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***Excerpt from the Proceeding of National Conference**

***National Conference on Open Data Sciences and Analytics II held at BIT 8-9 October 2018**

***National Conference on "Recent Innovations in Materials and Trends in Civil Engineering for Sustainable Construction (RICES-2019)" on 28th March 2019**

An Approach to Predict Heart Attack Disease in Health Care Using Classifiers in Cloud

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Abstract

Healthcare industries make use of data analytics to identify and diagnose several diseases. This technology supports a user oriented approach in discovering the patterns which are hidden in the data. Numerous amounts of data are being generated day to day. Data mining is most essential in extracting and decision making process and to provide the best support for doctors and patients. Most of the hospitals require large databases to store and process the data. Cloud is the cost effective method that supports in data collection and storage. This will help healthcare organizations to reduce cost and time in terms of looking for a database system. Data mining provides several techniques which can be applied in clinical diagnosis. In this paper, we provide a framework to predict heart attack diseases using Rule set classifier and Neuro-fuzzy classifier. Our proposed methodology will be a good decision making support system for doctors in medical information system.

Keywords: *Association Rule, Clustering, Cloud Computing, Classification, Decision Trees, Heart Disease, Healthcare, Knowledge discovery, Rule set classifier, Neuro-fuzzy classifier*

1. INTRODUCTION

Cloud computing plays a major role in supporting data collections and maintenance in health care industries. The two factors for efficient data analytics in huge patient's population are high volume storage and high throughput. Applying data analytics in cloud-based health services results in secure and privacy data processing. Healthcare organizations should maintain medical records in the cloud infrastructure. This can reduce the huge number of storage devices and maintenance in cost.
To meet with the current advancements in IT and to utilize cloud based services, hospitals should be committed to move from traditional paper based approach to electronic format. With this, the accuracy can be achieved. Policies should be enforced to manage the handling of healthcare data.

Data mining helps us to extract the data which provides meaningful information. Data mining supports to combine the statistical analysis of machine leaning with technologies related to database to pull out the hidden patterns and their relations. In building the predictive models, data mining can be used to detect unknown patterns and trends [8]. Data mining use two types of strategy: Supervised learning and unsupervised learning. Data mining is able to carry an evaluation of the courses in action confirm efficient through comparing and evaluation causes, symptoms and various treatments measures. The applications of data mining support data miners to extract from different set of problems in real-life healthcare industry whenever required. One of the best real life applications is effective working on a database which holds the medical records of heart disease. Several factors can be taken into account for the detection of a disease with its symptom. When a detection gets failed this leads to a false result this provides a path to erratic effects and failure of the system. In healthcare industries the techniques of data mining have been used to diagnose several human diseases such as Cancer, Diabetes, Heart diseases, etc., Healthcare organizations generate a large quantity of data and mining of this data is most essential. This makes the industries to deploy and maintain a large data repository. Cloud computing is an effective technology to maintain and process a large set of data so that industries may not rely on the huge data repository to be owned. Analytics prediction will be a big issue in future medical dataset. Challenges in maintaining these data repository systems can be solved by Cloud which also supports unlimited

data storage and the patient's data can also be shared between various healthcare Organizations [2,3]. The features of cloud and data mining in healthcare industry are given in the Fig. 1.

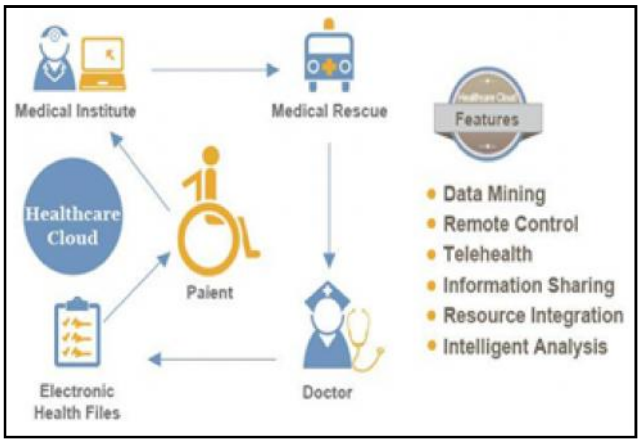

Fig.1 Features of cloud computing and mining in healthcare

2. RELATED WORK

Health Information Technology for Economic and Clinical Health (HITECH) Act motivated all the US healthcare organizations to move from the conventional paper-based to cloud based systems. Many of the nations like UK are also made a proposal to move from the conventional approach to an effective systematic approach to improve the patient's health related queries and diagnosis. By this cloud-based health care systems, we use a lesser amount of number of resources can be spent to hold multiple visits of patients; this can be made simple with just a computer interaction [7].

Numerous works related to diagnose heart diseases in data mining techniques motivated to work. A prediction model [17] IHDPS was proposed with the support of mining techniques such as neural networks, Naive bayes and Decision trees. IHDPS be competent of answering queries that the conventional DSS were not capable to do. Niti Guru et. al., proposed an approach to predict the heart disease, sugar and pressure with the support of neural networks. This was trained and tested with 13 variables as input such as pressure, age, blood level, etc.,

Carls Ordonez identified the difficulty with constrained association rules for heart diseases. The medical reports of people with the attributes of high risk factors have been assessed to predict the disease. Artery narrowing as a factor and moreover heart perfusion measurement was taken. Franck Le Duff et.al proposed a decision tree with the data collected from the physician. A major limitation of the process was knowledge acquisition and the necessitate to gather adequate data to generate an appropriate model. Kiyong Noh et.al proposed a method for the extraction of multi parametric features by assessing HRV from EGC.

2.1 Cloud Computing in Healthcare

Cloud Computing technologies was increased rapidly in the health care industries. The demand was increasing day by day. In delivering the most valuable medical services at low cost, cloud technologies are in demand in the health care environment. This is in a competition between various health care providers. Research clinics, doctors and several public health care organizations are looking for an alternative to offer the services with less cost. The problems that are faced by health care industries can be fulfilled by the advancements in cloud computing technologies. This would benefit healthcare organizations, doctor and patients all around the world. The various benefits of cloud computing in healthcare are shown in Figure 2.

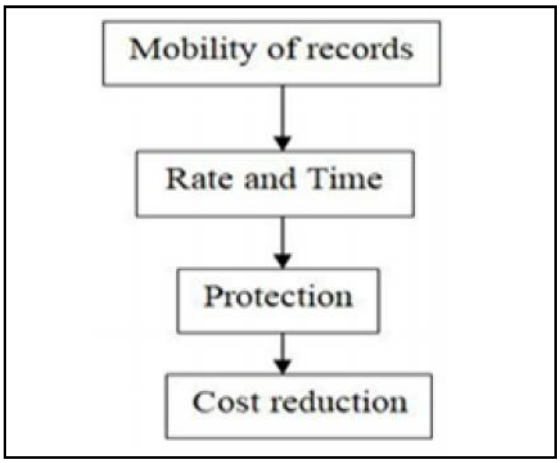

Fig. 2. Benefits of cloud computing in healthcare

Data analytics can be integrated with cloud to provide efficient prediction techniques in medical fields. Predicting diseases from huge data set is a challenging problem. Big Data Analytics provides a solution for data prediction and also processing huge data sets within a short period of time.

3. HEART DISEASES

Heart disease is enclosed with several types of diseases that have an effect on heart. Every 34 seconds one person dies with heart disease. Categories of heart disease are: Coronary heart disease, Cardiomyopathy disease and Cardiovascular disease.

3.1 Coronary Heart Diseases

It results in the narrowing of the coronary arteries by which there is a decrease of blood level and oxygen provided to the heart cardinal infarctions. Known as heart attacks, and angina pectoris or chest pain are encompassed in the CHD. When the blood received by the heart is inadequate with a sudden blockage of a coronary artery in because of blood clot which results in a heart attack chest pains.

3.2 Cardiomyopathy

This is the disease related to heart muscle. During this disease, the enlargement of heart muscles can be seen. In some cases, rarely scar tissue will replace the muscle tissue in the heart. Various types of cardiomyopathy are given in Figure 3.

