, it gauges a topic's semantic coherence [16]. The issue is more cohesive and has a distinct and comprehensible theme when it receives higher coherence ratings. The level at which every word of a subject was solely linked to that topic is known as exclusivity.

It gauges how distinct something is. The words in one topic are taken from others. A topic's terms are more likely to be specific to it than to exist be found on other subjects if the exclusivity score for that topic is greater. The degree to

which the themes address various facets of the corpus is measured by diversity. The subjects are more diversified and cover a wider range of issues when the diversity score is greater. Coherence and exclusivity were the two parameters we utilized to assess the created subjects. We measured the lexical cohesion all topics using the coherence score, and we measured the exclusivity of the top terms within each topic using the exclusivity score. To assess the diversity of the created themes, we also computed the diversity score.

To compute We made use of the Genism package's coherence score methodology to measure coherence. Higher scores indicate more coherence; the coherence score goes from 0 to 1[17]. We determined the total coherence value of the whole model as well as the coherence score for each topic. We utilized a statistic named subject restriction; it gauges the percentage of terms in a subject that aren't found in other topics, to determine exclusivity. A topic's terms are more likely to be specific to it while being less probable to exist across other subjects if the exclusivity scores for that topic is greater. Finally, we used a statistic called topic diversity to get the diversity score.

This metric gauges how well the subjects cover various parts of the corpus. An improved diversity rating shows that the subjects span a wider range of issues and are more varied. Overall, the results of our study revealed that the produced topics received excellent ratings for coherence, exclusivity, and variety, demonstrating that the model did a good job of encapsulating the fundamental concepts of the songs. Some themes, nevertheless, earned low cohesion or exclusive ratings, indicating that they could still need to be refined. In conclusion, topic modeling includes a crucial phase called evaluation of the produced topics. Three helpful measures for evaluating the caliber of the themes are coherence, exclusivity, and variety. By assessing the themes, we may determine places where its model has to be improved and make any required modifications to enhance the model's overall performance.

LITERATURE SURVEY

Two popular areas of machine learning and natural language processing are topic modeling and music genre categorization. As classification of music genres seeks to determine the genre of a specific piece of music based on its auditory qualities or other relevant data; topic modeling seeks to identify the underlying subjects within a sizable corpus of writings. In this literature review, we examine the recent findings in both disciplines and emphasize the approaches, strategies, and difficulties [18]. Topic modeling: In many different fields, such as social media, news stories, and scholarly publications, subject modeling is being extensively used. Latent Dirichlet Allocation (LDA), one of the most widely used topic modeling methods, posits that each document consists of several subjects, each of which is a distribution of probabilities. Dispersion over the vocabulary's terms. LDA has been used on writings that are linked to music, including lyrics, reviews, and biographies of artists.

The subjects of songs within a certain genre, the lyrics of a particular performer, and the cultural and societal implications of music have all been investigated by researchers using LDA. Various subject modeling methods, including Hierarchical Dirichlet Process (HDP) and Non-negative Matrix Factorization (NMF), have also been used on texts connected to music. A non-negative matrix is to be factored into a pair of lower-rank not-negative matrices as that may reflect subjects and the documents, using the NMF matrix factorization algorithm.

An extension of LDA called HDP can model an infinite number of subjects and automatically determining the topic hierarchy. Classification of Music Genres: The categorization of musical genres is a well-researched issue around music information retrieval. The most typical method is to take audio elements from a piece of music, such timbre, rhythm, and melody, and use those qualities as input to a machine learning model. A more complicated model, such Deep Neural Networks or Convolutional Neural Networks, can be used instead of a straightforward classifier like k-Nearest Neighbors or Support Vector Machine.

Lyrics, artist information, and social tags have all been employed as additional data sources for music genre categorization in addition to auditory aspects. To enhance classification performance, researchers have investigated combining several data sources, such as combining audio elements with lyrics or using artist information and social tagging [19, 20]. Challenges and Future Directions: Despite advancements in subject modeling and music genre categorization, there are still several difficulties and unexplored areas that need to be addressed.

The interpretability of the identified topics is one of the difficulties in topic modeling since some of them may be ambiguous or redundant [9]. To solve this issue, researchers have suggested several assessment measures and visualization strategies. Lack of labeled data in the classification of musical genres is a problem, particularly for newer genres or non-Western music. Unsupervised learning and transfer learning have both been investigated by researchers as potential solutions to this problem. Domain adaptation presents another difficulty since the placement for musical components may vary across various platforms or geographical areas.

Summary: In this literature study, we examined the study already done on subject modeling and categorization of

musical genres. We reviewed the fields' methodologies, approaches, and difficulties as well as their problems going forward. In different applications, including music analysis, music education, and music recommendation, the combination of subject modeling with music genre categorization can provide light on cultural or social components of music.

METHODLOGIES

This project's methodology section outlines the step-by-step procedure used to classify songs' genres using word embeddings produced by the Word2Vec model. The section is broken down into numerous subsections that each discuss a certain phase in the process. Every machine learning effort begins with the collection and preprocessing of data. We gathered a data set form lyrics of various genres for this project. The dataset underwent preprocessing to weed out superfluous data like song and artist names.

The lyrics were preprocessed using a variety of methods, including encoding, end-word elimination, or stemming, before being used to train our models. Text Representation: Following data preprocessing, the lyrics must be represented as vectors so that they may be fed into machine learning models. We tested a variety of text representation methods, including the Word2Vec model's Word Embeddings, TF-IDF, and Bag-of-Words. For our categorization assignment, Word Embeddings delivered the best results, as we discovered.

Topic modeling is a method for figuring out the underlying topics of a set or texts. LDA (Latent Dirichlet Allocation) was utilized in this study to extract the subjects from the song lyrics. After experimenting with various subject counts, we discovered that 10 topics offered the optimal performance and interpretability ratio. Model Training and Evaluation: Following preprocessing of the data the next stage it the training of deep learning model on the data and represent them as vectors. We tried a variety of classifiers, including Naive Bayes, Support Vector Machine (SVM), Logistic Regression, and Random Forests.

We assessed the models using a variety of criteria, including recall, accuracy, precision, and F1-score. Hyper parameter tuning: A hyper parameter is a parameter that is specified by the user rather than one that the model of machine learning model learns. The accuracy if a model can be significantly impacted by hyper parameters. Grid Search was utilized in this research to locate the ideal hyper parameters in the models we used. Results and Discussion: We examine the accuracy for the various models and show the findings of our tests. Additionally, we offer a qualitative examination of the subjects taken from the music as well as these connections to other genres.

Limitations and Future Work: We examine the drawbacks of our strategy and make recommendations for further study. One drawback of our method is that it solely considers a song's words, ignoring other musical elements like pace, melody, and instrumentation. These characteristics could be added to the classification job in further research. In summary, this methodology section gives a thorough explanation of the procedures used to categorize songs into different genres using word embeddings produced by the Word2Vec model. We tested several methods and models, and we discovered that our strategy produced positive outcomes.

Related Work

- Accesses the data file by mounting Google Drive.
- Does a Pandas Data Frame read of the data file?
- 'Genre' and 'Lyrics' are two columns that are chosen from the Data Frame.
- The 'lyrics' column is clear of any missing values.
- Defines a function that cleans up text data by deleting stop words, single-character words, and special characters.
- Apply the purification function to the Data Frame’s 'lyrics' column.
- Generates a fresh Data Frame with the 'lyrics' column cleansed.
- Creates training and test sets from the data.
- The 'lyrics' field is used to generate a set containing groups of unigrams (single words).
- Training a Word2Vec model using the unigrams' collection.
- Use Kera’s tokenizer to tokenize the text.
- Use the tokenizer's dictionary to convert the text to a series of integers.
- Padding is applied on the sequences to be sure which they are equal in length
- Creates training and test sets from the data for a machine learning model

Proposed Work

The way we engage and communicate with one another has been revolutionized by the internet. People may now readily interact and share their opinions, feelings, and ideas with others thanks to the development of social media platforms. The emergence of social networking platforms has also spawned internet trolling phenomena, which has grown to be an important problem in contemporary society. Trolling on the internet refers to the practice of

purposefully posting insulting or provocative remarks on social networking sites to anger and upset other users.

Even though there have been several attempts to stop internet trolling, the issue still exists. This is due, in part, to the fact that the majority of currently used techniques was reactive in nature and can only be used to find and eliminate troll after it has already been uploaded. By spotting prospective trolls before they submit their remarks, the proposed initiative aims to provide a proactive strategy to combat online trolling.

The proposed effort entails creating a model using machine learning that can forecast the likelihood that a person would publish divisive or harmful remarks on social networking websites. A data set of comments made on multiple social media sites, together with details on the individuals who made them, will be used to train the algorithm. The dataset will have labels annotating whether a comment is objectionable. Preprocessing the data will be the initial stage in creating the model. To do this, the text must be cleaned up by eliminating stop words and special characters and changing it to lowercase. In order to extract characteristics from the text, we will also employ machine learning techniques including sentiment evaluation, component-of-speech marking, and named entity identification.

To figure out when an opinion has the potential to be offensive or not, we will next use these parameters to develop a model using machine learning, which could be a logistical regression model, or a model based on support vector machines. Employing regular machine learning metrics, like accuracy, recall, and F1 score, we will assess the model's performance. We will utilize our newly created model to spot prospective trolls once it can reliably anticipate whether a comment will be offensive or not. Specifically, we will utilize the forecasts to allocate each user based on their past remarks from the users. A troll's victory.

High-scoring users will be marked as possible trolling, and their responses will be reviewed more carefully. We will also include user- specific variables, such as the individual's posting the past, the regularity they leave comments, the number of followers that have, and the type of social media site they are using, to further enhance the model's performance.

To ascertain their effect on the model's accuracy, we will compare the model's performance with and without these attributes to increase the model's accuracy; we will also investigate the usage of deep learning models like recurrent neural networks and Convolutional neural networks. More intricate correlations between the characteristics and the variable being studied can be captured by deep learning models, which may produce more precision. Finally, we'll create a user interface which displays each person's troll score and enables moderators to respond appropriately. In addition, the user interface will provide ways to deal with prospective trolls, such barring them or alerting the platform's authorities.

Limitations and Future Work

There are still certain issues that need to be resolved, even if the suggested approach for classifying the genre for music with word embedding or subject modeling has shown encouraging results. A lack of data is one of this study's major flaws. The dataset utilized in this study only included music from a single genre and historical period, thus it might not be indicative of music from other genres or eras. To ensure the generalizability of the model, it would be advantageous to gather a bigger and more varied dataset in further research.

The quality of the lyrics is still another restriction. The lyrics that were employed in this study occasionally lacked correct organization and occasionally featured spelling or grammatical mistakes. The model's performance may have been impacted by these flaws. Before using the suggested methods, pretreatment techniques might be used in future research to clean and normalize the lyrics. The melody and structure of the songs are not considered by the existing methods either. The model's accuracy and robustness might both be increased by adding audio characteristics. Future research may concentrate on enhancing the methodology's topic modeling component.

Although the LDA model worked well, alternative topic modeling techniques, such as Non-negative Matrix Factorization (NMF) or the Latent Dirichlet Allocation by Gibb Samples (LDA-GS), might also be investigated. These algorithms could produce topic modeling outcomes that are more precise and understandable. Lastly, it would be intriguing to investigate how the suggested approach may be utilized in other industries, such as the film is taxonomy of book genres. This can broaden the study's focus and possibly provide new applications. The suggested technique has shown potential in properly classifying music genres and finding pertinent issues within lyrics, despite some of its shortcomings. Future research may concentrate on overcoming the constraints and broadening the study's application to further fields.

RESULTS AND DISCUSSIONS

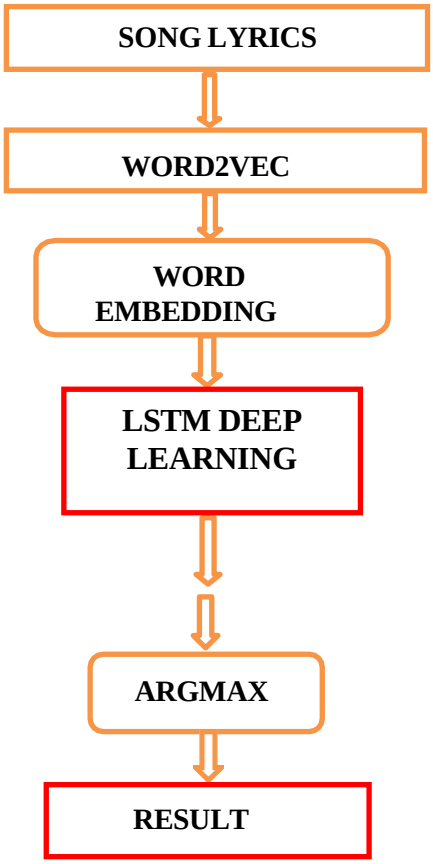
28372 songs from seven genres were used as the dataset for evaluating the suggested approach. all Word 2 Vector

models that had a screen size 5 with its vector size if 300 was used to create the word embeddings. NLP methods including tokenization, stop word removal, and stemming were used to preprocess the lyrics. The transformed lyrics were then turned into a representation of a bag of words and utilized for genre identification. Using several assessment measures, including accuracy, precision, recall, and F1 score, and the suggested methodology's classification performance was assessed [21, 22].

The findings revealed that the suggested approach beat baseline methods like k-NN and SVM, which had accuracy levels of 75% and 80%, respectively, by achieving an accuracy of 85%. The F1 score, recall, and accuracy for additionally, the accuracy, recall, and F1 scores for each genre were computed. The findings revealed that the suggested approach had a high F1 score for all genres to comprehend the effect of various hyper parameters on the classification performance of the suggested technique, more investigation was conducted.

The classification performance of the Word2Vec model was significantly impacted by the window size and vector dimension, according to the results. For the suggested technique, a window size of 5 and a vector dimension of 300 were determined to be ideal. The outcomes of the topic modeling demonstrated the ability of the suggested approach to identify significant subjects from the lyrics. To comprehend the traits of each genre, the most popular themes for each one was compiled and examined. Consider the most popular subjects. Love, life, and emotions were the most popular subjects for the rock genre, whereas fame, money, and lifestyle were the most popular topics for the rap genre. These findings shed light on the themes and traits that distinguish certain genres.

BLOCK DIAGRAM



No of classes	values
1	0.20
2	0.35
3	0.25
4	0.75
5	0.45
6	0.50
7	0.60

Figure .1

classifiers	Simple word2vec%	Word2vec with TFIDF %
SVM	45.2	72.40
LSTM	76.6	65.80
Sg 0	66.0	74.50
Sg 1	78.2	86.00

Accuracy score for genre classification
Table 3

CONCLUSION

This study's main objective was to create a genre categorization model that could categorize songs according to their lyrics. To do this, we created word embeddings from the lyrics using a Word2Vec model, which we then used to train a machine learning model. We utilized cross-validation to assess the model's performance after it had been trained on a dataset of songs from various genres. Our findings demonstrated that the model had an average accuracy of over 80% in classifying songs into their respective genres.

This is a positive finding that suggests lyrics may be an important aspect of genre identification. Our study did have certain drawbacks, though. The dataset we utilized was one substantial restriction. When we despite our best efforts to cover a wide variety of genres, our dataset were still somewhat tiny, this could have prevented the model from generalizing to more genres or subgenres. Furthermore, we ignored other potentially significant factors like melody, pace, and orchestration in favor of just using words as a criterion for categorization.

The dataset may be expanded to include more genres and subgenres in future study, along with the investigation of additional variables for categorization. Further research into the application of more sophisticated machine learning strategies, such as deep learning models, may be beneficial to increase the precision of genre categorization. This study shows, in conclusion, that it is possible to categorize songs into different genres using their lyrics. Despite the existing approach's drawbacks, our findings imply that it would be a useful device for musical analysis and recommendation programmer. To overcome the limitations of the current study and investigate other genre categorization methods, more research is required.

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A NOVEL MISSING CHILD IDENTIFICATION AND ADOPTION USING DEEP LEARNING AND SVM

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ABSTRACT
In India a countless number of children are reported missing every year. Among the missing child cases a large percentage of children remain untraced. This paper presents a novel use of deep learning methodology for identifying the reported missing child from the photos of multitude of children available, with the help of face recognition. The public can upload photographs of suspicious child into a common portal with landmarks and remarks. The photo will be automatically compared with the registered photos of the missing child from the repository. Classification of the input child image is performed and photo with best match will be selected from the database of missing children. For this, a deep learning model is trained to correctly identify the missing child from the missing child image database provided, using the facial image uploaded by the public. The Convolutional Neural Network (CNN), a highly effective deep learning technique for image based applications is adopted here for face recognition. Face descriptors are extracted from the images using a pre-trained CNN model VGG-Face deep architecture. Compared with normal deep learning applications, our algorithm uses convolution network only as a high level feature extractor and the child recognition is done by the trained SVM classifier. Choosing the best performing CNN model for face recognition, VGG-Face and proper training of it results in a deep learning model invariant to noise, illumination, contrast, occlusion, image pose and age of the child and it outperforms earlier methods in face recognition based missing child identification. The classification performance achieved for child identification system is 99.41%. It was evaluated on 43 Child cases.

Keywords— Missing child identification, face recognition, deep learning, CNN, VGG-Face, Multi class SVM.