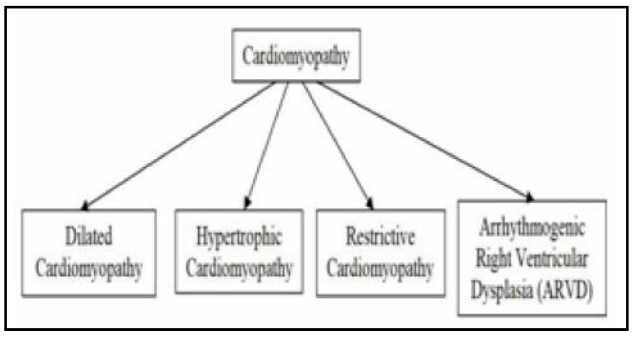

Fig.3 Cardiomyopathy

3.3 Cardiovascular Disease

Severe illness and disability are the results of this disease. In some cases, it leads to death. This disease affects blood vessels and the heart. Coronary artery disease, High blood pressure, valvular heart disease, rheumatic fever or stroke is the different forms of this disease.

4. DATA MINING TECHNIQUES IN HEALTHCARE

The techniques and algorithms of data mining can be used widely in healthcare industries for disease predication and diagnosis can be suggested, which can reduce the efforts of doctor in predicting the disease. With the benefits resulting from cloud-based healthcare systems, there are always issues related with secure authentication. Cloud service providers and healthcare organizations must have certain measures to handle and process the patient's medical data in a safe manner. Governments' rules and regulations are supposed to be in position to make sure that cloud service providers should act in accordance with the legislation and concern all necessary means to care for patients' data security and privacy. The benefits of storing by electronic means the report of patients have enlarged the productivity of patient care and easy accessibility and usage. The modern technological innovation in the health care is the discovery of cloud based Technology.

4.1 Rule Set Classifiers

Decision trees at complex level are difficult to understand and extract the information. A tree structure can be followed to classify the rule and also in confirming the symptom. A tree consists of a set of rules of the type, "IF P1 and P2 and P3 and ... then class X", the rules of each class will be combined in a group. We use a case to classify the findings, if the condition of the first rule is satisfied then that part will be treated else if rule is not satisfied them the default class is assigned.

5. IF condition THEN conclusion

This rule comprises of two blocks: IF block and THEN block. IF block will be the initial condition block which contains conditions about the value of the attributes used for prediction where as the THEN block contains the value used for prediction which is a goal attribute. Decision making process will be improved with this accurate prediction value. This IF-THEN is widely popular in data mining where decision making plays an important role.
(Indication) (Past... History) '! (Determinant ... of.... disease)

5.1 Neuro Fuzzy Classifiers

To construct fuzzy based neural network Stochastic back propagation algorithm was used. The steps involved in the construction process are:

- Random values are taken to initialize weight.
- Compute input and output value and also error rate for each unit.
- Calculate the certainty measure for each node. Based on the computed value, decision can be made.

The following conditions can be applied to compute the level of certainty.

IF CE <=0.1, THEN the certainty is very less.

IF 0.1 <= CE <= 0.4, THEN the certainty is less.
IF 0.4 <= C <= 0.6, THEN the certainty is average.
IF 0.6 <= C <= 0.8, THEN the certainty is High.
IF 0.8 <= C <= 1, THEN the certainty is very high.

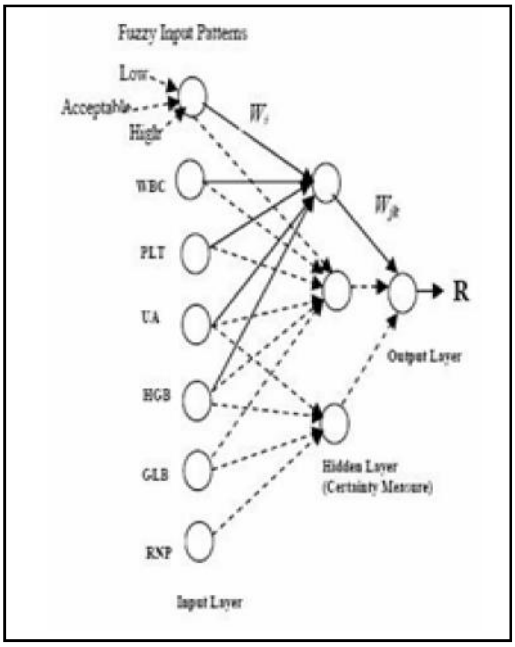

Fig.4 Fuzzy input patterns

The network is comprised of 3 levels of patterns.

- Input
- Hidden pattern
- Output

Input is provided with 9 nodes. Hidden layer is provided with 3 hidden pattern nodes. The output will be consisting of one output node. Medical guidelines suggest that when a thrombus or blood clot gets occupy more than 75 % of lumen area of an artery than the predicted result may be a heart disease or a prediction of call death. The Fuzzy input pattern is represented in Figure 4.

Table 1 Input Nodes

Input node	Expansion
WBC	White Blood Cell
PLT	Platelet
UA	Unstable Angina
HGB	Hemoglobin
GLB	Glibenclamide
RNP	Rib nucleoprotein

6. CONCLUSION

Cloud computing is shifting our life in numerous ways at a very fast velocity. Usage of cloud computing technologies is getting increased day by day. Cloud solutions help the physicians to keep on contact with their patients and check their health condition at a low expenditure. Big Data and Cloud Computing are most important for medical organizations in making their system to be automated and effective. In this paper, an effective heart attack prediction method using data mining techniques was shown. We have used two models (1) Rule set classifiers. (2) Neuro-fuzzy. These models can be used to predict in heart attack diseases, the proposed approach can also be enhanced to different heart related diseases and more than 15 attributes can be considered as listed in the medical literature. In addition to this list we have to incorporate other attributes which will effect on results such as financial status, stress, pollution, and previous medical history. Several data mining techniques like Clustering and Association Rules can also be used in analyzing the behavior of a data in predicting the results. In predicting the false alarm rate time series modeling can be used. It can also be utilized to study the patient's moralidity condition with value to clinical care. Categorical data can also be avoided by using continuous data to get better accuracy. Text mining can be used to extract the huge quantity of unstructured data available in health care databases. Cloud technologies in healthcare organizations would cause in a new era in healthcare industry.

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Cybercrime and Cyber Security Issues and Challenges on Healthcare: A Survey

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Abstract

Cybercrime and cyber-attacks are the twin bold problems for the digital world of all industries. In this digitized world everything is considered as a valuable data, which can be a target for the cyber criminals. The health industry in this era plays a vital role in providing the critical health care life services such as clinical diagnosis, preventive measures and patient management. Here comes the play of cyber criminals to exploit the vulnerability and attack the healthcare industry services, storages, information exchange paths and identity of the individuals. The healthcare industry produces massive amount of clinical and personal data which is confidential that burst a critical knowledge for cyber criminals. The survey study documents the cyber data breaches in healthcare and cyber security approaches and models to safeguard the healthcare industry. We bring out the research survey with impending various heading.

Keywords: *Cybercrime, Cybersecurity, Data protection, Data breaches, Encryption, Electronic health record, Healthcare*

1. INTRODUCTION

Healthcare industry has progressed significantly over the era; it has taken the main role in digitized world by providing health care services for the benefit of mankind through critical care services, clinical diagnosis, and preventive measures. Electronic health record(EHR) which holds the details of the patient details such as diagnosis of the diseases, treatment provided, clinical information's, personal information and medical insurance details are the main source of cyber-attacks generated by cyber criminals.

The EHR can be accessed and analyzed by the health indicators, individuals, service providers, insurance providers where exploitation of confidential electronic health record can be committed by the cyber criminals. Rise of digitization in healthcare stared to wash way with the storm of cyber security issues such as exploiting the vulnerable for hacking the health care data. Cyber criminals have found numerous avenues to attack the health care data lucrative. As per the regulation of [1], HIPAA (Health Insurance Portability and Accountability Act data breaches in the domain lead to the cyber-attacks by cyber criminals.

The Electronic health record (EHR) which includes medical or clinical data from wearable devices is more sensitive data about patient information. The data collected from different devices are shared among the several domains for the purpose of remote monitoring, which can be interpreted by the health providers. Being moved across several paths the medical data can be hacked and misused by the cyber criminals it is very difficult to poise the security of data when it is in gesticulation. [2] Various encryption techniques are also used to protect the medical data. EHR data breaches which lead to identity theft of individual, financial are the major concern among the health care industry. Cyber criminals target the healthcare industry for hacking patient data which is not yet secured properly. The ransomware attack generated by criminals totally slow down the healthcare domain and causes data breaches. There comes the identity theft of induvial personal detail and financial information by data breaches. Several encryption techniques are used in the communication channel in sending and receiving side where the decryption key can be hacked by the cyber criminals. The malicious insider attack also major cyber-attack on the health industry. By HIPPA report 67% of insider threat is far hard to reveal the details of committed crime. The review paper has been organized as data breaches, cyber-attacks on health care domain in section II. cyber security issues and challenges in health care domain in section III. Section IV presents existing and new cyber security techniques, models for health data. We have summarized the conclusion in section V.

2. DATA BREACHES AND CYBER ATTACKS

Data breach can be defined as the unintentional disclosure of private information. The health care data consist of Social security number, names, address, financial information, credit card details .data breaches occur when this personal information's are exposed. A breach can be caused by malware, hacks, lost or stolen devices and accidents (like attaching the wrong document to an email).

Electronic Health record is exploited to commit crimes by criminals when hackers get admittance to health data maintained by the healthcare system. Hackers can get the entire access in their hand by executing the malware installation by using the phishing emails and URLs on the organization network. If the organization uses the outdate software there the cyber criminals take their path to enter through it. Stolen EHR are sold in the black market by the cyber criminals for their benefit. Deep web hackers have group to sell and buy the personal information's for financial advantage and for threating a person. EHR is used for identity theft. The criminals who receive the health record from black market. They attempt to use the credentials to purchase the products for their use. Cyber criminals make forged credit card with the exploited user information and try to use deprived of credit card providers. However, thieves often can't sell every stolen record on the black market. A data breach might involve 10,000 stolen records, but only 100 cases of identity theft.

2.1 Causes of Data Breaches in Healthcare

Cybercriminal Attacks -32%, Lost or stolen devices-30%, Employee errors-20%, malicious error-8%. As per the cyber industry report by Cyber Security Buzz, the most commonly exposed data in healthcare breaches are medical records, followed by billing and insurance records, and payment information. Some 64% of attacks targeted medical files and billing and insurance records, up from 45%. Nearly 40% of healthcare organizations and 26% of their business partners say they know of medical identity theft incidents affecting their patients and customers, but 64% of healthcare organizations don't offer credit protection services for victims, and 67% of business partners don't have procedures in place to correct errors in medical records—a gap that could be life-threatening in the case of an identify thief using a patient's medical information for fraudulent purposes. Data breaches mainly occur in the health organization of type Health system, Physician practice, academic health Centre, health plan, and government plan. [3] Main cause of data breaches by physician practice is the stolen devices, unauthorized access and improper mailing. In health system management the EHR maintained by the servers are unprotected, cause of infections by malicious code injection in the organization network, vulnerable source code of the domain is the major dump for the cyber-attacks. Research issues for data breaches are Failure to restrict the URL Access, insecure cryptographic storage, insecure object references, broken authentication and session management.

2.2 Cyber-attacks in Healthcare

Cyber Attack: The deliberate exploitation of computer systems and networks using malicious code, logic or data resulting in disorderly significances that May conciliation data and lead to cybercrimes. The health care industries are the main target for cyber criminals to generate the cyber-attacks to commit the data breaches, identity theft, and cyber terrorism. [4] Cyber criminals handle so many different ways to hack the target by threats, SQL Injection, cross site scripting, Phishing, Malware attack, Ransomware attack, Password attack, distributed Denial of Service (DDoS) attack, email spoofing are some types of cyber-attacks. Structures Query Language (SQL) Injection: One of the major cyber-attack handled by the cyber criminals for the web application maintained by the developers of the Healthcare organizations is SQL Injection Attack. Cyber criminals exploit the vulnerability of web application of the healthcare domain for cyberattacks. SQL injection is a cyber-procedure used to take advantage of non-validated input vulnerabilities to pass SQL commands through web application for execution by a backend database. Based on the application and how it processes user supplied data, SQL injection can be used to perform the cyber-attacks such as authentication bypass, information disclosure, compromised data integrity and remote code executions. Injection attacks are classified under seven main categories: Tautologies, Illegal/Logically Incorrect Queries, Union Query, Piggy-Backed Queries, and Stored Procedures.

2.3 Ransomware Attack

Ransomware is a type of malware (malicious + software) that encrypts a victim's files, locking users out of the infected device/system or blocking access to encrypted files. [8] When ransomware executes, the data

and evidence is still on the victim's computers, however in encoded form, so is not accessible. The hackers keep it encrypted until the victim pays the ransom to decrypt it. In order to acquire the key to decrypt these files, the victim must pay a ransom, often in the form of bitcoin or other electronic currency.

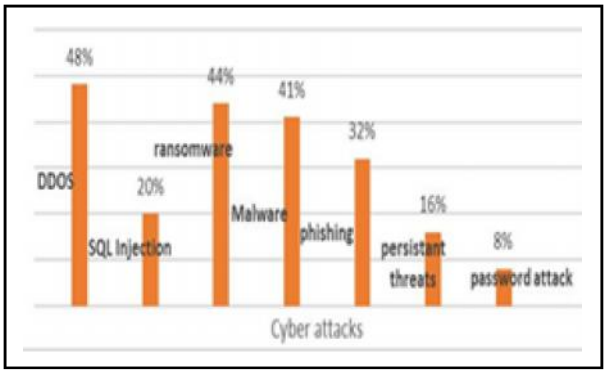

Fig.1 Cyberattacks in healthcare

2.4 Medical Identity Theft

Medical identity theft happens when someone snips Personal information like name, Social Security number, or Medicare number to obtain medical care, buy drugs, or defer to forged billings to Medicare. Main cause of medical identity is by phishing and email spoofing. It is the act of cheating someone into giving private information (like passwords and credit card information) on a fake web page or email form fantasizing to come from a genuine company. Phishing attack can be generated by creating fake URLs, Fake SSL Lock, URL Manipulation to steal login credentials and banking credentials. Malicious Insider attack: 20% of data breaches in healthcare domain is by the insider attacks by unauthorized access of the EHR. With privileged access the insider may steal the information for financial purpose.

3. CYBER SECURITY ISSUES AND CHALLENGES

The act of protecting Information systems and their contents has come to be known as cybersecurity. With the concern about the health care electronic health record information has to be protected by cyber security techniques. Major issues & challenges related are hacking, vulnerability exploits, unauthorized access, restricting URLs, etc. Medical identity theft keeps on the head of the patient record (EHR) where secrecy of information gets sold in black market. By generation of DDOS attacks the server of health care industry totally gets slow download to get payment. SQL Injection and phishing causes data base server get damaged by the cyber criminals.

4. CYBERSECURITY TECHNIQUES AND APPROACHES

Existing security techniques: various cyber security techniques have been used for overcoming the cybercrime in healthcare such as Biometric security, intrusion detection, database security, cryptography, access control, denial of service protection, information hiding, privacy and data protection, monitoring and surveillance. Insider attacks can be detected and investigated for capturing the criminal activity. The Electronic Health Record privacy can be preserved by the bifactor based authorization mechanisms. Enforcing conditions on which privilege the EHR can be accessed by healthcare staff, Roles and task-based authorization. Auditing –EHR is frequently monitored along with the log and activity.

Cyber Security over Denial of service attack: many security tools have been used to detect whether network can viewpoint counter to DOS attack. dSploit is a proven penetration testing tool for the Android operating system [10]. If the WiFi network of a healthcare capacity is not resistant to DoS attack, it is possible to completely block a medical device from using the WiFi network by the script injection technique of dSploit. Low Orbit Ion Cannon (LOIC) can block the target device by sending large streams of UDP, TCP, or HTTP request. Knowing the IP address of a medical device is enough for an attacker to perform the DOS attack using this tool. It is also possible to remotely run the tool using Internet relay chat (IRC) protocol [11].

Cyber security by Cryptography techniques: Insider Attack -Homographic encryption, proxy re encryption approach can run on service of cloud environments to reduce the insider attack. This encryption technique limits the users who have access to electronic medical record to only the system administrator who have decryption key access [12].