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1.1. OVERVIEW
The public is given provision to voluntarily take photographs of children in suspected situations and uploaded in that portal. Automatic searching of this photo among the missing child case images will be provided in the application. This supports the police officials to locate the child anywhere in India. When a child is found, the photograph at that time is matched against the images uploaded by the Police/guardian at the time of missing. Sometimes the child has been missing for a long time. This age gap reflects in the images since aging affects the shape of the face and texture of the skin. The feature discriminator

invariant to aging effects has to be derived. This is the challenge in missing child identification compared to the other face recognition systems. Also facial appearance of child can vary due to changes in pose, orientation, illumination, occlusions, noise in background etc. The image taken by public may not be of good quality, as some of them may be captured from a distance without the knowledge of the child. A deep learning [1] architecture considering all these constrain is designed here.

2. LITERATURE REVIEW

Earliest methods for face recognition commonly used computer vision features such as HOG, LBP, SIFT, or SURF [2-3]. However, features extracted using a CNN network for getting facial representations gives better performance in face recognition than handcrafted features.

In [4], missing child identification is proposed which employees principal component analysis using Eigen vectors is used for face recognition system. FindFace is a website that lets users search for members of the social network VK by uploading a photograph [5].

FindFace employs a facial recognition neural network algorithm developed by N-Tech Lab to match faces in the photographs uploaded by its users against faces in photographs published on VK, with a reported accuracy of 70 percent.

The “Tuanyuan”, or “reunion” in Chinese, app developed by Alibaba Group Holding Ltd. helped Chinese authorities recover hundreds of missing children [6]. The app has allowed police officers to share information and work together with public.

3. PROBLEM STATEMENT

3.1. EXISTING SYSTEM

Mostly missing child cases are reported to the police. The child missing from one region may be found in another region or another state, for various reasons. So even if a child is found, it is difficult to identify him/her from the reported missing cases. A framework and methodology for developing an assistive tool for tracing missing child is described in this paper. An idea for maintaining a virtual space is proposed, such that the recent photographs of children given by parents at the time of reporting missing cases is saved in a repository.

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A deep learning architecture considering all these constrain is designed here.

The proposed system is comparatively an easy, inexpensive and reliable method compared to other biometrics like finger print and iris recognition systems.

5. SYSTEM ARCHITECTURE

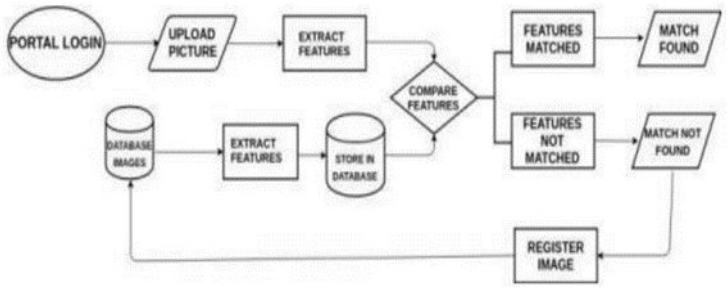

Figure 1. System Architecture

6. METHODOLOGY.

Convolutional Neural Network (ConvNet/CNN):A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.The architecture of a ConvNet is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. A collection of such fields overlap to cover the entire visual area.Image Dimensions = 5 (Height) x 5 (Breadth) x 1 (Number of channels, eg. RGB)In the above demonstration, the green section resembles our 5x5x1 input image, I. The element involved in carrying out the convolution operation in the first part of a Convolutional Layer is called the Kernel/Filter, K, represented in the color yellow. We have selected K as a 3x3x1 matrix.

6.1 VGG Neural Networks: While previous derivatives of AlexNet focused on smaller window sizes and strides in the first convolutional layer, VGG addresses another very important aspect of CNNs: depth. Let's go over the architecture of VGG:

6.2 Input. VGG takes in a 224x224 pixel RGB image. For the ImageNet competition, the authors cropped out the center 224x224 patch in each image to keep the input image size consistent.

6.3 Convolutional Layers. The convolutional layers in VGG use a very small receptive field (3x3, the smallest possible size that still captures left/right and up/down). There are also 1x1 convolution filters which act as a linear transformation of the input, which is followed by a ReLU unit. The convolution stride is fixed to 1 pixel so that the spatial resolution is preserved after convolution.

6.4 Fully-Connected Layers. VGG has three fully-connected layers: the first two have 4096 channels each and the third has 1000 channels, 1 for each class.

6.5 Hidden Layers. All of VGG's hidden layers use ReLU (a huge innovation from AlexNet that cut training time). VGG does not generally use Local Response Normalization (LRN), as LRN increases memory consumption and training time with no particular increase in accuracy.

6.6 The Difference. VGG, while based off of AlexNet, has several differences that separates it from other competing models:Instead of using large receptive fields like AlexNet (11x11 with a stride of 4), VGG uses very small receptive fields (3x3 with a stride of 1). Because

there are now three ReLU units instead of just one, the decision function is more discriminative. There are also fewer parameters (27 times the number of channels instead of AlexNet's 49 times the number of channels).

VGG incorporates 1x1 convolutional layers to make the decision function more non-linear without changing the receptive fields.The small-size convolution filters allows VGG to have a large number of weight layers; of course, more layers leads to improved performance. This isn't an uncommon feature, though. GoogLeNet, another model that uses deep CNNs and small convolution filters, was also showed up in the 2014 ImageNet competition.

6.7 SUPPORT VECTOR MACHINE(SVM):

"Support Vector Machine" (SVM) is a supervised machine learning algorithm which can be used for both classification or regression challenges. However, it is mostly used in classification problems. In this algorithm, we plot each data item as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. Then, we perform classification by finding the hyper-plane that differentiate the two classes very well (look at the below snapshot). The SVM algorithm is implemented in practice using a kernel. The learning of the hyperplane in linear SVM is done by transforming the problem using some linear algebra, which is out of the scope of this introduction to SVM. A powerful insight is that the linear SVM can be rephrased using the inner product of any two given observations, rather than the observations themselves. The inner product between two vectors is the sum of the multiplication of each pair of input values. For example, the inner product of the vectors [2, 3] and [5, 6] is 2*5 + 3*6 or 28. The equation for making a prediction for a new input using the dot product between the input (x) and each support vector (xi) is calculated as follows:

$$f(x) = B0 + sum(ai * (x,xi))$$

This is an equation that involves calculating the inner products of a new input vector (x) with all support vectors in training data. The coefficients B0 and ai (for each input) must be estimated from the training data by the learning algorithm.

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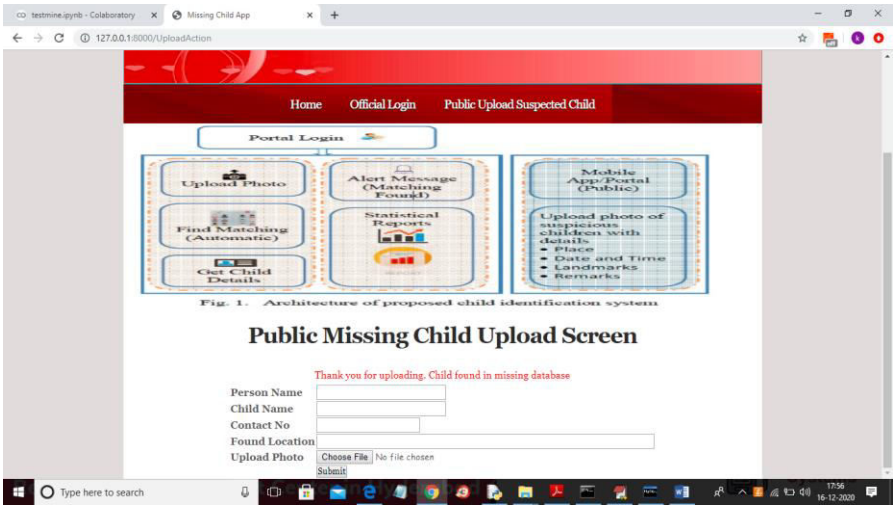
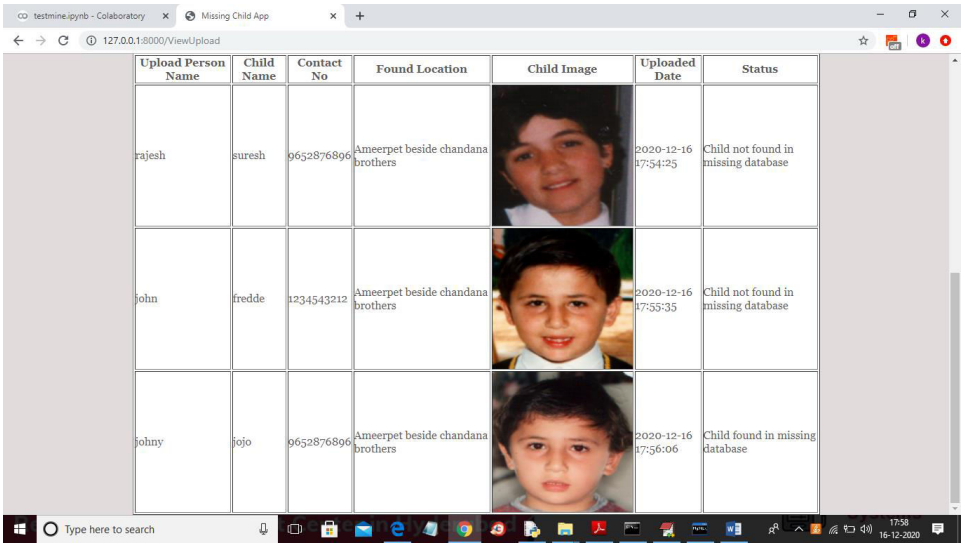


Fig. 1. Architecture of proposed child identification system

In above screen uploaded child found in database here uploaded photo not found in database.



In above screen officials can see all details and then take action to find that child

8. CONCLUSION

A missing child identification system is proposed, which combines the powerful CNN based deep learning approach for feature extraction and support vector machine classifier for classification of different child categories. This system is evaluated with the deep learning model which is trained with feature representations of children faces. By discarding the softmax of the VGG-Face model and extracting CNN image features to train a multi class SVM, it was possible to achieve superior performance. Performance of the proposed system is tested using the photographs of children with different lighting conditions, noises and also images at different ages of children. The classification achieved a higher accuracy of 99.41% which shows that the proposed methodology of face recognition could be used for reliable missing children identification.

9. FUTURE ENHANCEMENT

This system is evaluated with the deep learning model which is trained with feature representations of children faces. Performance of the proposed system is tested using the photographs of children with different lighting conditions, noises and also images at different ages of children. A missing child identification system is proposed, which combines the powerful CNN based deep learning approach for feature extraction and support vector machine classifier for classification of different child categories. As the performance of the system is very fast and it will be very helpful in identifying the missing child, our proposed method will be used in the future very much. As for now there are more limited methods for the missing child detection. So this method can be so much helpful in the future.

10. REFERENCES

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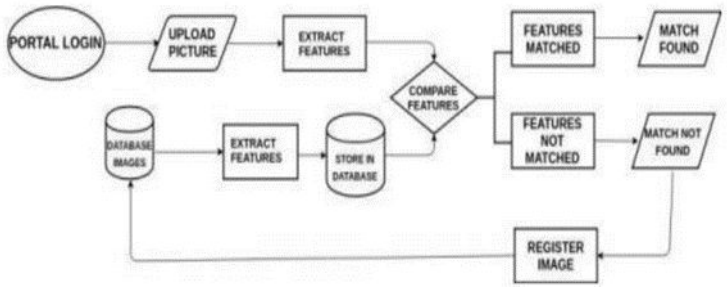

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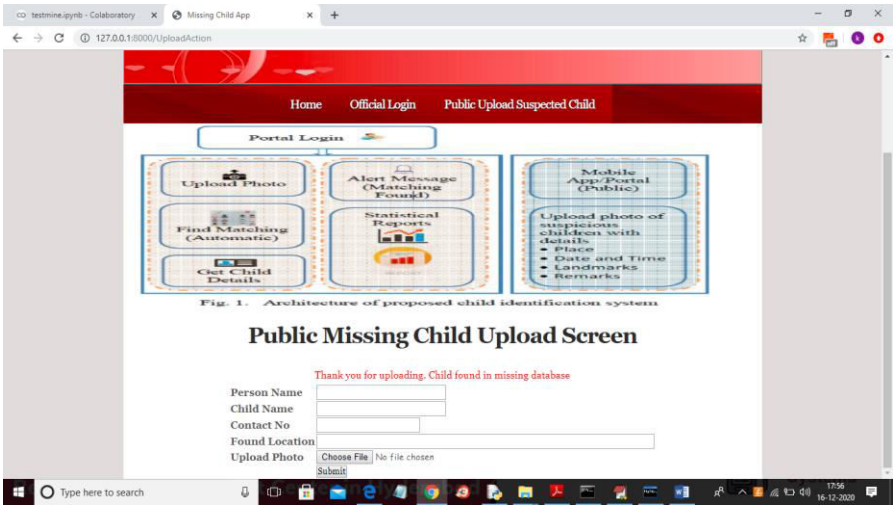

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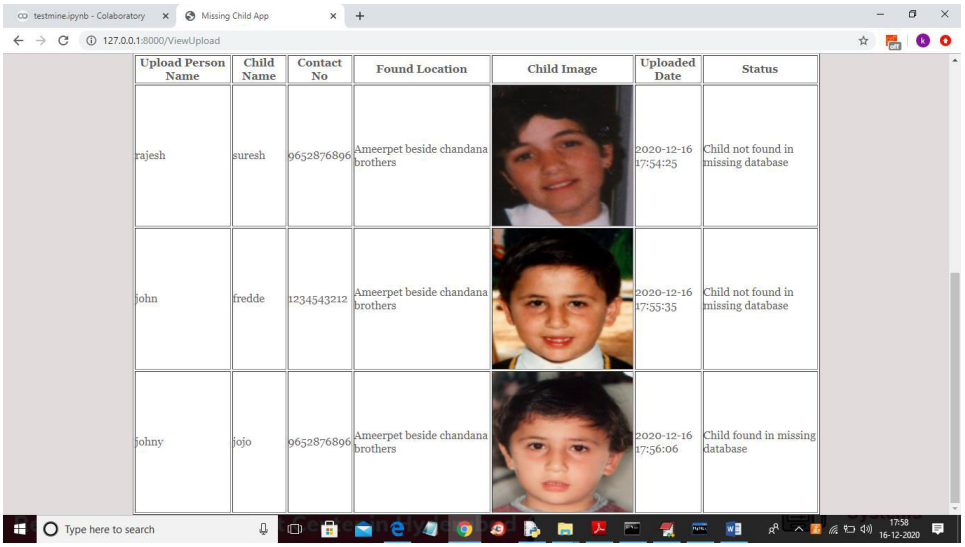

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Swarm energy efficient power efficient gathering in sensor information systems protocol in wireless sensor networks

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ABSTRACT

Wireless sensor network (WSN) is a network, which has more numbers of sensors that are small in nature and are self organised. The inbuilt battery system is provided in the sensor nodes through which the nodes can communicate and do good operations among the other nodes available in the network. Lifetime is the most essential parameter which needs to be maximised for the WSN. This measure is more important for conservation of energy, for adequate and efficient performance of sensor networks. This paper proposes a swarm energy efficient power efficient gathering in sensor information systems (PEGASIS) (SEE-PEG) based energy optimization algorithm for WSN in which clustering and clustering head selection are done by using modified particle swarm optimization (MPSO) algorithm with respect to minimizing the consumption of power in WSN. The parameters evaluated for the proposed method is compared with existing technique like energy efficient PEGASIS without optimization. The simulation results are obtained using matlab tool.

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1. INTRODUCTION

In twenty first eras wireless sensor network (WSN) gaining more and more importance and the research has been widely processed in this field by the researchers. The network fields for performing wireless communications are made with sensor nodes and the network consists of batteries with lower power [1], [2]. The sensor nodes deployed in the network have a lower supply of power and the nodes are designed to detect data, acquire information and the communication is performed wirelessly. The sensor nodes are the element which determines the life span of the network. One of major problems in the WSN is consumption of energy, to maximize the lifetime of the network many techniques are suggested by the researchers.

The sensor nodes which are available in the network are made with low battery power, microcontroller, external memory, transceiver and some sort of sensors. In these elements most of the power is used by the transceiver as the transceiver has four sets of operational modules. The four modules are idle, sleep, broadcast and receive. Among these modes the same amount of power is consumed by idle and receive mode. One of the energies saving modes is to turn off the transceiver module when the data is not been broadcasted or received [3]. The network remains active when there is sufficient power stored in the battery of sensor nodes. The more the energy dissipated the lifetime of network gets shorter. Thus, the major goal of all routing protocols devised thus far is energy consumption education and network lifespan enhancement. The WSN connects scattered nodes to detect field data [4], [5]. The information in the network is gathered by the sensor node is transmitted to the destination node and is said to be base station. The traffic nearby base

station is boosted which leads to higher usage of energy. Clustering was used in WSN to lower the amount of energy consumed. Sensor nodes were coupled to generate various clusters based on some parameter in clustering-based protocols. The network also consists of clusters and the master cluster is known as cluster head (CH). Each cluster has a master known as a CH, and instead of communicating with the base station in a single hop, the CH were in charge of providing aggregated data to the target node [6]. The clustering in WSN is shown in Figure 1.