Security over Insider attacks: cutting-edge of this information sharing era of healthcare system faces unintended attacks by authorized user. Considering the privacy of HER asymmetric key cryptosystem was proposed by the author [20] to permit the patients to isometrics comprehensive control over Electronic health

record. By this technique patient will have the control to distribute the single aggregate key to share the EHR with different users and the user has to submit the single aggregate trapdoor while querying EHR shared by same patient.

Phishing detection using multi filter approach: author [14] has used multi filter approach by providing the details about the correct site; the user is actually trying to visit. Different layers in this model act as filter to detect phishing using a specified dimension. The layers are auto upgrade whitelist layer, URL features, lexical signature layer, string matching layer, and accessibility score comparison layer.

Cyber security control over the download attacks: Author [15] proposed a behavior-based solution, to protect a browser against drive-by download attacks. Browser Guard records the download state of every file that is loaded into a host through a browser. Then based on the download scenario, Browser Guard blocks the execution of any file that is packed into a host without the accord of a browser user. Due to its behavior-based detection nature, Browser Guard does not need to examine the source file of any web folio or the run-time states in the least script code.

Cybersecurity and privacy control: Electronic health record out sourced to third party addresses the privacy issues. Secured e health framework proposed a patient centric access control with encryption. The author [17] used the encryption technique with digital signature to recognize the patient pseudo identity. Multi authority attribute-based encryption for securing EHR with advanced encryption explore how single point of contact helps in security of healthcare system.

Information hiding: The electronic health record (EHR) shared among the applications of health care system should be kept safe from criminals and sheltered through public network. Patient privacy is the important concern for cyber-attacks and data breaches. Here author V.Sankari[18] has proposed a Discrete wavelet Transform based steganography technique to guarantee the EHR privacy data and confidentiality. Here the novel algorithm of steganography has proposed to hide the electrocardiogram (ECG). Signal using Discrete Wavelet Transform to exchange the EHR. Encryption of the confidential data is exchanged in the network, only the doctor can see the Stego ECG signal and only the authorized medical doctor can extract the secret information and have access to the confidential details stored in host ECG signal [18].

Restriction of malicious URL attack: based on the execution method, malicious URL can be identified but due to traffic of the network it's not practical as it consumes resource and time. Author [19] proposed a method which examines only user web request not by the creep, to point out the drive by download web attacks. Reputation based URL filter examine the grade of target domain by adopting A-type, NS type records provided authority-based feature set is reliable.

5. CONCLUSION

In the Review paper we have discussed how the modern health system is under control of cyber criminals. In section II Not only, we have analyzed the data breaches and also its cause by cyber-attacks provide the prominent way for the research issues in cybercrime of Health sectors. We also completely pointed out the tribulations of cyber-attacks and how the entire health sector gets damaged by the data breaches, medical identity theft, and insecure cryptographic storage. In Section III we have discussed the various existing security techniques and methodologies to overcome the cyber-crimes committed. With this literature we have strong idea of overcoming the data breaches and cybercrimes in health sector. Major research concern is about Electronic health record privacy and protection against the cybercrimes and what security techniques full fill the cybersecurity control. With this we conclude that in future work of research the above-mentioned techniques and approaches can be used for detection and control of cybercrimes in health care system.

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Magnification of the Security by Using LSB Based Colour Image Steganography Method

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Abstract

Steganography is the method for concealing data inside the bearer record with the goal that it is intangible for unapproved parties. In this investigation, it is proposed to link numerous procedures to accumulate another strategy for shading picture steganography to acquire upgraded effectiveness, accomplish expanded limit and security with cryptography in the meantime. The goal of the proposed work is to outline vigorous calculations which produce stego media can convey an expansive measure of mystery information without lessening intangibility.

Keywords: *Concealing, Extraction, Inconspicuous, Integrity Check, Enormous Capacity*

1. INTRODUCTION

Unlike the cryptography methods which are used to have a secured data communication, the steganography methods are used to have a secret data communication. In the field of secure communication, the data hiding is very important. On the off chance that we could ready to save the nature of the mystery information which is implanted in the cover information, the concealing procedure is exceptionally effective. In our proposed strategy, every single piece of the mystery picture is installed into the cover picture and furthermore, we can extricate all the implanted bits with no bending. So the nature of the picture is protected 100%. Today web has turned into a confided in handyman of everybody. All installments like assessment, protection, bank exchange, medicinal services installment, installment in internet business are done carefully through a charge or Visa or through e-wallet. The data shares through these applications are the consuming focus to interlopers [1]. The cryptography and watermarking likewise utilized for concealing information identified with copyright data yet they are not adequate in light of the fact that numerous procedures are utilized to expel watermark.

2. LITERATURE SURVEY

To investigate the video steganography system, this paper guarantee that the national security and the classification of the data were displayed a calculation in view of the mystery sharing plan called Error-Correcting Code (ECC), for H.264/AVC. The coding has better invisibility and good robustness and the advantages including better anti-steganalysis, low BRI too. Forthcoming work may include by dividing the frames into pieces and conceal the data using the scheme known as secret sharing [2].

A calculation to grow new steganographic system is to stow away a huge measure of information in Bitmap picture utilizing LSB check technique. By utilizing three shading parts, the genuine position of the mystery bit into the fourth shading for installing and separating information can be recognized. The non-filtering algorithm is used based on LSB and also generates in an unbalanced distribution of pixels. This method improves the performance of the LSB hiding information at the cover image and making it difficult to determine the secret message for unauthorized persons [3].

The better comprehension on various cutting edge works is extremely useful for the approval of new execution and furthermore breaking down its execution precision regarding security. The rundown begins with the arrangement of the escape clauses of standard LSB method and afterward attempts to improve the considerations. The standard LSB system is anything but difficult to actualize where the Least Significant piece of pixel/tests of cover media is supplanted with target bit [4].

The technique can save indistinctness, however, experiences low power and limit. To present a safe steganography calculation HUGO which can ready to

overcome all steganalysis assaults by characterizing contortion in view of highlight vector officially utilized in steganalysis. It underpins limit of stego media seven times more than the standard LSB system. Be that as it may, the outcomes were not fulfilling at all on account of multi-bit approach [5].

Keep up the measurable and perceptual qualities of the cover picture in the stego media by totally protecting the cover histogram. Their LSB++ strategy causes bring down bending in the co-event networks by shielding the delicate pixels from an additional piece installing. Their technique is more capacitive and keeps up a histogram of JPEG pictures [6].

For the most part, the picture steganographic strategy is assessed by three key points of view: limit (the greatest payload that could be inserted into the cover-picture), visual symmetry (the stego-picture ought to be perceptually indistinguishable to its cover-picture), and security (the stego-picture must be impervious to steganalysis location assaults). Consequently, the perfect steganographic technique ought to be all the while prepared to do high limit, great visual symmetry, and imperceptibility. Frequently, high payload steganographic strategies present the contortion antiques in stego-pictures and are powerless against steganalysis. In addition, great visual quality steganographic techniques experience the ill effects of the low payload. Step by step instructions to all the while accomplishing high limit, visual symmetry, and security are a testing research issue because of the inconsistencies between them [7].

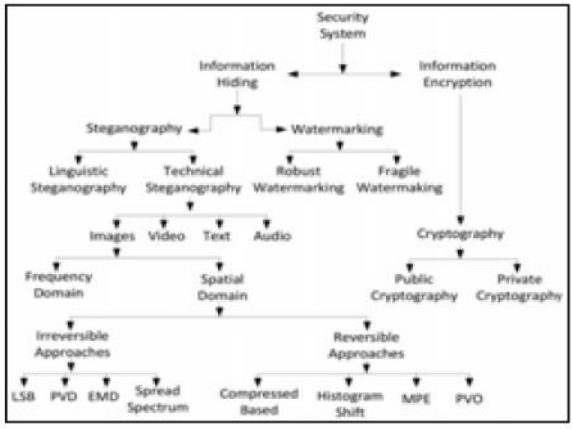

Fig.1 General Classification of Information Hiding System

3. PROPOSED MODEL

The proposed work is to outline powerful calculations for doing the followings:

1 Improve strength through arbitrary and virtual piece plane inserting as opposed to static layer installing, through esteem change system rather coordinate substitution of bits, through implanting at chosen district than sequential pixels/tests.
2 Preserve Imperceptibility through piece modification or esteem change and by thinking about the attributes of human recognition.
3 Increase Capacity through multi-bit installing in 24-bit picture and in addition sound and through packed information inserting.