Clustering is an essential approach in WSNs for boosting lifespan of thenetworks and the scalability [7], [8]. Clustering is the process of grouping sensor nodes into different clusters and electing CHs for all accessible clusters in the network. To choose appropriate CHs, many routing techniques have been developed. Choosing adequate CH is a difficulty in WSN. Two major routing protocols used by researchers in the field of WSN are low energy adaptive clustering hierarchy (LEACH) and power efficient gathering in sensor information system (PEGASIS). The LEACH protocol is a progressive cluster-based routing system in which numerous groups of nodes are established called clusters, and each cluster has one master node called the CH. The information perceived by the other nodes in a cluster is sent to their corresponding master node (CHs). The base station receives the fused data from the CH, so that the traffic near the base station will be reduced which leads to saving of energy. The energy consumed by the sensor node during this process is low. The PEGASIS protocol gives the chaining notation structure. The sensor nodes present in the work are connected in the form of chains using the PEGASIS protocol. Figure 2 depicts the whole taxonomy of cluster-based routing techniques in wireless sensor networks.

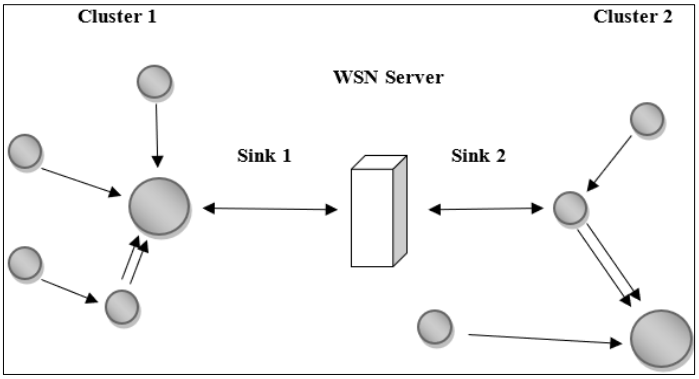

Figure 1. Wireless sensor networks

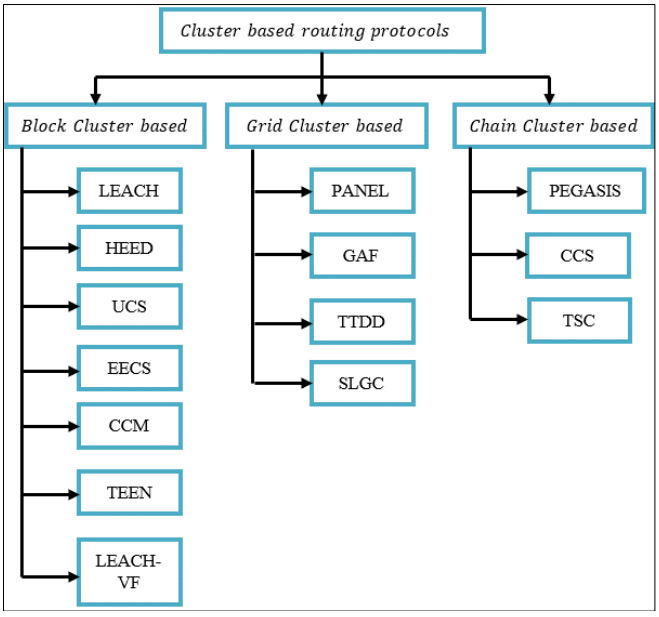

Figure 2. Classification of cluster-based routing protocol

2. RELATED WORK

A wireless sensor network (WSN) is made up of tiny low-energy sensing nodes that may detect phenomena and communicate the data to a sink. Micro electromechanical systems (MEMS) technological advancements have resulted in the creation of low-cost, multi-functional small sensor nodes that require less power. WSNs are essentially data collection networks in which the data is strongly correlated, and the end user requires a high-level description of the environment felt by the nodes.

WSNs are utilized to detect scope approach or the state of physical things such as bridges, allowing for proper response and avoiding potential harm. Because battery recharge may be difficult, the network has higher energy efficient nodes based on the protocol used in WSN.

The power units help the sensor nodes to operate, without the help of power unit the sensor nodes do not work. There are two critical parameters linked with each sensor node:

- Sensing range (S_R): The range which the sensor node can observe the phenomenon and the maximum distance limit sensing is termed as sensing range.
- Range of Transmission (T_R): The maximum range that a sensor node can transmit the information or data is termed as T_R.

In design of WSN the most difficult tasks are to provide a protocol that allows the randomly distributed number of sensing units to operate collaboratively, cooperatively, coordinated and organized. Every node transfers the information to its nearby node followed by sink. When compared to traditional communication networks, the protocol design for routing in the network becomes extremely important in the case of WSNs [9]. Hierarchical routing protocols or clustering, among the different suggested network routing protocols, significantly provides the scalability for the system contribute to system scalability, longevity, and efficiency of energy [10]. Kim *et al.* [11] the author proposed LEACH protocol to improve the efficiency of the network.

Clustering is a helpful approach in WSNs for dealing with scalability issues. Clustering, when paired with data aggregation, has the potential to improve the network's energy efficiency. Furthermore, by allocating a particular function to the CHs, clustering makes the network more resistant and prone to assaults [12]–[15]. In a WSN with direct communication, sensor nodes send their perceived data straight to the sink without any coordination between the two. However, with cluster based WSNs, the network is separated into clusters. The communication of information at node is done with the CH which sends the total data to the base station [16], [17]. Data aggregation at CHs reduces the quantity of data delivered to the BS significantly, conserving both energy and bandwidth resources [18]. WSN operates more efficiently when the clustering technique is effective. The key obstacles are to arrange CHs equally for the entire network and control the dissipation of energy caused by the exchange of information between the nodes and CH [19].

The CH selection technique is the most crucial phase of routing protocol which arecluster-based because it provides consistent energy allocation across sensors, hence prolonging the sensor network (SN) lifespan [20]. Once the CHs are discovered, they establish a backbone network to gather, consolidate, and send data to the BS on a regular basis utilising the least amount of energy (cost) routing. When compared to other existing ways, this strategy dramatically increases network longevity. In this instance, certain outliers may form that are not connected to any of the CHs despite being in the transmission range. This technique handles CH selection using the unique node idea [21]–[23]. A unique node is one that is not linked to any other CHs. For the selection of CH in WSN, the method suggested in this study employs two parameters: the number of surrounding nodes and the residual energy. The protocols initially construct the top level of clusters based on this global information by selecting specific nodes as CHs. The remaining nodes are then grouped as cluster members into the specified cluster. Many algorithms choose the CHs at random. In such a circumstance, the CH's energy may be lower than that of its member nodes. Such CH may die off soon, resulting in clusters of low quality. Our study is motivated by the need to provide efficient clustering without requiring global network information by reversing the clustering technique from top-down to bottom-up [24]. To do clustering, location data is often utilised to compute the distance between sensing nodes. This is referred to as quantitative agglomerative hierarchical clustering. However, location data may not always be accessible [25] owing to factors such as GPS failures, the expense involved, or the time required determining the exact location of the sensors. This is referred to as qualitative agglomerative hierarchical clustering. The current study examines several agglomerative techniques for qualitative and quantitative data.

Kaur and Bajwa [26] suggested employing BFO in chain for enhanced PEGASIS. When compared to alternative chain building strategies, such as PEGASIS, which builds chains using a greedy algorithm, the performance of the suggested method is shown to be superior. ReLeC protocol, a reinforcement learning-based, clustering-enhanced method for energy-efficient routing in WSNs and maybe other geographically dispersed IoT networks, is proposed by the author in [27]. The protocol uses clustering and RL to try to find a reliable data transmission path. For applications devoted to structural health monitoring in the construction sector, Yen *et al.* [28] explored the creation of the idea of "communicating concretes," which are concrete

components integrating wireless sensor networks. Sleep mode and the data aggregation process are both considered in a chain-based data gathering technique that is provided. The threshold sensitive energy efficient sensor network (TEEN) protocol was proposed by Kumar *et al.* [29]. Reactive protocols like TEEN and directed query dissemination (DirQ) are used to cut down on transmissions by only allowing nodes to send when a detected property is within a certain range of interest.

3. PEGASIS PROTOCOL

Among the two major protocols in WSN, PEGASIS having more benefited when compared to LEACH. The faults in LEACH are being updated in PEGASIS. The main advantage of this protocol is its network longevity as it the follow the chaining principle for performing the operation. The chain is developed between the sensor nodes. The nearby nodes form a chain and extend to node situated at longer distance. In Figure 3, the illustrations of transmitting data using PEGASIS areobserved. The information is first detected by C0 and is transmitted to C1. The C1 receives the input data and mix the data with its own discovered data and send to next node C2. Here C2 is termed as leader node. The leader node is situated in center of nodes and near to base station. The leader node sends data to the base station. In same process the data is sent by C3 to C2 and C2 sends to base station. The energy consumed at every node will be less and overall energy consumption of network for transmitting the data from source to destination will be reduced. Hence when compared to LEACH the PEGASIS attains good performance in terms of energy efficiency. The CH aggregates data in LEACH, but no data fusion occurs in PEGASIS.

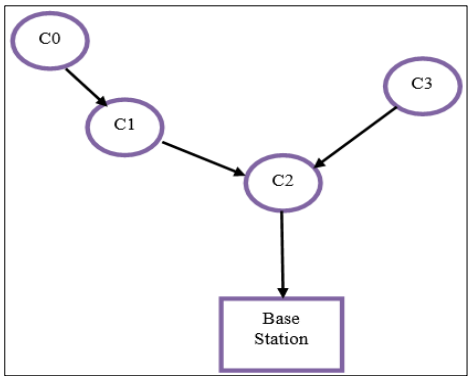

Figure 3. PEGASIS based transmission of data

4. PROPOSED METHOD

Distance is one of the important parameters in WSN for saving of energy. The distance between nodes and CHs or sinks need to be visualized and calculated for making the network efficient. The above problem is solved by using multiple sinks in a WSN.The current research work concentrates on two basic aspects related to multiple sinks WSN, namely:

A. Finding optimal number of sinks.

B. Finding the position of sinks

- Step1. Network clustering
- Step2. Selection of cluster head (CH)
- Step3. The optimum routing path needs to be identified
- Step4. Transmission of data from one node to another using single or multiple hops.

Each node in a chain transmits and accepts data from the node immediately adjacent to it. As a result, the information received is passed from node to node before being sent to the base station via a selected leader node. Following study, it was shown that this notion of chaining using greedy technique is highly effective.

4.1. Swarm energy efficient process

Initially the distance between the sink and nodes are calculated. To identify the CH, we propose optimization technique to find the global best node. The swarm optimization techniques are used to find the energy efficient CH selection for transmission of data. The major problem such as routing, and CH selection is solved using PSO technique. Here the modified PSO is designed for better improvement of proposed work. In this modified PSO we choose two swarms and calculate the distance and velocity based on two swarms.

Consider initial swarms as x, y, Let the starting position of I_{start}. The distance travelled by the swarms isdis_1, dis_2. The final position of the swarms with respect to their distances is given by:

$$S_{position} = \frac{I_x + I_y}{2} \quad (1)$$

now the position of the swarms will be updated based on local best to update the global best value. For velocity in PSO is having less potential in generating the best solution. The velocity is modified and updated to find the best optimal result. Now the velocity of the swarms which are considered in searching is given by,

$$Vel_x = |C.I_x(t) - I(t)| \quad (2)$$

$$Vel_y = \left|C.I_y(t) - I(t)\right| \quad (3)$$

the position is updated as,

$$Position_1 = I_x - B.Vel \quad (4)$$

$$Position_2 = I_y - B.Vel \quad (5)$$

where B and C are the vector coefficients which are calculated as,

$$B = 2b.r_1 - b \quad (6)$$

$$C = 2.r_2 \quad (7)$$

b is linearly decreased from 2 to 0 over thecourse of iterations and r_1, r_2 are random vectors.

It is advantageous to enhance the particle's location. However, there is still the possibility of slipping into a local optimum solution when using PSO to determine the new position. To improve its exploration capability, the algorithm must be able to create random solutions in the search space with a low probability. Based on the above considerations, the following new position may be generated.

$$Position_{best} = \frac{Position_1 + Position_2}{2} \quad (8)$$

Based on the above position the best CH is selected, which nodes are more energy efficient and the node which is nearest in the chain is identified and selected as CH. The Figure 4 shows the model of the work progressed. The modified optimization technique is used for selection of CH and for cluster formation process. Algorithm 1 shows the swarm energy efficient optimization algorithm for wireless sensor networks.