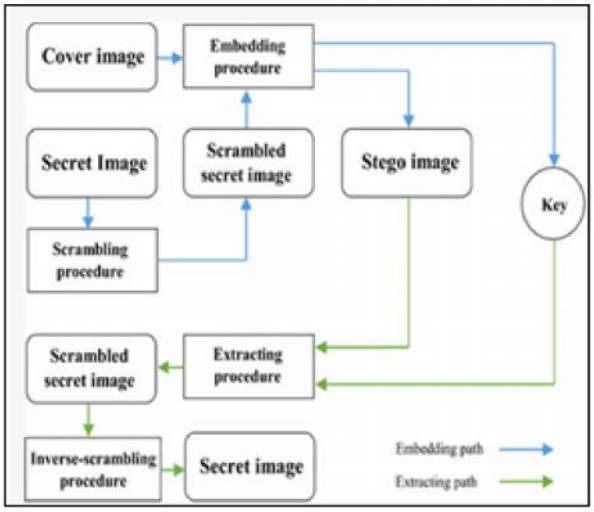

Fig.2 Block Diagram of Proposed Model

More or less the entire work endeavors to decrease the rate of converse extent among the three difficulties of steganography. The execution of the proposed strategy is assessed in light of various Image Quality Assessment Metrics (IQAMs) (e.g. PSNR, NCC, LMSE, SSIM and so forth.), Bit-plane investigation, measurable test (histogram contrasts, Chi-square assault), basic assaults (SP, WS and so on.), various steganalysis assaults like RS assault and so on. A standard benchmark apparatus Stir Mark Benchmark is utilized for dissecting the execution of proposed strategy in view of various parameters. The security quality of the calculations is estimated through KL difference and the limit of the stego picture in view of bpp. The accompanying Figure 1 demonstrates the stream of the proposed strategy.

The example results appear in Figure 2. The technique upgrades the limit by inserting a character inside a pixel utilizing 2-2-2 organize rather 3-3-2 (which is utilized in the greater part of the cases for 8 bit ASCII) which again safeguards nature of stego media. Yet, the strategy does not demonstrate any appealing answer for the change of strength [8].

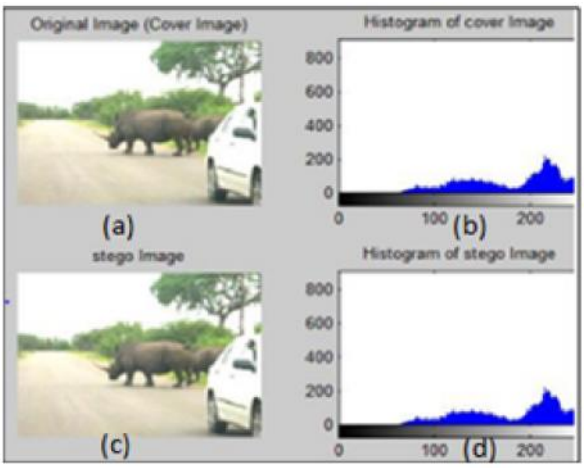

Fig.3 (a) Cover image (b) Cover Histogram and (c) Stego image (d) Stego Histogram

4. CONCLUSION

The strategy starts with the arrangement of a low limit issue in standard LSB system by concealing numerous bits in pixels/tests. The issue of low vigor is tackled by installing information at the higher LSB layer of both picture and sound. The strategies turn out to be more vigorous by considering numerous piece planes haphazardly to embed target information and furthermore perform inserting in virtual piece planes. The intangibility and also the vigor of steganography strategies are expanded by inserting different bits in a specific district chosen either in light of some picture traits or by Human Visual Perception. The rundown is additionally featured the benefits of changing space procedures over the spatial area and install information in DWT area. Then again the examinations on reversible steganography helps in the successful use of the proposed investigate works in a genuine situation. The majority of the procedures are dissected in light of various appraisal measurements. The obstruction is tried against various steganalysis assaults. The examination demonstrates rightness, though the correlation with the cutting edge works helps in approval of this exploration in the field of security. Moreover, different techniques can be used for steganography that is of more effective especially when used in video films.

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Reliability Modelling for Cloud

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Abstract

Cloud Computing is a computing hypothesis, where a huge group of systems are linked together in private, public or hybrid network, to offer dynamically ascendable infrastructure for data storage, file storage and application. With this emerging technology, application hosting, delivery, content storage, and computation cost is reduced and it act as an essential module for backbone of the Internet of Things (IOT). The efficiency of cloud Service provider (CSP) can be improved by considering significant factors such as availability, reliability, usability, security, responsiveness, and elasticity. Assessment of these factors leads to efficiency in designing scheduler for CSP. These metrics also improved the Quality of Service (QoS) in cloud. Many existing models and approaches can evaluate these metrics. But these existing approaches doesn't provide efficient outcome. In this paper, a prominent performance model named as Spectral Expansion Method (SPM) to evaluate cloud reliability. Spectral expansion Method (SPM) is a significant technique useful in reliability and performance modelling of computing system. This approach solves the Markov model of Cloud Service Provider (CSP) to predict the reliability. The SPM is better compared to matrix geometric methods.

Keywords*:Cloud Computing, Spectral expansion Method, Quality of Service, Virtual machine.*

1. INTRODUCTION

Cloud computing is computing model for enabling expedient, on-demand network service to a pool of computing resource such as servers, storage, networks, services and applications that can be promptly planned and released with minimum executive effort or service provider interface. The cloud computing has novel characteristic such as service oriented computing, huge scale resource sharing, and on-demand services [1,2]. Many cloud applications are developed using Multi-tier architecture [Lloyd W et al. (2013)]. In traditional model, one-tier, two-tier, 3-tier, to N-tier models are available in cloud to provide n no of services based on the tier type. Among these model, Multiple-tier or N-tier cloud is significant model because it can provide N no of service together in a single tier model. As it provides multiple services, the maintenance of performance is more required to this model. To maintain the capacity of the model, the Reliability evaluation is necessary for this Multi-Tier Cloud system. For example, Microsoft Azure Cloud service in [4] and Amazon cloud service (EC2) in [5] uses the Multi-tier cloud environment for their web application. Compared to traditional architecture, the Multi-tier cloud model guarantees Service Level Agreement (SLA) with combined service in single physical machine. To manage the SLA, reliability of the system must be predicted. Multi-tier model can simultaneously manage multiple users with high workload. To reduce the usage of power and storage, the main concept called Virtualization is evolved in each tier for better performance of the system. In [6], the author come out with outcome that Multi- Tier Architecture is best suitable with Virtualization technology. This combination can save power, storage and reliability.

Although various studies have proposed approaches recently on maintaining availability, balancing power performance [7-10], no one considered reliability, another major factor of cloud service. Reliability is the assertion that cloud provisions are free from software faults, hardware faults and other faults that breaks down the system's efficiency. Reliability modelling is necessary to the cloud environment. In [11], the author evaluates the reliability model for maintaining the performance and power of cloud virtualization environment. The reliability maintenance of the system indirectly affects the performance and energy. In [12], a quality models called CLOUDQUAL is proposed to manage QoS among cloud service. The Quality factors considered in this model

are availability, reliability, usability, security and elasticity. From this, reliability is a significant model to achieve QoS in cloud environment. In all existing work, the reliability is calculated in different way and considered as important parameter for QoS of the Cloud.

In this work, the high level performance modelling called Spectral Expansion method is proposed to estimate the reliability of cloud computing environment. The Spectral Expansion method is a mathematical performance technique for analysis of two- dimensional Markov process of finite state space. This Markov model occurs commonly in reliability and performance problem of computing systems. The Markov model of the computing system is first represented in matrix-form to compute the eigenvalues, л and eigenvectors, Ш. The eigenvalues and vectors form a linear equation, $н_i$ and solving it. The solution of the linear equation $н_i$, determines the reliability of the system in graphical form. The remaining section of the paper describes as section 2 discuss about existing works, Section 3 describe the Spectral expansion model and algorithm, and finally section 4 concludes with conclusion and future work.

2. RELATED WORK

Reliability and availability are critical requirement for cloud services and must be represented with appropriate planning and modelling [22, 23]. In [24], the reliability model is focused in Virtual Machine (VM) of cloud environment to accomplish high performance. Vishwanath K. V et al. [25] considered reliability parameter to maintain the consistency of cloud based hardware system. The Quality of Service (QoS) is improved using reliability metric in performance analysis. In [26], the author states that reliability service and availability services are strongly associated in performance analysis of cloud based service.

A reliability optimization algorithm [27] is introduced to maintain performance of top banking sector developed using cloud system. Y Xia et al. [28] determined the reliability analysis of computing system using non-Markov stochastic Petri net (NMSPN). This method takes service invocation and message as model input. Reliability modelling is done for predicting the fault-tolerant of the computers. The small change in design or insight may cause high variation in performance modelling. To prevent the variation, reliability modelling is estimated in this work [29]. KL Peng et al. [30] propose the reliability framework that collaborates failure dependencies as well as consider individual services and failure source. Reliability of the Computing system [31] prevents the failure and dependency from occurring. Heimann, David I *et al.* [32] computes the dependability analysis of computer system which combines together the concepts like maintainability, availability and reliability. System reliability measures the instance of offensive events in the computing system. From this instance, the prevention measure can be applied. In [34], a survey has been presented on reliability and energy efficiency in loud computing system. They predict that key challenge in cloud is to manage reliability of the system. Reliability is defined in context of resource failure, in context of VM failure, in context of service failure or in context of security. Nachiappan *et al.* [33] have used reliability for cloud storage scheduling in big data. From the existing works, very few reliability modelling is proposed for cloud based system. These works consider only few parameters and doesn't produce efficient outcome.

In this paper, the Spectral Expansion Method (SPM) is evolved for estimation of reliability modelling. This method has been used for performance modelling of network based system. The main task of SPM is to solve any class of Markov model. This method provides better solution compared to matrix-geometric method [35]. Chakka R. et al. [36] used the Spectral Expansion Technique for finding solution for Markov model in some finite queue. This model exacts solution for analysis of Markov process. The results include the performance analysis of computing system. The Spectral Expansion Method is applied for the performance and dependability analysis of computing system. In this work, the SPM is applied to predict the reliability of Cloud based service.

3. SIMPLEX RESOURCE MANAGEMENT (SRM) ALGORITHM

The Initial process of evaluating a reliability of the system is design the Markov model for Multi-Tier Cloud environment. Consider Multi-tier cloud architecture as show in fig2. With M Identical Virtual machine (VM) and Host machine (HM) processing different and unbounded queue of job. The VM and HM can fail from time to time. The failure may be single and independent or multiple and dependent failure. In this system design, both single, independent repair and multiple, dependent repair are allowed. In execution of tasks in queue, the VM and HM process a single job at a time and each job require only one VM processor at a time. The policy applied for failure of the processor is to resume, repair

and re-sampling. The service rate, failure rate and repair rate follows exponential distribution.

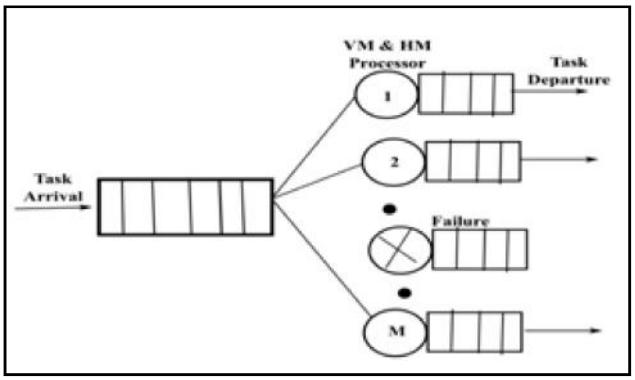

Fig.1 Multi-Processor working mechanism

The system is modelled by SPM. X(t) is the functioning state of the system, denoting number of VM processor running at time t which varies from 0 to M. Y(t) is number of process waiting in the queue system and served process at time t. The irreducible Markov model representing the Multi-tier cloud system is defined as I= {[X(t), Y(t)]; t>0}, with state space {0,1, . . ., M}x {0,1, . . .}. Tasks are assumed to arrive based on Poisson process with rate л when the operative state X(t) = i. Two kinds of failures are possible. One is, individual processors breakdown independently at rate д and are repaired independently at rate и. Second is an "Overall" breakdown of all currently VM and HM processors, at rate $д_0$, and "Overall" repairs rate of all currently non-processing processors is at $и_M$. The processing state of the system never changes during the arrival and departure of the tasks unless if there is independent attack towards the changes. Hence, the alteration in VM and HM state of the system is done only in matrices P and P_y.

The single-move upward transition is generated by the single task arrival. Hence, Q and Q_y, the single – move upward transition matrices rate are defined as,

$$Q = Q_y = diag\ [\lambda_0, \lambda_1, \ldots, \lambda_M]$$

This is applicable for all values of y (y= 0, 1,)

The single move downward transition occurs by decampment of the single task that is arrived. R and R_y are the single move downward matrices rate. Let μ be service rate of VM and HM processor. The decamping rate of tasks at time t depend rely upon X(t) = x and Y(t) =y, and that is defined as R_y (x, x). If x > y, then every task is allocated to the processor for service provision and all VM and HM processors are not occupied, thus the decamping rate, R_y (x, x) = yμ. Otherwise if x d" y, then all the VM and HM processor are occupied with tasks, therefore decamping rate, R_y (x, x) = xμ. Thus we conclude that R_y (x, x) does not rely on y if y e" x and R_y does not depend upon y if y e" M. Therefore, we have,

R_y=diag[0,min(y,1)μ, min (y,Z)μ ...min (y, M)μ]:
$0 < y < M$.

R= diag[0,μ, 2μ, ...Mμ] : y>M .
R_0 is equal to zero.

In order to evaluate the reliability of Cloud based system, three different states are considered based on breakdown and repair rate in form of matrices P and P_y. The three states are:

Case 1: In this state, VM and HM processors leads to failure independently at rate of д per processor. Each non-functional processor has repair rate of и. There is no synchronization between failure and repair of multiple VM and HM processors.

The matrix P_y and P are defined as,

$$P = P_y\ (y = 0, 1, \ldots) = \begin{bmatrix} 0 & M\theta & & \\ \delta & 0 & (M-1)\theta & \\ & 2\delta & 0 & \ddots \\ & & \ddots & \ddots & \theta \\ & & & M\delta & 0 \end{bmatrix}$$

Case 2: Independent failure and repairs as in state 1, and 'overall' failure occurring at rate $д_0$. All currently functioning processors fails at this rate except the independent failure.

$$P = P_y\ (y = 0, 1, \ldots) = \begin{bmatrix} 0 & M\theta & & \\ \delta_0 + \delta & 0 & (M-1)\theta & \\ \delta_0 & 2\delta & 0 & \ddots \\ \vdots & & \ddots & \ddots & \theta \\ \delta_0 & & & M\delta & 0 \end{bmatrix}$$

Case 3: It similar to state 2 but in additions to this, the currently non-functioning processor gets repairs simultaneously. This "Overall" repair occurs at $и_M$.

$$P = P_y\ (y = 0, 1, \ldots) = \begin{bmatrix} 0 & M\theta & & & \theta_M \\ \delta_0 + \delta & 0 & (M-1)\theta & & \theta_M \\ \delta_0 & 2\delta & 0 & \ddots & \vdots \\ \vdots & & \ddots & \ddots & \theta \\ \delta_0 & & & M\delta & 0 \end{bmatrix}$$

The threshold limit is given as H, and it should be H=M. The spectral expansion model works until y=H-1=M-1. The changes occurred in functioning state is observed in matrix P, it is likely to find simple form for the total average service rate of multi-processor, and the steady state distribution of number of functioning processors. Let u be marginal distribution of number of functioning processors. Then,

$$u = (q_0, q_1, \ldots, q_M) = \sum_{y=0}^{\infty} u_y$$

This is the probability vector of matrix P- D^P, and can be acquired by solving the following equation,

$$u(P - D^P) = 0; u\varepsilon = 1.$$

Then the total average service rate, named as capacity of multi-processor service is uR, and average task arrived is uQ. It can be emphasizing that the cloud based system is stable when the average task arrival should be less than the capacity of service. δ

$$uQ\varepsilon < uR\varepsilon$$

CONCLUSION

In this the reliability of the multi-tier cloud system is evaluated using Spectral Expansion Method (SPM). The SPM is developed for three cases of Multi-tier cloud system. Their reliability modelling is done using SHARPE tool. The comparison of the performance concludes that the system with simultaneous repair and failure rate works with better reliability. Thus using the SPM, the Multi-tier cloud based system can be evaluated and analysed. The SPM provides accurate reliability evaluation compared to other standard methods because it considers all parameter for calculating the model. Thus the graph results show the reliability can be maintained with failure and service rate in processing tasks.