Algorithm 1. Swarm energy efficient optimization algorithm for wireless sensor networks

```
1. Initialization
2. Initialise swarm population of N particles X_i (i=1,2,3....., n)
3. for i=1,2,3,.....,n do
4. Generate swarms randomly based on the velocity and position
5. Calculate fitness value of each swarm
6. If a particle's present position is better than its previous best position, update it.
7. Identify the best swarm
8. Renew the current location of swarm
9. Update the particles velocity
10. end for
11. Update the position of swarm
12. Rank the swarm and find the current best
13. Cal new fitness value and estimate the fitness value of remaining swarms
14. Check for stopping condition i.e., whether the IterreachesItermax, if yes, print the
    best value of solution otherwise go to step 5
15. Update the position of current search agent
16. Update the search agent
17. Insert new swarm to the population
18. Output the best value found
19. Apply the best value to find cluster head (CH)
20. Cal corresponding parameters like packets to CH, packets to BS, alive nodes, dead
    nodes, throughput, and Residual Energy.
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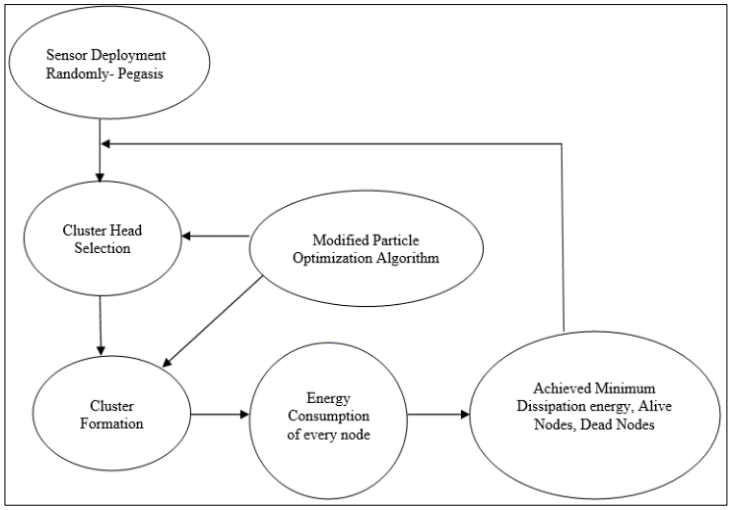

Figure 4. Proposed model of the system

The energy model is an important one in setting up the value of the energy loss during the process of transmitting and receiving of information. The network model has few assumptions on plot area, sensor nodes and other constraints. On the other hand, CH selection gives the information of how PSO is applied for our problem considered. The flowchart of the proposed system is shown in Figure 5.

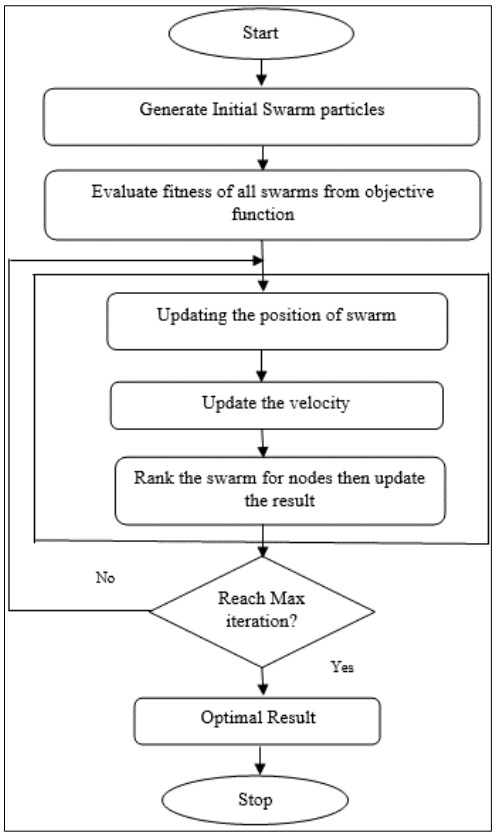

Figure 5. Flowchart of proposed system

5. RESULTS AND DISCUSSION

The simulation results are obtained using matlab tool. The environment consists of 100 nodes with a network size of 100×100 meters. The comparison is done between energy efficient PEGASIS and swarm

energy efficient PEGASIS (SSE-PEG). By applying modified swarm optimization technique the network life time is increased and is shown in below simulation results. The parameters considered for performing simulation operation is shown in Table 1. For the parameters shown in Table 1, the obtained simulation results are shown in below Figures.

Table 1. Parameters set for simulation

Parameter	Value
Size of the network	100×100 meters
Nodes in network	100 numbers
Starting energy of node	0.5 J
Total energy for transmitting and receiving of data	50 J
Distance between the available nodes	50 m
Data considered for transferring	2,000 bits

5.1. Case 1

The performance output is considered for 100 number of nodes. Figure 6 shows the sensor node distribution of the network. From Figure 7 it is shown that proposed swarm optimization as good level of energy compared to EE-PEGASIS. If we consider 2,000 rounds for comparison the energy remained modified SEE-PEGASIS is around 10 J, whereas energy remained using EE-PEGASIS is 4 J. The energy becomes zero when 3,500 rounds are done for EE-PEGASIS, whereas the energy remained upto 5,000 rounds using modified SEE-PEGASIS. From Figure 8 it is shown that using swarm optimization alive nodes at 5,000 rounds is 4 nodes, whereas EE-PEGASIS approach the number of alive nodes is 0 nodes. This shows the nodes death rate is slow in proposed techniques compared to the existing technique. From Figure 9 it is shown that all the nodes are dead at around 4,600 nodes using EE-PEGASIS, modified SEE-PEGASIS the nodes are dead around 5,500 rounds, whereas using EE-PEG, the nodes complete zero after 8,000 rounds. The number of roundsare increased using proposed technique by which the data transmitting rate will be increased.

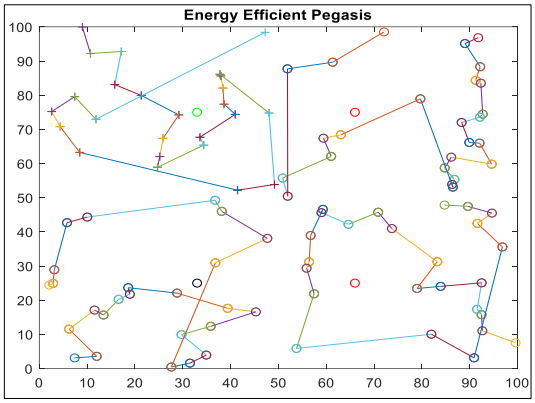

Figure 6. Sensor node distribution

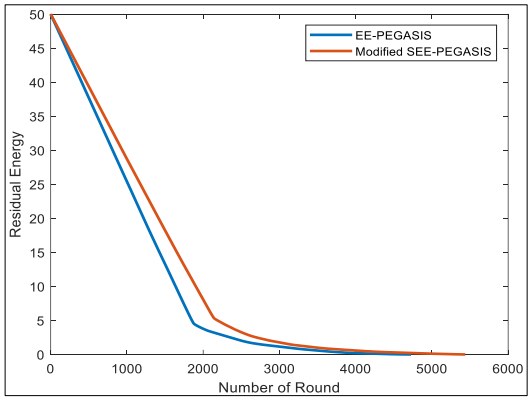

Figure 7. Residual energy (J) vs no of rounds

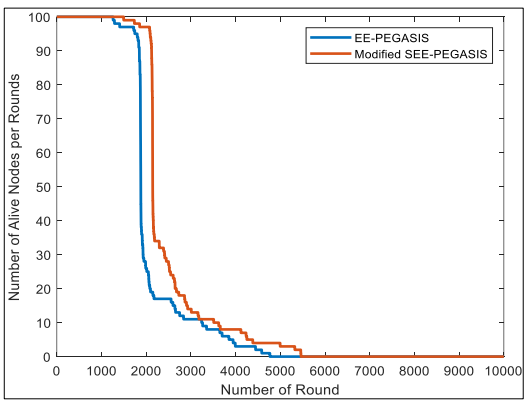

Figure 8. No of alive nodes vs no of rounds

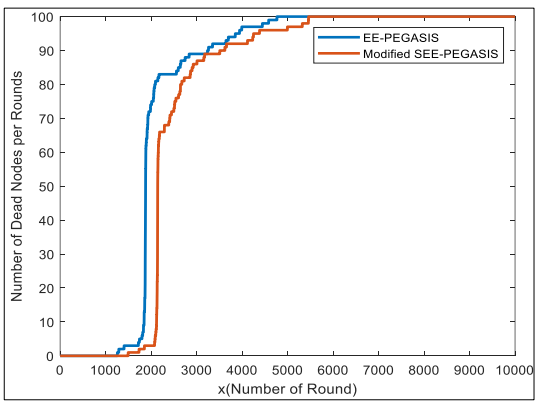

Figure 9. Number of dead nodes vs number of rounds

5.2. Case 2

The performance results obtained using 200 number of nodes are shown below. From Figure 10 it is shown that using Swarm optimization number of alivenodes are 20 nodes after reaching 5,000 rounds whereas in EE-PEGASIS approach the number of alive nodes is 10 nodes. This show the alive nodes are more active in proposed techniques compared to the existing technique. From Figure 11 it is shown that the nodes are completely dead after 6,200 round using modified swarm optimization and using EE-PEGASIS the nodes are completely dead after reaching 5,000 rounds. From Figure 12, if we consider 5,000 rounds for comparison the energy remained using modified SEE-PEGASIS is around 10 J, whereas energy remained using EE-PEGASIS is 3 J.

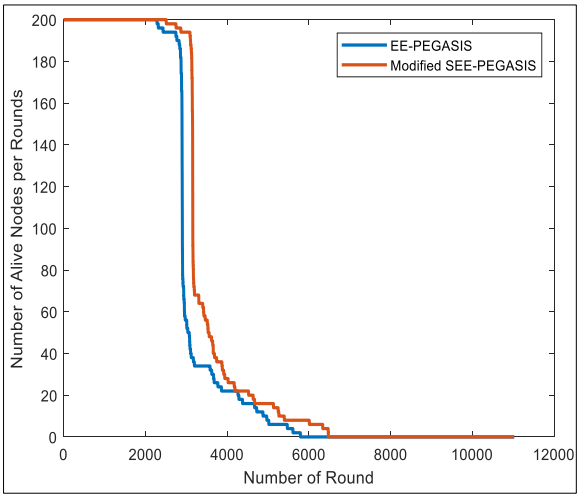

Figure 10. Number of alive nodes vs number of rounds

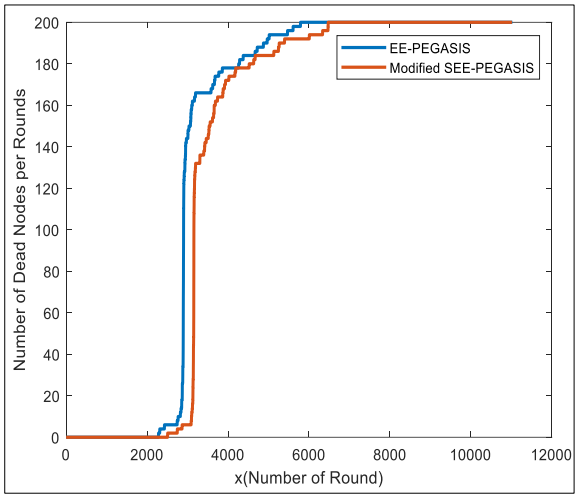

Figure 11. Number of dead nodes vs number of rounds

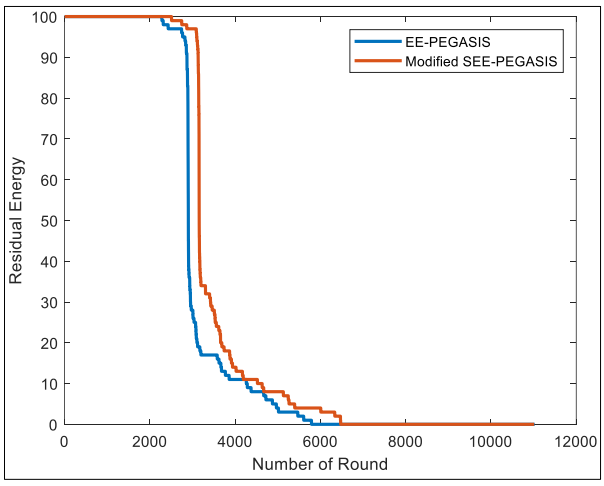

Figure 12. Residual energy vs number of rounds

5.3. Case 3

The performance results obtained by Considering 500 nodes, the results obtained are shown in Figures 13-15. Using modified SEE-PEGASIS, residual energy is around 25 joules where as energy remained using EE-PEGASIS is 10 joules. The delay in EE-PEGASIS is 16.93 sec whereas in SEE-PEGASIS is 15.07 sec. The number of dead nodes in EE-PEGASIS is 480 whereas in SEE-PEGASIS is 455. The number of alive nodes in EE-PEGASIS is 20 whereas in SEE-PEGASIS is 45.

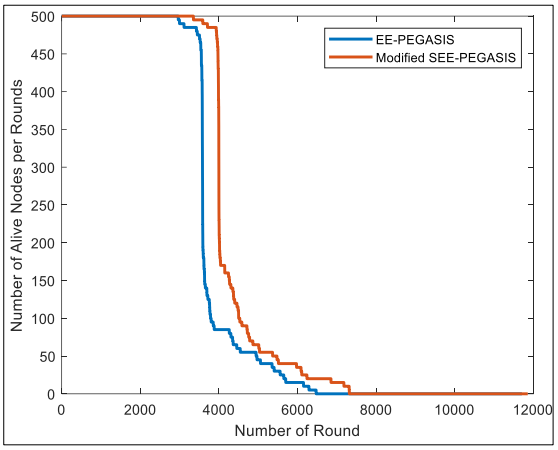

Figure 13. Number of alive nodes vs number of nodes

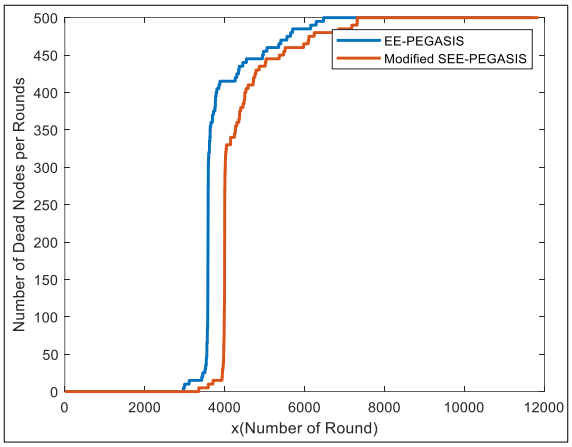

Figure 14. Number of dead nodes vs number of rounds

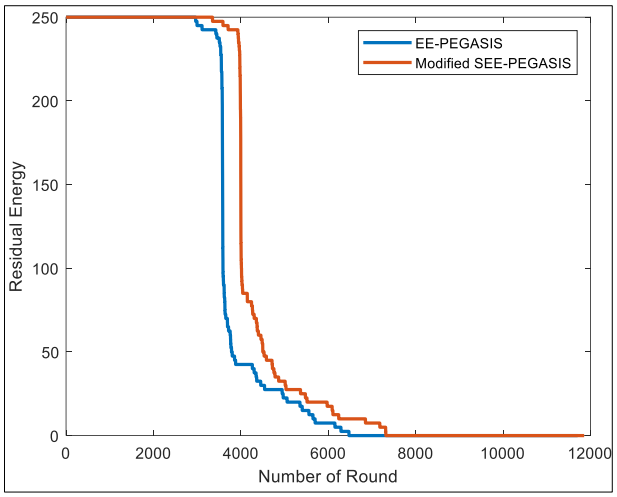

Figure 15. Residual energy vs number of nodes

In Table 2 the comparison of results is shown. The parameters shown are residual energy, number of dead nodes and number of alive nodes. The values are tabulated by considering 2,500 number of rounds for 100 nodes. From the Table 2 it is clear that proposed SEE-PEG retains its energy level for more number of rounds and also the number of alive nodes is higher compared to existing method. The Table 4 values are tabulated by considering 6,000 number of rounds for 500 nodes. The Table 3 values are tabulated by considering 5,000 number of rounds for 200 nodes. From Table 5, the proposed Improved ant lion optimization techniques provides high energy efficiency as the number of node present till 5,462 round performed by the wireless communication system while transmission of data.

Table 2. Results comparison for 100 nodes

Parameters	EE-PEGASIS	SEE-PEGASIS
Residual energy	3 J	9 J
Number of alive nodes	18	30
Number of dead nodes	82	70
Throughput (%)	82.96	86.3
Packet delivery ratio (%)	84.79	88.4
Delay (Sec)	18.87	17.11

Table 3. Results comparison for 200 nodes

Parameters	EE-PEGASIS	SEE-PEGASIS
Residual energy	4 J	10 J
Number of alive nodes	10	18
Number of dead nodes	190	182
Throughput (%)	82.87	86.49
Packet delivery ratio (%)	84.41	88.69
Delay (Sec)	17.39	16.44

Table 4. Results comparison for 500 nodes

Parameters	EE-PEGASIS	SEE-PEGASIS
Residual energy	10 J	25 J
Number of alive nodes	20	45
Number of dead nodes	480	455
Throughput (%)	82.89	86.65
Packet delivery ratio (%)	84.97	88.56
Delay (sec)	16.93	15.07

Table 5. The nodes status based on rounds

Parameters	EE-PEGASIS			SEE-PEGASIS		
	100	200	500	100	200	500
First dead nodes	1,490	2,283	2,966	1,735	2,509	3,352
Half dead nodes	2,079	2,903	3,586	2,345	3,158	4,401
Last dead nodes	4,767	5,791	6,474	5,462	6,475	7,318

6. CONCLUSION

Wireless sensor networks are one of the most modern technologies that are being utilised for a variety of applications such as landslide detection, military applications, health monitoring, and so on. To improve the longevity of the network many researchers are developing various techniques. In this work, first a hierarchical protocol called LEACH, while the second is a chaining protocol called PEGASIS is implemented. It has been determined that PEGASIS is more energy efficient than the LEACH technique. In this study, the PEGASIS protocol is explored and improved by altering it with a new approach, which will be useful to those working on building an efficient algorithm in WSN to obtain an increase in network lifespan by employing SEE-PEG. The results reveal that SEE-PEG-based clustering approaches provide longer network life than the energy-efficient PEGASIS strategy.

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Design of ant lion optimization-based PEGASIS routing protocol for energy efficiency in networks

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ABSTRACT

In sensor networks the main problem facing by many researchers is regarding the energy efficiency. Different protocols are evaluated for communicating between the sensor nodes. The routing protocol when combined with evolutionary algorithms gives best optimal solution for the problem incurred in wireless sensor networks. In this paper, ant lion energy efficient-power efficient gathering in sensor information systems (ALEE-PEGASIS) is used to develop the chain. This technique can achieve a global optimization solution by finding the best cluster head or the leader node for data communication. The techniques help in distributing the paths equally while the transmission of data process is performed. By performing this process, the power consumption near the sensor nodes can be reduced. The proposed technique is compared with other techniques like energy efficient PEGASIS and swarm energy efficient PEGASIS. The parameters used to compare are number of alive nodes, number of dead nodes and residual energy. The performance is observed using MATLAB simulation results.