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Android Versions

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Abstract

The Android is a software stock for all mobile devices that includes an operating system for its applications. Android is a software platform and operating devices for mobile data devices based on the linux operating system by Google and the most important Open Handset Alliance. It also allows the developers to write the manage code in Java -like languages that utilizes Google developed Java libraries but does not support the programs developed in codes.

The Android platform on 5 November 2007 was announcement on founding of Open Handset Alliance software and telecom companies devoted to advance open standards for all mode available under the Apache free software and Open Source license.

1. INTRODUCTION

Before Apple was announced the first i-phone and its first IOS, the term "Smart Phone" came into existence and used by the people in all over the world in October 2003. The Android Inc was founded by four members Richie Miner, Nick Sears, Chris White, Andy Rubin. Android OS was improved by Digital Cameras which was revealed by Rubin in 2013, to the PC World. Android is an Operating System and Programming platform for many devices by Google. For market place, it provides as the app distributor. It is an ecosystem for all mobile apps. The Android powers hundred of million mobile devices in more than 190 countries among the world. It also develops building for the multi-screen world. Also keeps user and their codes secured. It also helps in understanding the market and users.

The Android runtime provides a key component called Dalvik Virtual Machine which is a kind of java virtual machine. It is specially designed and optimized for android. The Dalvik VM is the process virtual machine in the android operating system. It is a types of software that runs on android devices. The Dalvik VM makes use of Linux core features like memory management and multithreading which is in a java language. The Dalvik VM enables every android application to run it own process. The Dalvik VM executes the files in the .dex format. The Emulator is a new application in android operating system. The emulator is a new prototype that is used to develop and test android applications without using any physical device.

The android emulator has all of the hardware and software features like mobile device except phone calls. It provides a variety of navigation and control keys. It also provides a screen to display your application. The emulators utilize the android virtual device configurations. Once your application is running on it, it can use services of the android platform to help other applications, access the network, play audio, video, store and retrieve the data.

2. ANDROID VERSIONS

2.1 (ALPHA)

The first Commercial Version of Software. The Linux Version was Kernel Version 2.6.The various features in this version are to change the quality, resolution, white balance etc. Then, most common feature in this version is to keep all the icons in a single folder. It also act as a first step for introducing Google apps like G-mail, Google contacts, Calender, Google maps, Google search, Google talk. This version allows the notification to appear in Status bar. This also connects wifi, Bluetooth, etc.

2.2 (BETA)

The updated version of 1.0 is 1.1. In this the bugs were resolved from the above one. It remains same as 1.0 version. It resolves for the searching of business on the maps which gives plenty of details and reviews. This also has ability to save the attachment in messages.

2.3 CUPCAKE

This android 1.5 was updated to many features. Its Linux Kernel is 2.6.27. This version supports widgets, playback, virtual keyboard, pairing, stereo options for Bluetooth, auto rotation, animation, copy paste features in the web for the first time introduced by Google and it is able to see pictures of our favourites in contact. In this version, the update from those versions is one touch to access to contact the call logs. Although, this version increased the speed and performance.

2.4 DONUT

The Linux Kernel is 2.6.29. The important feature in this updated version is voice search and search box was added. This version could able to access the camera, camcorder, gallery together and the users can select multiple photos to delete at a time. It also increases speed and reduces time in search and camera applications.

2.5 ECLAIR

This updated version came in existence with more API levels. The Linux Kernel is 2.6.29. In this the multiple account can be used in both G-mail and contacts. The connection of Bluetooth supports in this version. In this version, the camera quality is increased by flash, digital zoom, scene mode, colour effect etc. It improves speed in typing this keyboard.

2.6 FROYO

The version 2.2 has only one API level (8). The Linux Kernel is 2.6.32. The introducing of the version improved application launcher and adobe flash. It also supports numeric and alpha numeric passwords. The hotspots feature was introduced in this Froyo version. The security for the android OS was updated in this version.

2.7 GINGERBREAD

This version supports the large screen sites. It contains the keyboard for faster word input. This version also provides new audio effect headphones, virtualization and power Management. In this version the games were updated by audio and graphical and Improved the efficiency of battery.

3. HONEY COMB

This version has 3 API levels and Linux Kernel is 2.6.36. The Honey Comb version was introduced for mainly tablets. For the first time, this version supports multicore processors. This also able to connect joysticks and gamepads. The browser was improved adobe flash supports.

4. ICE CREAM SANDWICH

The Linus Kernel for this version is 5.0.1. The main feature is to allow the drag and drop style to create folder. It also enables to zoom and take screen shot in

the smart phones. The new feature in this Ice Cream Sandwich (4.0) version is face unlock. The gallery and camera performance was enhanced in this version.

4.1 JELLY BEAN

The Jelly Bean Linux Kernel is 3.0.31. The notification was expanded in this version. In this version, the feature allows the Bluetooth to transfer data. Camera and clock applications were improved. The group messaging was first time introduced in this version.

4.3 KIT KAT

The feature in the Kit Kat (4.4) version is by wireless printing capacity. The application like sensor batching, stop detector, counter was released. The screen recording was also added.

5. LOLLIPOP

The version 5.0 was first time supported for 64-bit CPL's. The print preview was installed. The language more than 15 were updated. The smart lock feature was also there in this version. In November 12, 2014, the updates became available as official over-the-air (OTA). The changes done in this version were improvement on notification, accessed from the lock screen. The material design, bringing a restyled user interface. The multiple user accounts were available in those phones. The main feature is smart lock features.

6. MARSHMALLOW

The code name for Marshmallow is known as "Android M". The Doze mode which can able to reduce CPU speed while the screen is off, was introduced in this version. For the first time, Finger Print Reader is updated in this version. This also provides 4K display mode for apps. Description for the USB connection options. Double tap to power button which helps to open camera feature in this version.

7. NOUGAT

The Nougat was codenamed as N in-development. The program which allows supported devices to be upgraded is "Android Beta Program" through via Over-Air-update. The Nougat version has able to Display colour settings, ability to screen zoom and to switch apps by Double tapping the overview button. The Day Dream virtual reality platform were updated. Multi window support, Data saver mode etc.. Finger Print Sensor were developed to open/close the notification. Battery usage alerts were implemented.

8. OREO

Android Oreo which was used by the people, the most, nowadays. This version updated the improvement in notification and channels, dots(badges) system-wide auto full-framework. It also protect the Google Play. The

CODE NAME	VERSION NUMBER	INITIAL RELEASE DATE	API NUMBER
Alpha	1.0	23 September 2008	1
Beta	1.1	9 February 2009	2
Cupcake	1.5	27 April 2009	3
Donut	1.6	15 September 2009	4
Éclair	20-2.1	26 October 2009	5-7
Froyo	2.2-2.2.3	20 May 2010	8
Gingerbread	2.3-2.3.7	6 December 2010	9-10
Honeycomb	3.0-3.2.6	22 February 2011	11-13
Ice cream Sandwich	4.0-4.0.4	18 October 2011	14-15
Jelly Bean	4.1-4.3.1	9 July 2012	16-18
Kit Kat	4.4-4.4.4	31 October 2013	19-20
Lollipop	5.0-5.1.1	12 November 2014	21-22
Marshmallow	6.0-6.0.1	5 October 2015	23
Nougat	7.0-7.1.2	22 August 2016	24-25
Oreo	8.0-8.1	21 August 2017	26-27
Pie	9.0	6 August 2018	28

boost speed increases 2 times faster and also integrated printing support and colour management (deep colour and wide colour). This also acts as the wifi – assistant. The themes with dark and light colour was made as autofill. Navigation button becomes dim when it is not in use. The “power off” and “restart” button was included in new screen and floating toolbars.