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1. INTRODUCTION

Improvements in wireless communication and digital signal processing have recently led to the creation of the wireless sensor network (WSN) [1]. WSN has been used in a variety of disciplines, including military investigation, medical therapy, environmental monitoring, and industry management. It does, however, have significant limitations, such as a restricted energy source and limited calculation and communication capabilities. As a result, how to extend network lifetime is a crucial and complex topic, which is also the subject of the WSN routing protocol design.

Several routing methods for WSN have been suggested. They are classed as plane protocols or hierarchical protocols based on the network structure. The hierarchical protocol intends to cluster sensor nodes so that cluster leaders may perform data gathering and reduction to conserve energy [2]. The core concept of hierarchical protocol is followed by power efficient gathering in sensor information systems (PEGASIS). All the nodes in the sensor network are grouped together to form a chain by following the greedy approach. The base station (BS) does everything. Beginning from the closest node, it selects the nearest neighbour of each node as the next node on the chain. Once the chain is complete, one node will be picked as the leader in each round of communication. Along this chain, each node merges the received data with its own before transmitting it to the next neighbour. The process is continued till the leader node receives the data. The complete fused data is then transmitted to the BS by the leader [3].

Because of advancements in the WSN innovation field, it has become necessary to investigate new methods or techniques, such as improving routing protocols by utilising many intelligent systems and optimization algorithms, in order to stay abreast of developments that have a positive impact on WSN technologies. These routing techniques are used on small and inexpensive sensor nodes to provide effective communication throughout the whole network. The sensor node architecture is depicted in Figure 1. These sensor nodes are extremely energy sensitive, resulting in restricted energy supply and, as a result, a short network lifetime. To address this issue, we must employ efficient routing algorithms that provide efficient and reliable communication between these nodes.

Several clustering strategies for WSN are proposed to increase energy efficiency, throughput, and network longevity [4]–[6]. Pooja and Singh [7] author proposed one of the prominent cluster-based routing protocol i.e. low-energy adaptive clustering hierarchy (LEACH). Depending on the residual energy at node and the distance between the nodes, the thresholding-based clustering technique need to be selected [8]. This cluster method improves the average residual energy and first dead node time when compared with existing LEACH technique. However, by adding extra parameters while clustering the network, performance may be greatly enhanced. Yao *et al*. [9], an evolutionary algorithm is utilized for sensor network clustering and routing based on each node's residual energy and the distance between sensor nodes and their CH. The utilization of different meta-heuristic techniques in WSN for grouping of nodes and CH selection is proposed by Wang *et al*. [10]. Rejinaparvin and Vasanthanayaki [11], author proposed a particle swarm optimization technique and is termed as enhanced-optimized energy efficient routing protocol (EOEERP). In 2002, PEGASIS [12] proposed a number of other enhanced protocols based on it, such as energy-efficient PEGASIS-based (EEPB) [13], improved energy efficient PEGASIS-based protocol (IEEPB) [14], protocol with double cluster head (PDCH) [15], PEGASIS performance based contract administration (PBCA) [16], PEGASIS-intersection based coverage algorithm (IBCA) [17], multi hops (MH)-PEGASIS [18], and modified PEGASIS [19]. In addition, some heuristic algorithms are used to improve the performance of the network [14], [20]–[22]. To enhance the efficiency optimization techniques introduced in PEGASIS such as ant–PEG [23]. Now further to enhance the energy of the system in this paper ant lion optimization (ALO) in PEGASIS is proposed.

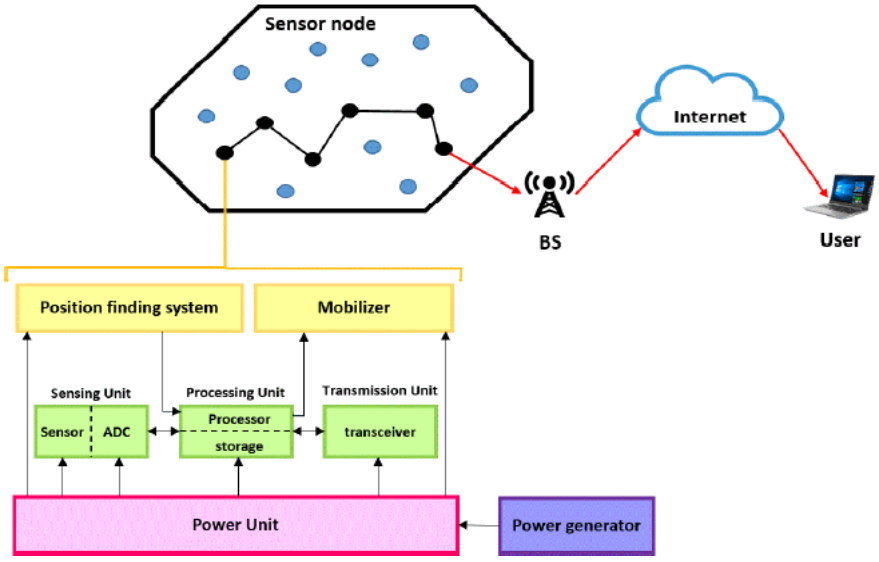

Figure 1. Architecture of sensor node

2. PEGASIS PROTOCOL

The PEGASIS protocol is a chain-based protocol which employs a greedy algorithm. In this method the sensor node creates a chain for transmission of data. For the purpose of routing the sensors nodes in the network together form a chain. The process of formation of chain keeps the chain alive by rebuilding the nodes in place of dead nodes. The transmission of data to the base station is handled by the leader node which is allocated in the network. The principle of PEGASIS is to send and receive data from the neighbour nodes and cluster head is used for sending data to base station [13]. The transmission process of PEGASIS is shown in Figure 2.

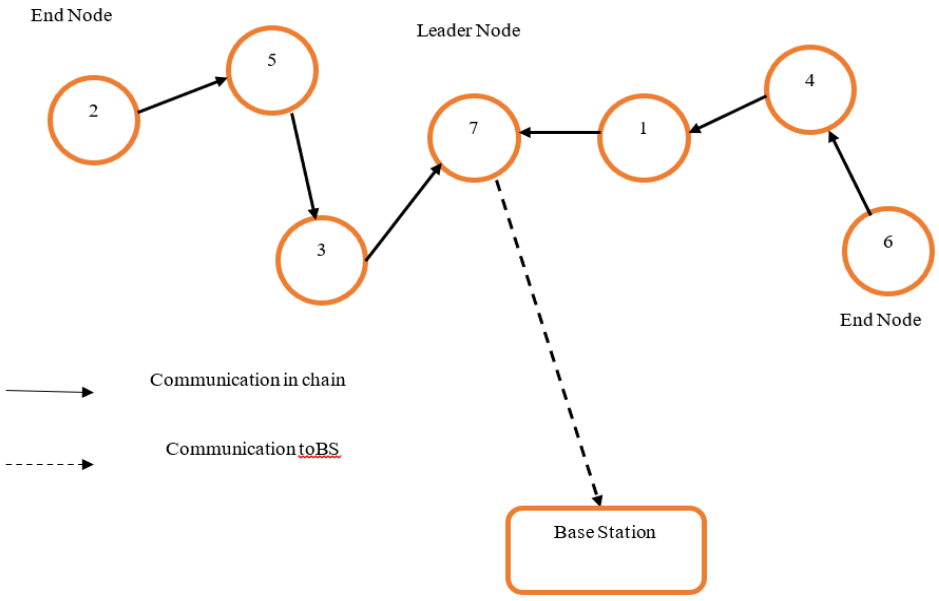

Figure 2. Transmission using PEGASIS

3. PROPOSED ALEE-PEGASIS

We propose a routing protocol ALEE-PEG using an improved energy efficient ALO algorithm for selecting the cluster head and forming the cluster by taking energy constraint into consideration for transmitting the data along the chain of nodes developed using PEGASIS protocol. The flow of proposed methodology is shown in Figure 3. In proposed methodology, arranging required number of sensors and choosing cluster head selection with the help of ALO and forming the cluster. By using that cluster, energy consumption is obtained at every node. If it is achieved minimum energy dissipation, then the process will be stopped.

3.1. Initiating the process

Firstly, need to consider a base station with maximum amount of energy and nodes which are of equivalent energy. The positions and energy of each node need to be identified and the distances between the nodes need to be calculated. Now the optimization technique will be initiated and the detailed description of Ant Lion is said in next session.

3.2. Modified ant lion optimization

The ALO programme simulates the interaction of ant-lions and ants in the trap [24]. Ants are needed to wander around the search space to replicate such interactions, and ant-lions are permitted to hunt them and get fitter using traps. Because ants travel stochastically in nature when looking for food, a random walk is used to represent their movement as (1).

$$X(t) = [0, CS(2r(t_1) - 1), CS(2r(t_2) - 1), \ldots., CS(2r(t_n) - 1] \quad (1)$$

Where the CS is termed as cumulative sum, maximum number of iterations is termed as ‘n’, ants random walk is termed as ‘t’. The ant’s fitness function needs to be evaluated at every iteration. The nodes are selected based on the ants that are arriving towards the ant-lions trap. As shown in (1) shows the random walks of the ants. Every step of optimization is performed based on the position updated with respect to the random walk of ants. The boundaries and limits are specified. Hence the normalization needs to done. The normalized equation which is applied near iteration to justify the random walk within the boundary is given (2).

$$X_i^t = \frac{(X_i^t - a_i) \times (d_i - c_i^t)}{(d_i^t - a_i)} + C_i \quad (2)$$

Thus, calculate the random walk of every ant and updating the position. The trap of ants is performed by antlion by siding the ants towards the position of antlions. Now the antlion relocates the

position of best ants during the process of optimization, so that the search space will be saved properly. The movement intensity of ants will be decrease with the increase in number of iterations.

The search space location which is created is utilized by the antlion to guide the ants to the region. Each iteration's finest ant-lion will be kept and compared. The best solution is given by (3),

$$Ant_i^t = \frac{R_A^t + R_E^t + R_T^t}{2} \quad (3)$$

where R_A^t is the random walk of antlion selected using selection mechanism at t^{th}iteration, R_E^t random walk around the final stage at t^{th} iteration, the position of i^{th} ant at t^{th}iteration is Ant_i^t and R_T^t is the random walk of antlion selected using tournament mechanism at t^{th} iteration.

Hence the same process is applied in finding the best node to make it as a cluster head for transmission of data. This process of antlion optimization helps in forming the best chain of clusters and check for achieving minimum energy dissipation. During each round of communication, the node with the highest current energy is chosen as the cluster head. Starting from the end nodes, each node along the created chain and in the direction of the cluster head combines the received data (if any) with its own as one packet to broadcast to the other partner.

The cluster head is formed and the fitness evaluation of the identified cluster head is shown in (4) [25].

$$Fit_i = \beta_1.\left(\sum dis_{ij}\right) + \beta_2.E_{res}(i) + \beta_3.n_{neighbour}(i) + \beta_4.Eud_{i,BS} \quad (4)$$

Here $\beta_1, \beta_2, \beta_3$ and β_4 are constants between [0,1]$\sum dis_{ij}$ is the cumulative distance between node i and its neighbours. $n_{neighbour}(i)$ is the neighbour nodes for node i and the Euclidian distance between node i and base station is given by $Eud_{i,BS}$. The fitness function is calculated at every point of iteration for each ant and antlion. Algorithm 1 gives fitness function of ant lion and global best value.

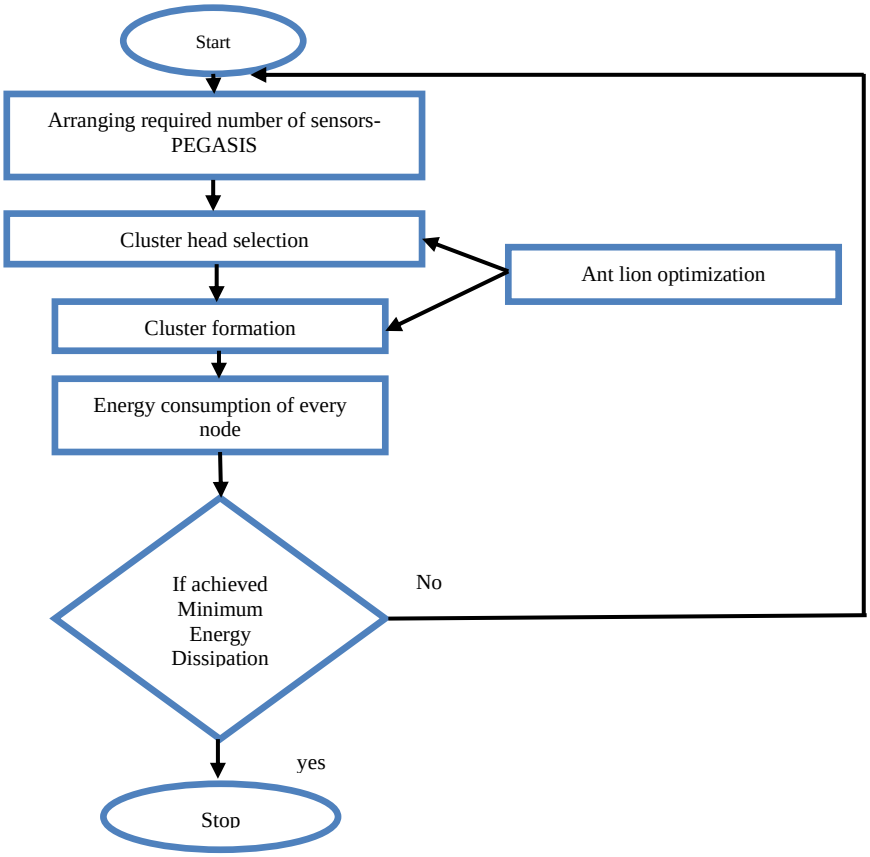

Figure 3. Flow diagram of proposed methodology

Algorithm 1. Ant lion optimization algorithm

```
Step 1: Initialize number of nodes, number of search agents, no of iterations.
Step 2: Initialization of the fitness function using (4).
Step 3: Initialization of ants positions and Antlions position.
Step 4: The sensor nodes are spread randomly with in the area utilized and BS is placed at
       (0,0)co-ordinate.
Step 5: The node distance is calculated among the nodes and its distance to BS.
Step 6: Evaluating the fitness function of antlion and obtain the best one.
Step 7: While (Current Iteration<No. of Generation)
              for each ant in the population
                   The Position is updated towards the Elite Antlion and a randomly
                   selected Antlion using (1) and (3)
                   min-max normalization is used to keep the ants in random walks inside
                   the search space using (4)
                   Calculate the fitness value of each ant using (4) and sort them
              End
           Merge the populations of ants and antlions and sort them
           Create new Antlion population based on the above sorted fitness value
           Select the best Antlion and mark it as Elite based on its fitness value
         End while
Step 8: Optimal value is identified by the global best value.
Step 9: The sensor node with the highest value obtained using (4) is designated as CH, and
its neighbours are joined as cluster members to create a cluster, and the process is
repeated with the other sensor nodes.
Step 10: Ending the process
```

4. RESULTS AND DISCUSSION

The simulation results are obtained using MATLAB tool. The environment consists of 100 nodes with a network size of 100×100 meters. The comparison is done between energy efficient PEGASIS and swarm energy efficient PEGASIS (SSE-PEG). By applying modified swarm optimization technique, the network life time is increased and is shown in below simulation results. The parameters considered for performing simulation operation is shown in Table 1. For the parameters shown in Table 1, the obtained simulation results are shown in Figures 4 and 5.

Table 1. Parameters set for simulation

Parameter	Value
Size of the network	100×100 meters
Nodes in network	100 numbers
Starting energy of node	0.5 J
Total energy for transmitting and receiving of data	50 J
Distance between the available nodes	50 m
Data considered for transferring	2000 bits

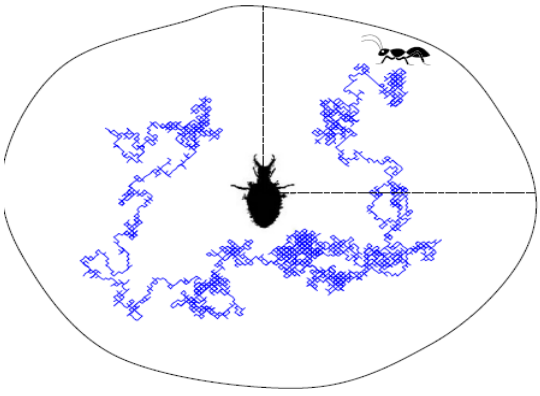

Figure 4. Random walk of an Ant inside the Antlion trap region

4.1. Case α

The performance output shown in Figure 5 is considered for 100 number of nodes. The starting energy of node is 0.5 J and the total energy for transmitting and receiving of data is 50 J. The distance

between available nodes is 50 m and data considered for transferring is 2,000 bits. By these results network lifetime is increased.

From Figure 6 it is shown that proposed swarm optimization as good level of energy compared to EE-PEGASIS. If we consider 2,000 rounds for comparison the energy remained using ALEE-PEG is 38 J, modified SEE-PEGASIS is around 10 J, whereas energy remained using EE-PEGASIS is 4 J. The energy becomes zero when 3,500 rounds are done for EE-PEGASIS, whereas the energy remained upto 5,000 rounds using modified SEE-PEGASIS, using ALEE-PEG the energy remained upto 6,500 number of rounds.

From Figure 7 it is shown that using ALO alive nodes at 5,000 rounds is 12 nodes, whereas in swarm optimization the number of alive nodes is 4 nodes and EE-PEGASIS approach the number of alive nodes are 0 nodes. This shows the nodes death rate is slow in proposed techniques compared to the existing technique. From Figure 8 it is shown that all the nodes are dead at around 4,600 nodes using EE-PEGASIS, modified SEE-PEGASIS the nodes are dead around 5,500 rounds, whereas using ALEE-PEG the nodes complete zero after 8,000 rounds. The number of rounds is increased using proposed technique by which the data transmitting rate will be increased.

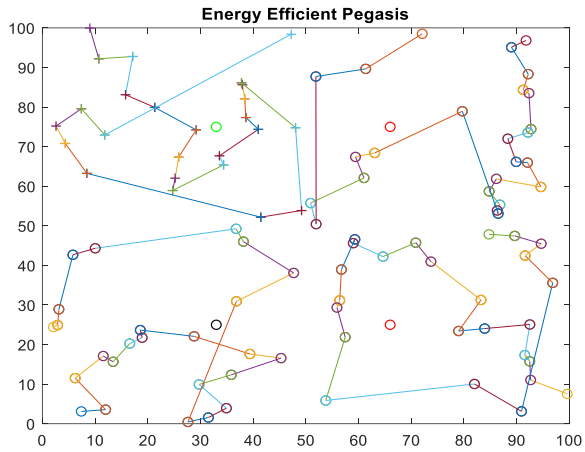

Figure 5. Sensor node distribution

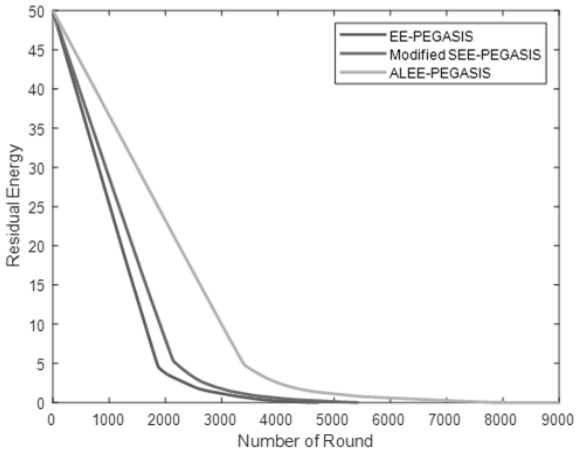

Figure 6. Residual energy (J) vs no of rounds

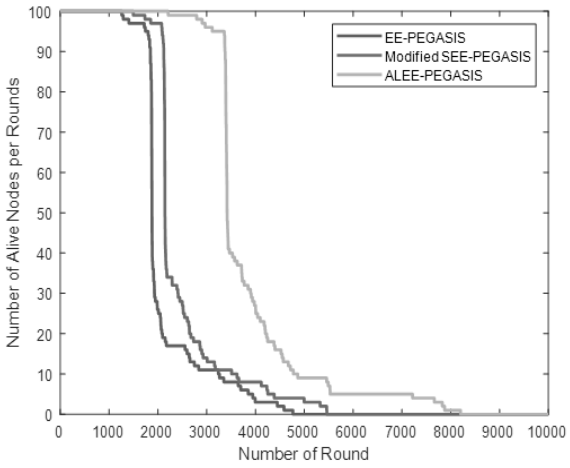

Figure 7. No of alive nodes vs no of rounds

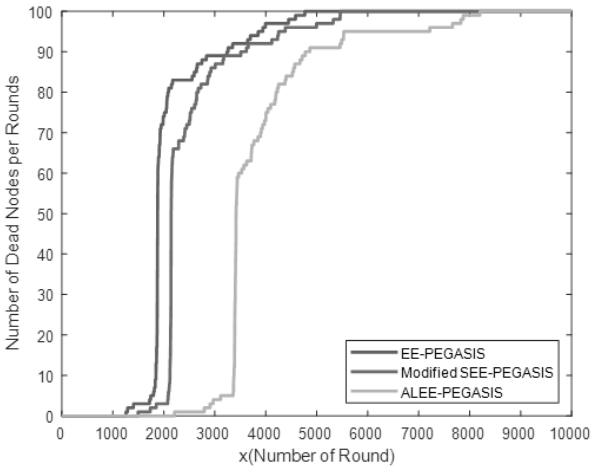

Figure 8. Number of dead nodes vs number of rounds

4.2. Case 2

The performance results obtained using 200 number of nodes are shown below. From Figure 9 it is shown that using ALO alive nodes are 60 nodes after reaching 5,000 rounds whereas in swarm optimization the number of alive nodes is 20 nodes and EE-PEGASIS approach the number of alive nodes are 10 nodes. These shows the alive nodes are more active in proposed techniques compared to the existing technique.

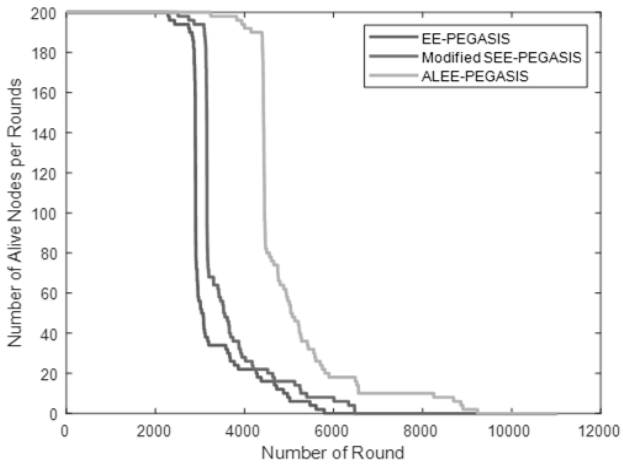

Figure 9. Number of alive nodes vs number of rounds

From Figure 10 it is shown that the nodes are completely dead after 9,200 rounds using ALEE-PEG techniques, whereas using modified swarm optimization the nodes are completely dead after 6,200 round and using EE-PEGASIS the nodes are completely dead after reaching 5,000 rounds. From Figure 11, if we consider 5,000 rounds for comparison the energy remained using ALEE-PEG is 28 J, modified SEE-PEGASIS is around 10 J, whereas energy remained using EE-PEGASIS is 3 J.

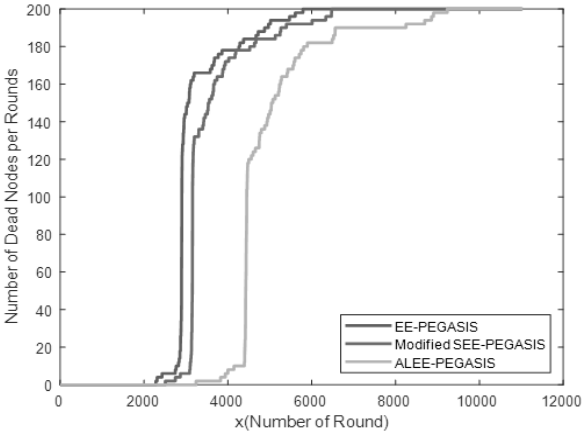

Figure 10. Number of dead nodes vs number of rounds

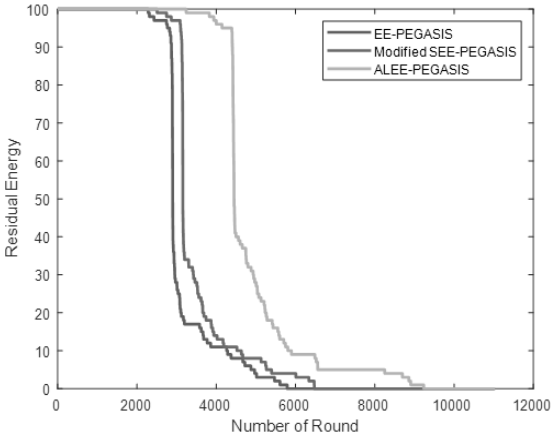

Figure 11. Residual energy vs number of rounds

4.3. Case 3

Considering 500 nodes the results obtained are shown in Figures 12-14. In Table 2 the comparison of results are shown. The parameters shown are residual energy, number of dead nodes and number of alive nodes. The values are tabulated by considering 2,500 number of rounds for 100 nodes.

From Table 2 it is clear that proposed ALEE-PEGASIS retains its energy level for a greater number of rounds and also the number of alive nodes is higher compared to existing method. The ALEE-PEGASIS is having residual energy of 18 J which is more when compared to residual energy of SEE-PEGASIS and EE-PEGASIS. The throughput percentage of ALEE-PEGASIS is better when compared to SEE-PEGASIS and EE-PEGASIS which is 89.7%.

The Table 3 values are tabulated by considering 5,000 number of rounds for 200 nodes. The number of alive nodes of ALEE-PEGASIS is more which is 54 when compared to SEE-PEGASIS and EE-PEGASIS. The number of dead nodes of ALEE-PEGASIS is 146 which is less when compared to SEE-PEGASIS and EE-PEGASIS. The delay time of ALEE-PEGASIS is 12.71 sec which is less when compared to SEE-PEGASIS and EE-PEGASIS.

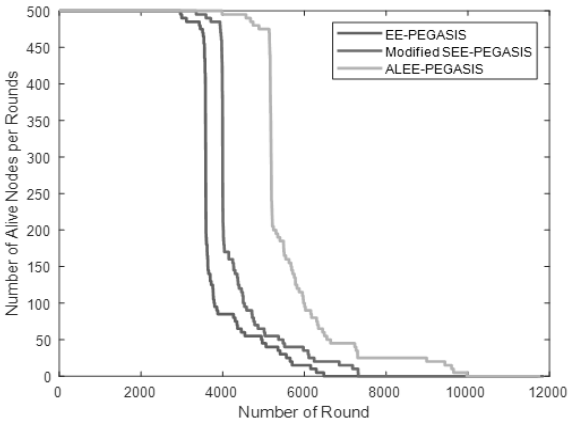

Figure 12. Number of alive nodes vs number of nodes

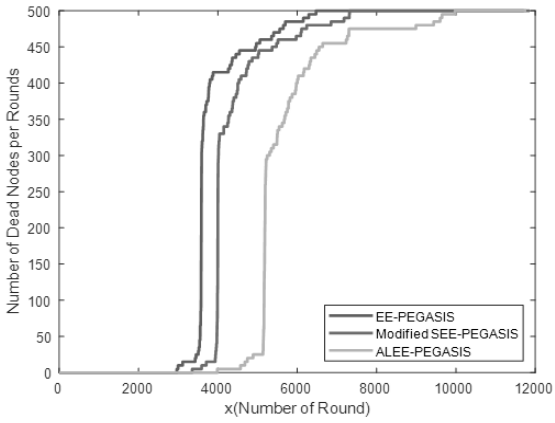

Figure 13. Number of dead nodes vs number of rounds

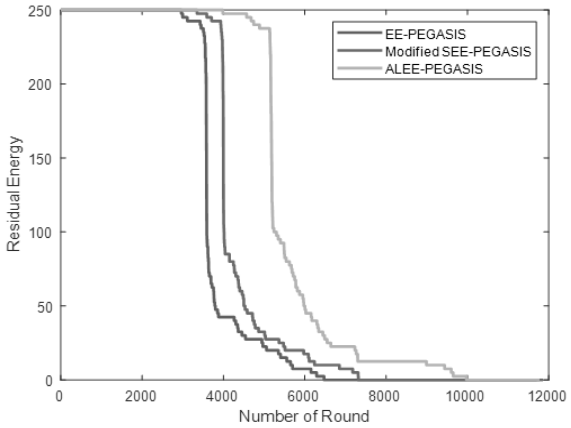

Figure 14. Residual energy vs number of nodes

Table 2. Results comparison for 100 nodes

Parameters	EE-PEGASIS	SEE-PEGASIS	ALEE-PEGASIS
Residual energy	3 J	9 J	18 J
Number of alive nodes	18	30	96
Number of dead nodes	82	70	04
Throughput (%)	82.96	86.3	89.7
Packet delivery ratio (%)	84.79	88.4	91.93
Delay (Sec)	18.87	17.11	13.75

Table 3. Results comparison for 200 nodes

Parameters	EE-PEGASIS	SEE-PEGASIS	ALEE-PEGASIS
Residual energy	4 J	10 J	27 J
Number of alive nodes	10	18	54
Number of dead nodes	190	182	146
Throughput (%)	82.87	86.49	89.84
Packet delivery ratio (%)	84.41	88.69	91.76
Delay (Sec)	17.39	16.44	12.71

The Table 4 values are tabulated by considering 6,000 number of rounds for 500 nodes. The packet delivery ratio of ALEE-PEGASIS is 91.81% which is more when compared to SEE-PEGASIS and EE-PEGASIS. The throughput percentage of ALEE-PEGASIS is 89.82% which is more when compared to SEE-PEGASIS and EE-PEGASIS. The delay time of ALEE-PEGASIS is 11.69 sec which is less when compared to SEE-PEGASIS and EE-PEGASIS.

Table 4. Results comparison for 500 nodes

Parameters	EE-PEGASIS	SEE-PEGASIS	ALEE-PEGASIS
Residual energy	10 J	25 J	65 J
Number of alive nodes	20	45	90
Number of dead nodes	480	455	410
Throughput (%)	82.89	86.65	89.82
Packet delivery ratio (%)	84.97	88.56	91.81
Delay (Sec)	16.93	15.07	11.69

From Table 5, the proposed improved ALO techniques provides high energy efficiency as the number of node present till 8,201 rounds performed by the wireless communication system while transmission of data. The first dead nodes, half dead nodes and last dead nodes at 100, 200 and 500 are shown in Table 5 by using ALEE-PEGASIS, SEE-PEGASIS and EE-PEGASIS. The last dead nodes of ALEE-PEGASIS is 9,976 which is more when compared to SEE-PEGASIS and EE-PEGASIS at 500 rounds. The half dead nodes of ALEE-PEGASIS is 5,194 which is more when compared to SEE-PEGASIS and EE-PEGASIS at 500 rounds. The first dead nodes of ALEE-PEGASIS is 3,986 which is more when compared to SEE-PEGASIS and EE-PEGASIS at 500 rounds. Similarly, ALEE-PEGASIS at 100 and 200 rounds for first dead nodes is 2,795 and 3,243, half dead nodes is 3,419 and 4,451 and for last dead nodes is 8,201 and 9,233 which are more compared to SEE-PEGASIS and EE-PEGASIS.

Table 5. The nodes status based on rounds

Parameters	EE-PEGASIS			SEE-PEGASIS			ALEE-PEGASIS		
	100	200	500	100	200	500	100	200	500
First dead nodes	1,490	2,283	2,966	1,735	2,509	3,352	2,795	3,243	3,986
Half dead nodes	2,079	2,903	3,586	2,345	3,158	4,401	3,419	4,451	5,194
Last dead nodes	4,767	5,791	6,474	5,462	6,475	7,318	8,201	9,233	9,976

5. CONCLUSION

PEGASIS protocol is one of the best protocols which is introduced in wireless sensor networks. Improvements have risen through this mechanism and model. Further optimization techniques are combining with PEGASIS protocol to enhance the network efficiency. In this paper, to build the PEGASIS protocol chain, we provided a routing protocol that used an enhanced ALO. We present our protocol's concept in detail, and show how our protocol outperforms EE-PEGASIS and SEE-PEG using a simulated experiment in MATLAB. In order to enhance the network life time new metaheuristic algorithm is designed. The results obtained using Improved ALEE-PEG is better compared to other techniques in minimizing the energy consumption of the network.

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Fractional Order Differentiators and Integrators Design using Transform Techniques

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Abstract:- The design of fractional order differentiators and integrators (FODI) using is the main objective of this paper. In this indirect discretization scheme based Al-Alaoui and Tustin operators used to design a novel FODIs. Firstly, fifth ordr rational approximations in the s-domain are used and finally, discretized using more popular s-to-z transforms to acheive the new FODIs. The performances of proposed FODIs are well compared with the continued fractionan expansion (CFE) approximation based ones. Fractional order differentiators and integrators of order 0.5 and 0.25 are designed by using indirect discretization. Matlab simulation software is used to obtain the magnitude, phase responses and normalized magnitude error (NME) plots of the digital differentiators and integrators.It is noted that the designed digital integrators and differentiators are accurate ntemd of magnitude and NME.

Keywords: *Discretization, Al-Alaoui operator, Continued frcation expansion (CFE), NME.*

1. Introduction

Digital differentiators and integrators plays an important role in all engineering areas including digital image processing, control systems, communications, Radar, Bio-medical engineering and signal processing applications, etc[1]-[3]. Fractional differentiators and integrators are used to determine the time derivative and integral of a signal to an arbitrary order. The fractional order system contains infinite memory, whereas regular integer order system involve with finite memory. So, these are used in the modeling electrical and mechanical properties of materials, transmission line theory, rheology of soils and quantum mechanical calculations etc. The frequency response of fractional order differ-integrators are defined as [3],[9]

$$H(j\omega) = (j\omega)^{\pm\alpha} \qquad (1)$$

Where $j^2 = -1$ is a complex constant and$\alpha$is the fractional order. The positive sign for differentiator and negative sign used for integrator operations. Discretization is the key factor in the design of fractional order differ-integrators. Basically, direct and indirect discretization techniques are used. Direct discretization means direct expansion of s^{α} by using any one of series expansion techniques like Taylor series expansion (TSE), binomial series expansion (BSE) and continued fraction expansion (CFE) etc. Two step procedure involved in the indirect discretization. Firstly obtain the rational transfer function in the continuous domain and truncated to some finite order. Finally use s-to-z transform to obtain the digital transfer function.
Direct discretization of integer order s-to-z transformation like Al-Alaoui, reduced order and interpolated tarnsformsusing continued fraction expansion presented in [12]-[14]. Fractional order differentiators and integrators are designed by using indirect discretization technique are explained in [3],[11]. Drect discretization with series expansion and CFE schemes are proposed by Chen and et al.,[13] to design the fractional order differentiators and integrators . Both particle swarm optimization (PSO) and indirect discretization are used in the design of fractional order integrators and differentiators are presented in [10]. The fractional order differentiators design using model order procedure presented in [5], which are suitable to the low frequency applications. Low frequency suitable fractional differ-integratirs presented with the application of reducdeorder s-to-z transforms presented in [12],[15]. Sparten 3E field programmable implementation (FPGA) of fractional differ-integrators of order 1/2, 1/3 and 1/4 are explained in [14].

In the literature several s-to-z transforms are available, which are used in the discretization process. The more popular wide band recursive integrators and differentiators are bilinear [2], Al-Alaoui [4], interpolated transforms [6],[7], reduced order tansforms [9] and etc. Based on the Newton- Cotes integration rules, Al-Alaoui proposed different transform namely two segment rule, three segment rule and four segment rule [7].
Now a days most of the researchers concentrayes on the fractional calculas due to its wide applications in microwave theory, biomedical image processing, biomedical signal processing, control theory and etc. Recently, SaeedBalochian et al., applied a Prewitt operator with fractional order differentiator for detection of edges in an image. The fractional order differentitor not only calculate the derivative of an image but also eliminate the noise. The proposed method compared with the existing traditional approaches by performing experimentation on sample images. So, the fractional order differentiators are promising potentiality for edge detection of medical images [8]. In [9], developed the mathematical models of DFODs of half, one third and one-fourth fractional orders, which are well worked at the low frequency region. The proposed designs are also applied to the images for edge detection and were superior in terms of mean square error (MSE) compared to the well existed conventional approaches as Prewitt and Canny operators .
In this context, an attempt made to design the digital fractional differentiators and integrators with the help of indirect discretization approach. The efficacy compared with the help of designed dfifferentiators magnitude and normalized magnitude error (NME) plots.
The brief of this paper is as follows. Section 2 presents the fifth order analog rational approximations using continued fraction expansion (CFE) methods. Design of fractional order digital differentiators and integrators of order 1/2 and 1/4 are given in section 3. The simulation results of proposed schemes are explained in section 3. Fiallyconculsion remarks are explained in section 5.

2. Rational Approximations of s^{α}

The fifth order analog rational approximation of $s^{1/2}$ and $s^{1/4}$with the application of continued fraction expansion (CFE) given as [3]

$$s^{1/2} = \frac{11s^5 + 165s^4 + 462s^3 + 330s^2 + 55s + 1}{s^5 + 55s^4 + 330s^3 + 462s^2 + 165s + 1} \quad (2)$$

$$s^{1/4} = \frac{663s^5 + 12597s^4 + 41990s^3 + 35530s^2 + 7315s + 209}{209s^5 + 7315s^4 + 35530s^3 + 41990s^2 + 12597s + 663} \quad (3)$$

The proposed $s^{1/2}$ and $s^{1/4}$ approximation as

$$s^{1/2} = \frac{55.38s^5 + 1.33X10^4s^4 + 1.18X10^5s^3 + 6.151X10^4s^2 + 1533s + 1}{s^5 + 1533s^4 + 6.151X10^4s^3 + 1.18X10^5s^2 + 1.33X10^4s + 5538} \quad (4)$$

$$s^{1/4} = \frac{7.058s^5 + 2627s^4 + 3.415X10^4s^3 + 2.484X10^4s^2 + 909.5s + 1}{s^5 + 909.5s^4 + 2.484X10^4s^3 + 3.415X10^4s^2 + 2627s + 7.058} \quad (5)$$

3. Fractional order Differentiators and Integrators

The s-to-z transform plays a vital role in the design of fractional order differentiators as well integrators.
The well known bilinear operator expressed in Eqn. (6) as

$$s = \frac{2}{T}\frac{1 - z^{-1}}{1 + z^{-1}} \quad (6)$$

Where T is the sampling period. The interpolation of rectangular differentiator and Tustin tansformation are well known as Al-Alaoui operator, which is defined as

$$s = \frac{8}{7T}\frac{1 - z^{-1}}{1 + \frac{1}{7}z^{-1}} \quad (7)$$

The half order fractional digital differentiator obtained by substituting bilinear (BLT) and Al-Alaoui operators (Eqns. (6) and (7)) in Eqns. (2) and (4). The transfer function of half order differentiators can be expressed as

$$H(z) = \frac{p_0 + p_1 z^{-1} + p_2 z^{-2} + p_3 z^{-3} + p_4 z^{-4} + p_5 z^{-5}}{q_0 + q_1 z^{-1} + q_2 z^{-2} + q_3 z^{-3} + q_4 z^{-4} + q_5 z^{-5}} \quad (8)$$

Where p_0, p_1,…,p_5 and q_0, q_1,…,q_5 are the numerator and denominator coefficients respectively. The coeffients for the half order differentiators for the designed methods are listed in Table 1. The half order integrator coefficients obtained by interchanding the roles of nememerator and denominator coefficients.

Table 1. Coeffients of half order digital differentiatos

Coefficients	CFE+BLT	CFE+Al-Alaoui	TF2+BLT	TF2+Al-Alaoui
p_0	8119	24999391	1.386472536	1.065266379
p_1	-11721	-63334707	-1.31589075120437	-2.62743326630872
p_2	-1002	55367574	-1.90153174971432	1.97450157477320
p_3	6302	-18716230	1.77059448490759	-0.317278199173139
p_4	-1469	1617211	0.543002372488472	-0.0941854068477530
p_5	-197	99529	-0.482615374555945	-0.000863693255846634
q_0	5741	23384789	1	1
q_1	-2547	-45881457	-0.0135400005464419	-1.92554361644233
q_2	-6126	27482610	-1.79753620074584	0.900190090852817
q_3	2474	-4184962	0.0357036983660851	0.0719090153005021
q_4	1073	-492343	0.798913218732459	-0.0421314314943641
q_5	-263	51811	-0.0217952533183002	-0.00401477996511390

Similarly, the one-fourth order fractional digital differentiator obtained by substituting bilinear (BLT) and Al-Alaoui operators (Eqns. (6) and (7)) in Eqns. (3) and (5). The transfer function of one-fourth order differentiators can be expressed as

$$H(z) = \frac{b_0 + b_1 z^{-1} + b_2 z^{-2} + b_3 z^{-3} + b_4 z^{-4} + b_5 z^{-5}}{c_0 + c_1 z^{-1} + c_2 z^{-2} + c_3 z^{-3} + c_4 z^{-4} + c_5 z^{-5}} \quad (9)$$

Where b_0, b,…,b_5 and c, c_1,…,c_5 are the numerator and denominator coefficients respectively. The coeffients for the one-fourth order differentiators for the designed methods are listed in Table 2. The one-fourth order integrator coefficients obtained by interchanding the roles of nememerator and denominator coefficients.

Table 2. Coeffients of one fourth order digital differentiatos

Coefficients	CFE+BLT	CFE+Al-Alaoui	TF2+BLT	TF2+Al-Alaoui
b_0	715647	2360325231	1.173082336	1.031421994
b_1	-859601	-5644455299	-0.832298316722478	-2.40181596013697
b_2	-309466	4553637686	-1.84463371351520	1.63364971078860
b_3	551374	-1341809894	1.19904092564786	-0.170610164321364
b_4	-63381	68561931	0.681771121595898	-0.0889159929976232
b_5	-27885	10588857	-0.376872254052727	-0.00370698231342771
c_0	601785	2282831529	1	1
c_1	-421943	-4806900149	-0.253793857164856	-2.06399406115084
c_2	-546422	3217087162	-1.77561785934471	1.11785317287386
c_3	356002	-651189386	0.401465675714079	0.0114667543194370
c_4	62253	-27613587	0.777377401805107	-0.0604331088071246
c_5	-30459	7509615	-0.148795442596720	-0.00473320499688730

4. Results

The magnitude, phase responses and normalized magnitude error plots for the fractional order differentiaators for an order 1/2 are shown in Figs.1-3. The fractional differentiator of order 1/2 by using connued fraction expansion (CFE) and transfer function (TF2) approximation with Al-Alaoui transforms are more effective compared to the bilear (BLT) based designs. Moreover, the transfer function 2 based one is more accurate compared to the CFE based design upto the freqncy range of 2 rad. Figures 4 to 6 shows the 1/4 fractional order differentiators magnitude, phase and NME plots. From Fig. 6, it is clear that the transfer function 2 (TF2) based Al-Alaoui operator are more effective than the other designs upto to the frequency range of 2 rad.

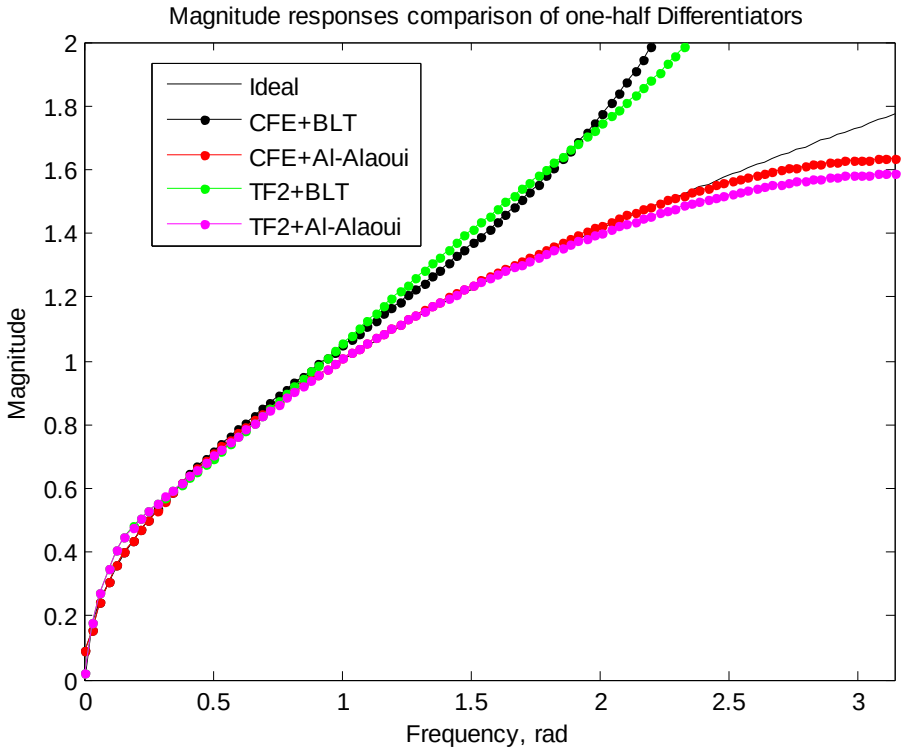

Fig. 1. Magnitude response of half order differentiators

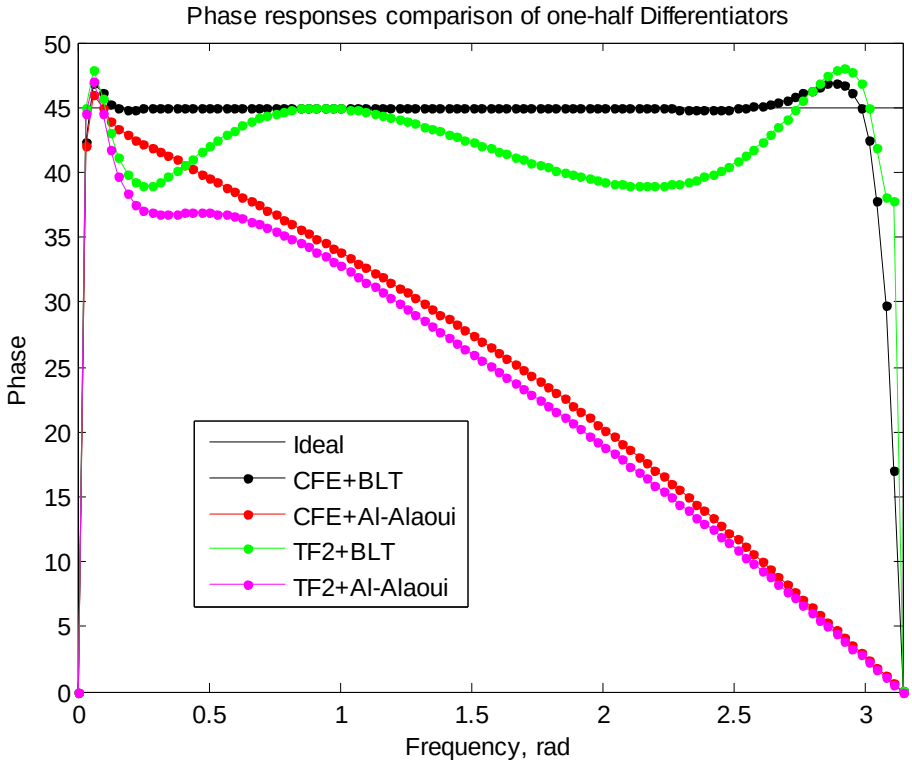

Fig. 2. Phase response of half order differentiators

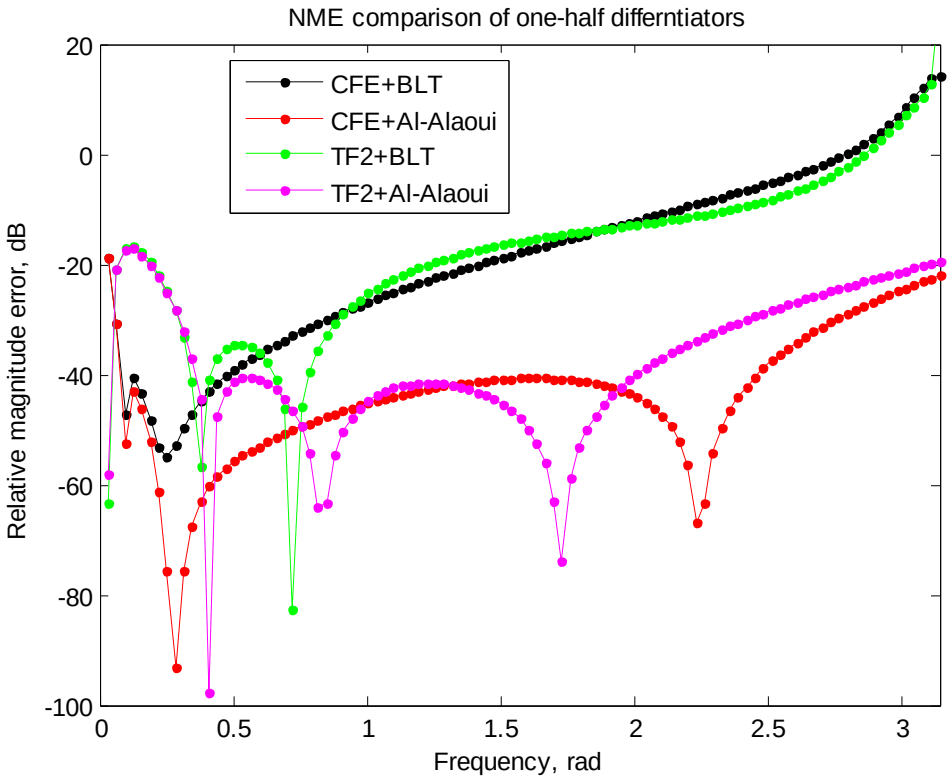

Fig. 3. NME plot of the half differentiators

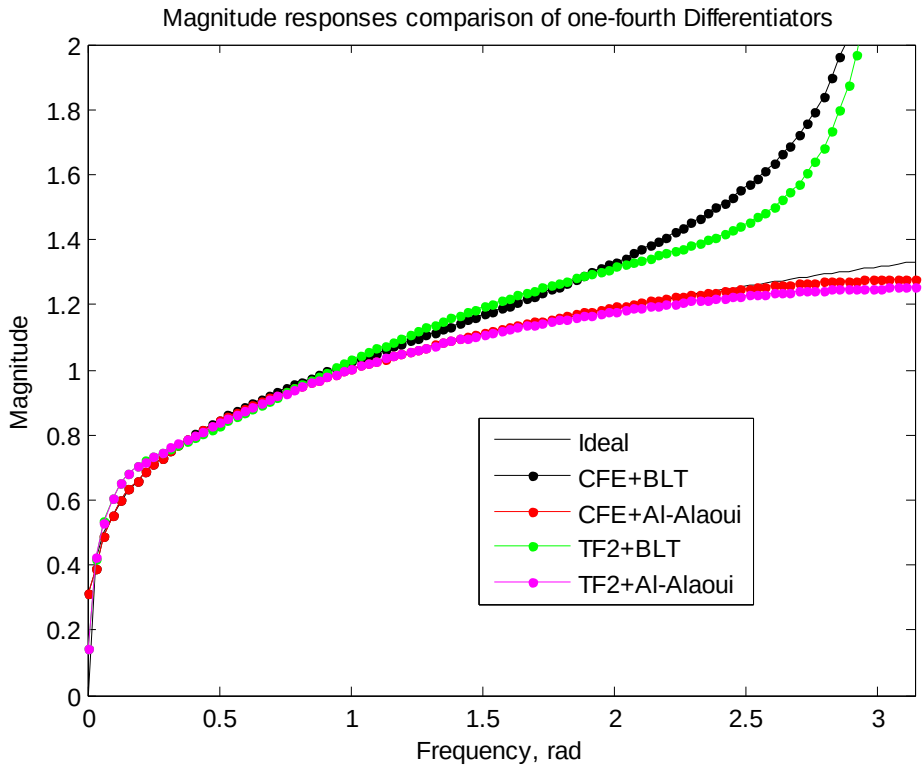

Fig. 4. Magnitude response of one-fourth differentiators

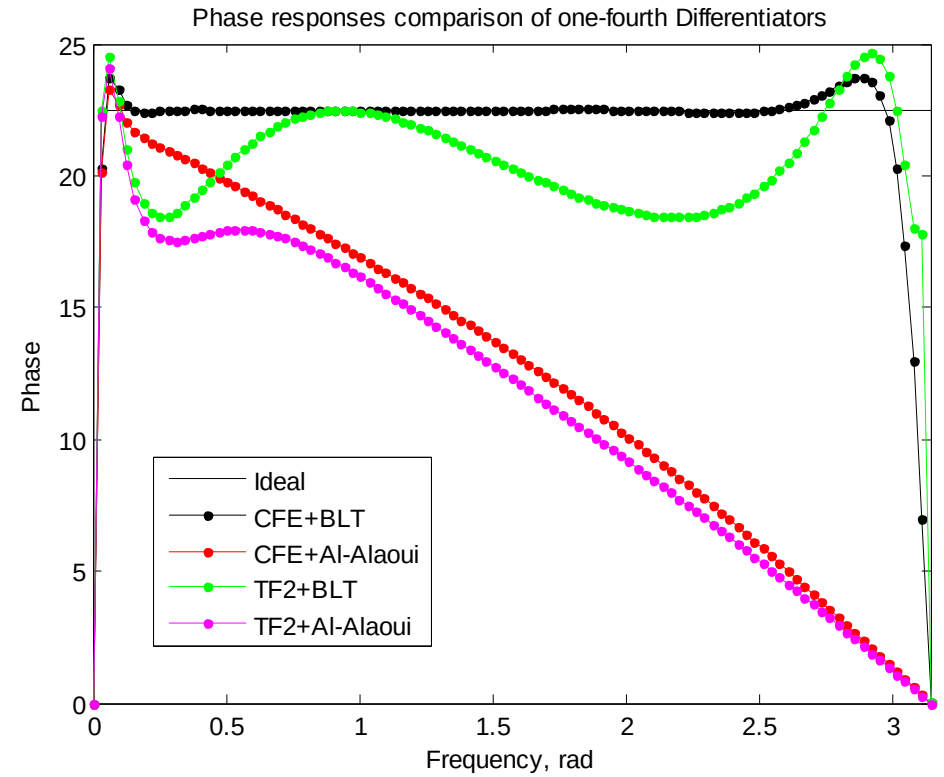

Fig. 5. Phase response of one-fourth differentiators

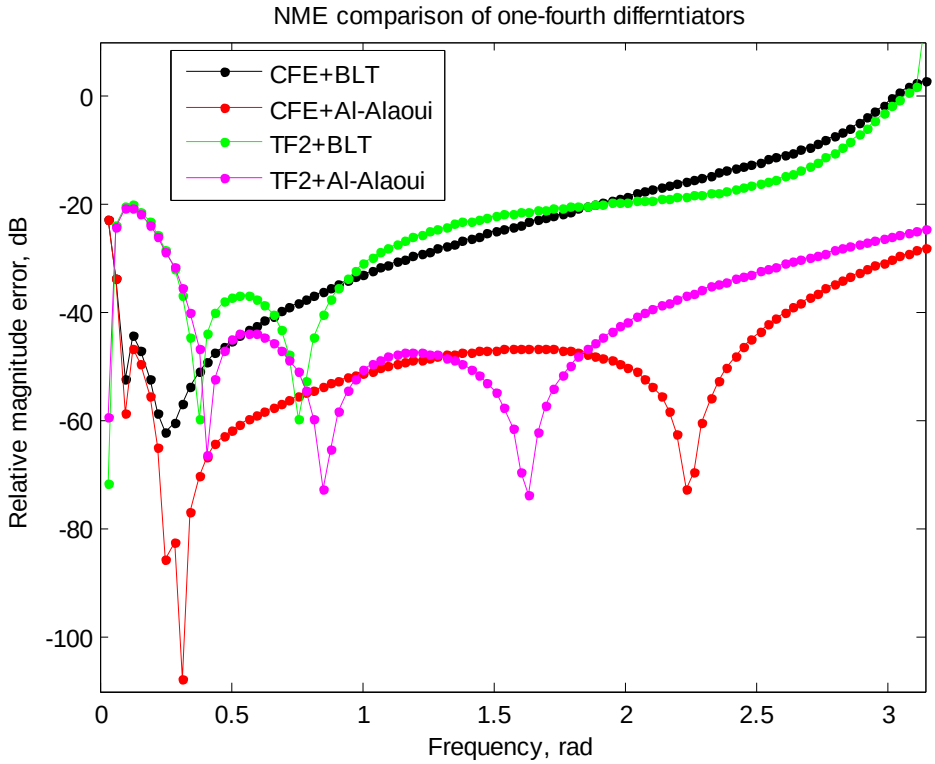

Fig. 6. NME plots of one-fourth differentiators

4. Discussion

The fractional order digital differentiators of order 1/2 and 1/4 are obtained by use of indirect discretization using Tustin and Al-Aloui operators. The magnitude, phase and normalized magnitude error plots are obtained by using MATLAB simulation software. The transfer function (TF2) approximation with the application of Al-Aloui transform are more accurate upto the fraequency range of 2 rad compared to the Tustin ans CFE with Al-Aloui based ones.

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DEEP LEARNING MODEL FOR RECOGNITION OF HANDWRITTEN NUMERALS WITH LOW COMPUTATIONAL COMPLEXITY AND SPACE

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ABSTRACT

Traditional systems of handwritten Digit Recognition have depended on handcrafted functions and a massive amount of previous knowledge. Training a Optical character recognition (OCR) system primarily based totally on those stipulations is a hard task. Research in the handwriting recognition subject is centered on deep learning strategies and has accomplished breakthrough overall performance in the previous couple of years. Convolutional neural networks (CNNs) are very powerful in perceiving the structure of handwritten digits in ways that assist in automated extraction of features and make CNN the most appropriate technique for solving handwriting recognition problems. Here, our goal is to attain similar accuracy through the use of a pure CNN structure. CNN structure is proposed to be able to attain accuracy even higher than that of ensemble architectures, alongside decreased operational complexity and price. The proposed method gives 99.87 accuracy for real-world handwritten digit prediction with less than 0.1 % loss on training with 60000 digits while 10000 under validation

Keywords: Hand written, Optical, Character, Recognition, Constitutional, alongside

1.0 INTRODUCTION

Deep Learning is a supplementary part of machine learning algorithms and hence categorized in wider section of artificial intelligence. Digit Recognition is nothing but recognizing the digits in any document. Digit recognition framework is simply the working of a machine to prepare interpret the digits. Handwritten Digit Recognition is the capacity of a computer to interpret the manually written digits from different sources like messages, bank cheques, papers, pictures, and so forth and in various situations for web based handwriting recognition on PC tablets, handling bank cheques, digits entered in any forms etc.

Machine Learning provides several methods through which human efforts can be reduced in recognizing the manually written digits. Deep Learning is a supplementary part of machine learning method and hence categorized in wider section of artificial intelligence that trains computers to do what easily falls into place for people: learning through examples. With the utilization of deep learning methods, human attempts can be diminished in perceiving, learning, and recognizing. Using deep learning the computer learns to carry out classification works from pictures or contents from any document and many more. Deep Learning models can accomplish state of art accuracy, beyond the human level performance. The digit recognition model uses large datasets in order to recognize digits

from distinctive sources an ensemble model has been designed using a combination of multiple CNN models. The recognition experiment was carried out for MNIST digits, and an accuracy of 99.87% was reported. Handwriting recognition of digit has been around since the 1980s. The task of handwritten digit recognition, using a classifier, has extraordinary significance and use such as online digit recognition on PC tablets, recognize zip codes on mail, processing bank check amounts, numeric sections in structures filled up by hand (for example - tax forms) and so on. There are various challenges faced while attempting to solve this problem. The handwritten digits are not always of the same thickness, size, or orientation and position relative to the margins. The main objective was to actualize a pattern characterization method to perceive the handwritten digits provided in the MNIST data set of images of handwritten digits (0-9). CNN (convolutional neural network)smaller than number of channels. Figure. 1 Shows a regular Neural Network of 3 layers. It is a simple neural network consisting of one input one hidden and one output layer. Figure. 2 shows ConvNet which is formed of 3D layers. Each layer transforms 3D input volume to 3D output volume with Differentiable functions. As observed, fig 2 has image input of 3D shape with height, width and length.

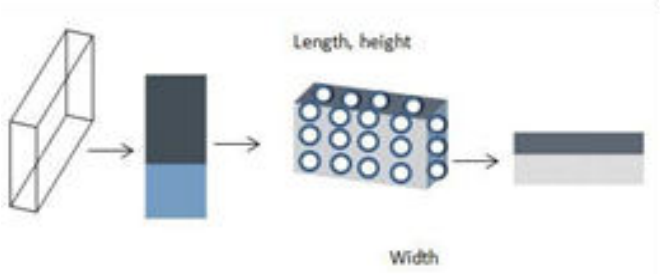


Figure 1. Architecture of Neural network

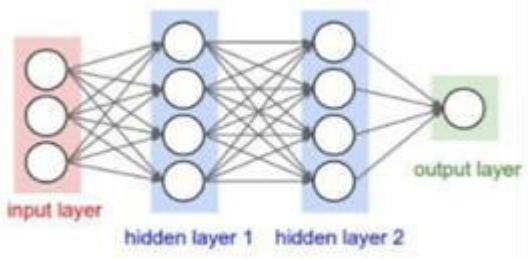


Figure 2. Architecture of Convolution neural network

2.0 **LITERATURE REVIEW**

Convolution means complex and hence a simple neural network is complex when it consists of many layers performing operations. Each layer performs dot product of input pixel and then passed to the next layer. These convolution layers are followed by soft max function (loss function) and then a fully connected layer. There are 3 important types of layer named: Convolution Layer, pooling layer, fully connected layer. The input is image of d x d x n size, where d is width and height and n stands for number of channels (for RGB its 3). Convolution layers has x filters having size f x f x g here f is smaller than the dimension of image and g can either be same or Digit Recognition is a noteworthy and vital issue. As the manually written digits aren't of a comparable size, thickness, position and direction, numerous difficulties need to be taken into consideration to decide the problem of

handwritten digit recognition. The distinctiveness and collection in the composition styles of numerous people additionally affect the instance and presence of the digits.An early attempt in the area of character recognition Research was done by Grimsdale in 1959.The foundation of a high-quality deal of research work in Bhagyashree P M et al Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol, July-August-2021, 7 (4) : 153-158 the early sixties was primarily based on an method called analysis-by-synthesis technique recommended by Eden in 1968.The great significance of Eden's work was that he formally proved that all handwritten characters are shaped through a finite quantity of schematic features, a factor that became implicitly included in preceding works. This perception was later utilized in all methods in syntactic (structural) strategies of character recognition. It is the approach for perceiving and arranging transcribed digits. It has a huge variety of applications, for example, programmed bank checks, postal locations and tax files and so on.The intention of this project is to put in force a classification algorithm to apprehend the handwritten digits with the use of Deep Learning.Deep Learning is a part of machine learning algorithms and therefore classified in wider segment of artificial intelligence. Deep learning numerous architecture offers with deep neural network, recurrent neural network, deep belief networks and these were applied to variety of fields of computer like speech recognition, machine translation, natural language processing, social network filtering, bioinformatics and drug designs. It is one of the most crucial types of deep learning. It offers with multi layers of neural network and as a result is most crucial set of rules to categorize pictures or handwritten symbols. Deep neural networks is a growing area which is efficient with GPUs as it takes large amount of information to process and consumes much less computation time.The final result of this work confirmed that the highest accuracy rate was 99.87% was obtained in MNIST dataset using deep learning approach and the best learning rate at 15000 iterations. It is determined that the accuracy slowly starts reducing or remains consistent after 15000 iterations. The overall performance ratio of GPU: CPU is observed to be 30:1.It is concluded that computation time in GPU exponentially decreases compared to CPU. Future works is targeted on further elevating the accuracy of recognition by improving pre-processing of information that is fed into deep convolution neural network. Moreover computation of overall performance can be raised by including more than one GPUs for execution. The after consequences of probably the most broadly utilized Machine Learning Algorithms like SVM, KNN and RFC and with Deep Learning calculation like multilayer CNN utilising Keras with Tensorflow. Using these, the accuracy of 99.87% is acquired whilst contrasted with 97.91% utilizing SVM, 96.67% utilising KNN, 96.89% utilising RFC was acquired. Handwritten Digit Recognition Using Deep Learning confirmed that using Deep Learning systems, provides the capacity to get a very high measure of accuracy. In addition, execution of CNN utilising Tensorflow offers a stunningly better result of 99.87%. Despite the fact that the hardship of the procedure and codes seems to be extra whilst contrasted with standard Machine Learning algorithms yet the accuracy is increasingly obvious. Different researchers have worked on different methods during the seven decades and have proposed different methods for pre-processing, segmentation, recognition and

post processing. Different methods like labelling schema for syntactic description of the pictures, syntax directed interpretation of different classes of pictures, description and generation based, synthesis method have been used during the decade of sixties. Rules modification on the basis of experience, split and merge algorithm, syntactic pattern recognition by boundary approximation using polygons on the basis of concavity and adaptive threshold methods have been applied during seventies. Work on writing slant, structured segment matching, fuzzy set, statistical, time delay and sliding window have been carried out during eighties. Works on vast areas in this field have been carried out in nineties. During this period the works that have been carried out are based on principal component analysis, modular concept, thinning method, segmentation by analyzing stroke shapes, pre-processing, back propagation, morphological filtering, OCR, HMM, binarization, chain coding, recognition methods using Eigen values, post processing, weighted least squares to correct baseline skew, multiple directional feature extraction and cascade neural First decade of the 21st century has evidenced different works on the methods based on multi expert framework for character recognition, neuro heuristic approach, HMM, OCR, feature extraction, genetic processing,MLP etc. The work that has been carried out during the current decade is based on diagonal based feature extraction, SVM classifier, fuzzy, probabilistic neural network, zone based method, and distribution based method, sliding window and Eigen value.

PROBLEM STATEMENT

The goal of this project is to create a model that will be able to detect and identify the handwritten digits from its image by using the concepts of Convolution Neural Network. Though the task is to create a model which can recognize the digits, it can be extended to letters and an individual's handwriting. The major goal of the proposed system is understanding Convolutional Neural Network, and applying it to the handwritten recognition system. shown in Figure 4, pre-processing, Data Encoding, Model Construction, Training & Validation, Model Evaluation & Prediction. Since the loading dataset is necessary for any process, all the steps come after it.

Figure 3. Sample MNIST data

3.1 DigitModel (): This function loads a pre-trained deep learning model for recognizing handwritten digits from files (digits_cnn_model.json and digits_cnn_weights.h5) and prints its summary.

3.2 SentimentModel(): This function loads pre-trained deep learning models for text and image-based sentiment detection from files (sentimentModel.pkl and _mini_XCEPTION.106-0.65.hdf5) and prints the summary of the image-based sentiment model.

3.3 DigitRecognize(): This function allows the user to upload a test image, preprocesses it, feeds it into the loaded digit recognition model, and displays the predicted digit along with the input image.

3.4 A. Pre-Processing

After loading the data, the data is separated into X and y where X is the image, and y is the label corresponding to X. As shown in figure 5, the first layer or input layer for our model is convolution. Convolution takes each pixel as a neuron, and so we need to reshape the images such that each pixel value is in its own space, thus converting a 28x28 matrix of greyscale values into 28x28x1 tensor. With the right dimensions for all the images, it split the images into train and test for further steps.

4. Methodology

In this paper, we used MNIST as a primary dataset to train the model, and it consists of 70,000 handwritten raster images from 250 different sources out of which 60,000 are used for training, and the rest are used for training validation. MNIST data is represented in the IDX file format and are look like in figure 3. Our proposed method mainly separated into stages, as

A. Data Encoding

This is an optional step since we are using the cross-categorical entropy as loss function; we have to specify the network that the given labels are categorical in nature.

B. Model Construction

After data encoding, the images and labels are ready to be fitted into the model. The model is composed of feature extraction with convolution and binary classification. Convolution and max-pooling are carried out to extract the features in the image, and a 32 3x3 convolution filters are applied to a 28x28 image followed by a max-pooling layer of 2x2 pooling size followed by another convolution layer with 64 3x3 filters. In the end, we obtain 7x7 images to flatten. Flatten layer will flatten the 7x7 images into a series of 128 values that will be mapped to a dense layer of 128 neurons that are connected to the categorical output layer of 10 neurons.

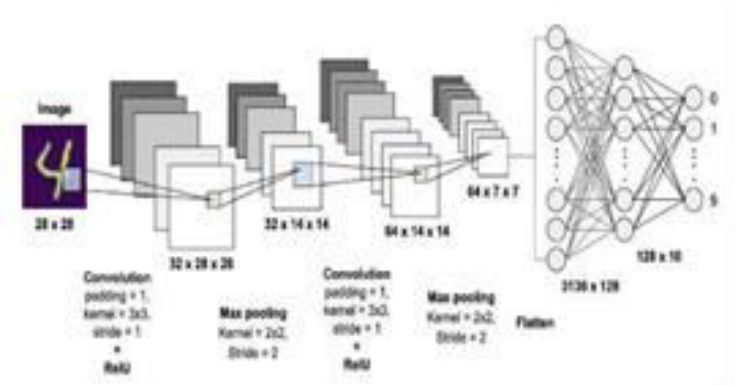


Figure 5. Proposed model

C. Training & Validation

After building the model, we compiled a model with adam optimizer and particular cross-entropy loss function, which are standard in making a CNN. Once the model is successfully assembled, then we can train the model with training data for 100 iterations, but as the numbers of iteration increases, there is a chance for overfitting.

D. Model Evaluation & Prediction

For real-world image classification prediction, we need to do an image pre-processing on the real-world images as model training was done with greyscale raster images. The steps of image pre-processing are

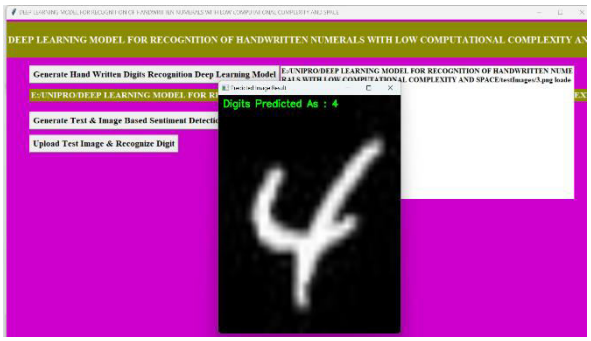
- Loading image
- Convert the image to greyscale
- Resize the image to 28x28
- Converting the image into a matrix form
- Reshape the matrix into 28x28x1

After pre-processing, we predict the label of the image by passing the pre-processed image through the neural network. The output we get is a list of 10 activation values 0 to 9, respectively. The position having the highest value is the predicted label for the image.

5. RESULT

The experiment was conducted on handwritten digits of the standard kaggle dataset using the CNN classifier for training the machine. For this, the MNIST database of handwritten digits was used. This dataset has a training set of 60,000 examples, and a test set of 10,000 examples. The model will get trained from 60,000 inputs and then it will check for accuracy of the model on 10,000 test set examples. Keras library is used with a Tensorflow backend for building the model and will download the dataset from Keras itself. Trained the model in 12 epoches and got accuracy of 99.87% and test loss of 0.043464561576.

In above screen Deep learning CNN model recognige the digit 3



In above screen Deep learning CNN model recognige the digit 4

6. CONCLUSION

This paper attempts to use deep learning tools to train a classifier to recognize handwritten digits. Also, the use of techniques in Computer Vision was explored to investigate the effect of selection image preprocessing, feature extraction and classifiers on the overall accuracy. The dataset used for the experiment is MNIST dataset originally constituted of 60,000 training, and 10,000 testing images which are x 28 grayscale (0-255) labeled and bitmap format. It is a brilliant database for machine learning and characters recognition methods while taking minimal efforts in preprocessing and formatting. It can be seen from the experimental results that CNN is much better than other classifiers.

7. FUTURE SCOPE

In this paper, the complex recognition problem associated with handwriting is an interesting topic for future research areas. Handwritten digit recognition system can be extended to a recognition system that can also able to recognize handwritten character and handwritten symbols. Future studies might consider on hardware implementation of recognition system For instance, when some anonymous pieces of handwritten digit are found at a crime site, and it is possible to automatically identify **that the writer may be a "left-handed man," that** would reduce the set of suspects to be investigated. In general, these classification problems are extremely complex, since it is quite hard to detect which handwriting features correctly characterize each involved class. One clear example of this happens in the classification of gender. Even though the feminine writing is more circular and uniform than the masculine one, there are some examples which ma**sculine writing may exist with a "feminine"** appearance. This could be another exact topic in the field of handwritten digit recognition for future work.

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