9. CONCLUSION

From the above information we conclude that Android versions growth is because of the updating some information which made easier than before version and quick access of internet and other information to know more knowledge and usage of the internet is the growth for this technological world.

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An Approach to Predict Taxi-Passenger Demand Using Quantitative Histogram on UBER Data

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Abstract

The precise prediction of the day to day and monthly transactions is of great value for companies. This information can be beneficial for the companies in analyzing their ups and downs and draw other plans. Moreover, a precise prediction method can optimize the performance of the company. The branch of analytics that deals with predictions is known as predictive analytics. This paper presents the use of data analytics to analyse the transaction date set provided by uber and predict the possible outcomes and the changes to be made. The histograms and heat maps drawn would provide us a clear visualisation of the dataset and we must predict the rest out of it.

Keywords: *Data analytics, Data prediction, Heat map, Histograms, Uber trip data.*

INTRODUCTION

In this generation many technologies are created to support our day to day needs. In 2014, technology based applications on transportation were at peak. The scopes of technology in the field of transportation were booming. This gave birth to one such company named Uber, which later on became one of the pioneers of the world in the field of technology based transportation.

Many new companies started to turn their attention towards technology based transportation, which they believed to be the future of transportation industry. The key players in this system are the people who are the end users benefitted. The companies started focusing of the existing customers instead of focusing on gaining new customers. The companies used social media for this purpose. This was a great strategy. The company started to get responses from their customers which later were the source of knowledge about customer needs and behaviors which played an important role in maintaining a relationship between the customer and the management. This information was of great help to the Uber in overpowering Yellow cab rides in the centre and Green cab rides in the outskirts of New York City.

Taxi driver need to decide which place is the most suitable place for picking up the more customers. Passengers also prefer to quickly find a taxi whenever they are ready for pickup.

Drivers don't have adequate data about where travelers and different cabs are and plan to go. Along these lines, a taxi focus can sort out the taxi armada and proficiently convey them as per the request from the whole city. To construct such a taxi center, a wise framework that can anticipate the future request all through the city is required.

2. RELATED WORK

From the taxi informational collection, we can gauge and anticipate the met taxi request, that is, the quantity of the taxi administrations developed what's more, will develop at various areas. In any case, the neglected taxi request, e.g., the ratio between the number of individuals who require a taxi at a particular time and the number of taxis readily available at that time may not be the same. To fix this issue, late papers attempt to gather the neglected taxi request from the taxi informational collection. In [7] the creators join flight landing with taxi request and foresee the traveler request at diverse air terminal in Singapore utilize queueing theory.

Taxi request expectation issue has pulled in more considerations as of late due to the accessible of taxi informational index [3]. Mukai et. al forecast the taxi request from prior taxi information with a neural network system.

Kai Zhao [1] focused to predict taxi demand by analyzing maximum predictability ($Đ^{max}$) of taxi demand.

Maximum predictability is defined by entropy of taxi demand including both randomness and temporal correlation. Moreira-Matias [10] introduced a methodology for predicting spatial distribution of taxi-customers using streaming data. Histogram time series is used to get the frequency of the taxi demand.

K. Zhao [9] finding the city region based on the maximum taxi visits. In this paper Association rules are used to infer the functional regions in the city.

3. IMPLEMENTATION

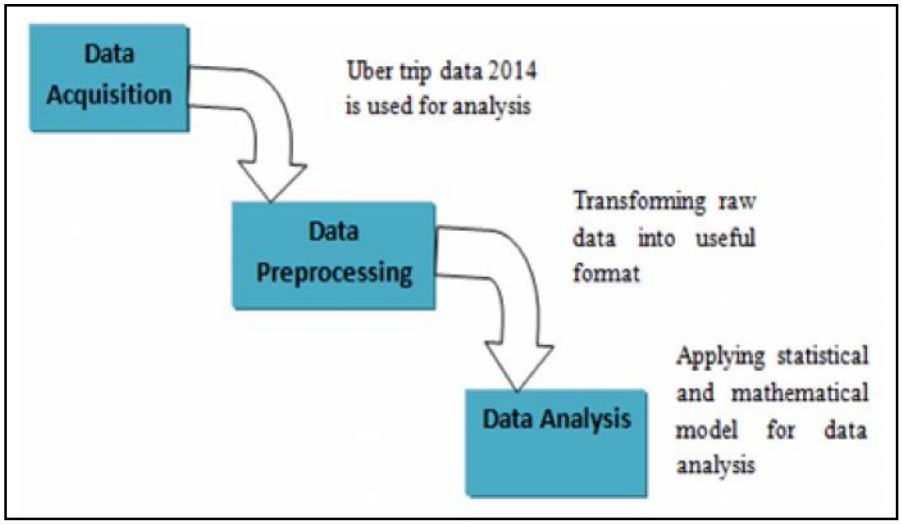

Fig.1 Flow Diagram of uber data analysis

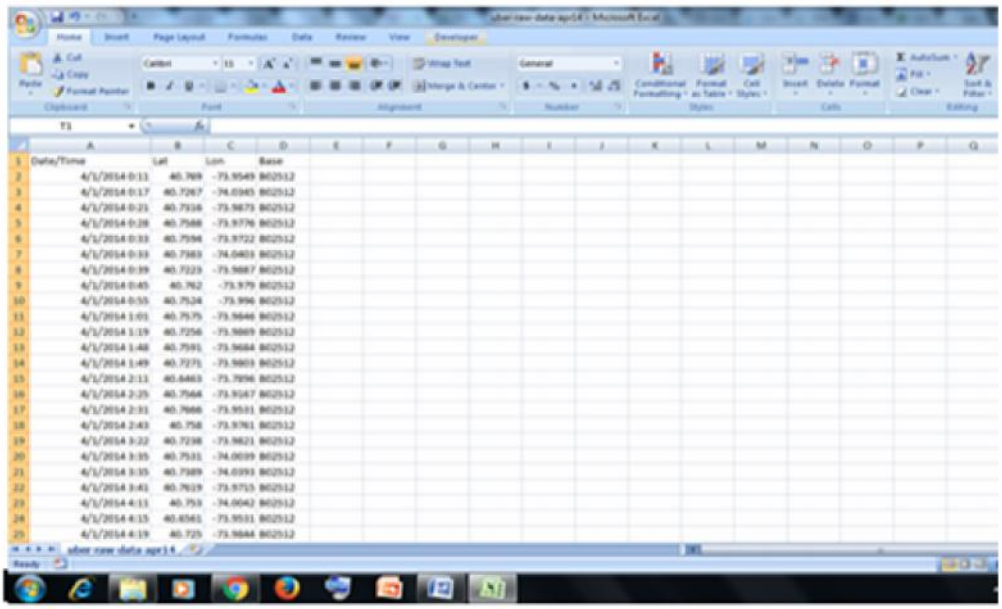

Fig.2 Uber dataset 2014

4. DATASET ACQUISITION & DATASET DESCRIPTION

4.1 Uber Dataset

Dataset consist of trip record data of Uber. It made up of following fields.

Date/Time: The date and time of the Uber pickup
Lat: latitude of the Uber pickup
Lon: longitude of the Uber pickup
Base: The TLC () base company code affiliated with the Uber pickup.

Pandas is an open-source, fast and flexible python library which is used to import the data. In data preprocessing stage, the raw data is transformed into desirable format as shown in figure 3.

	Date/Time	Lat	Lon	Base	dom
564511	2014-04-30 23:22:00	40.7640	-73.9744	B02764	30
564512	2014-04-30 23:26:00	40.7629	-73.9672	B02764	30
564513	2014-04-30 23:31:00	40.7443	-73.9889	B02764	30
564514	2014-04-30 23:32:00	40.6756	-73.9405	B02764	30
564515	2014-04-30 23:48:00	40.6880	-73.9608	B02764	30

Fig.3 Data Frame format

5. DATA ANALYSIS

In this model DOM (Date of the month) is calculated to find the peek day, in which most trips have taken place.

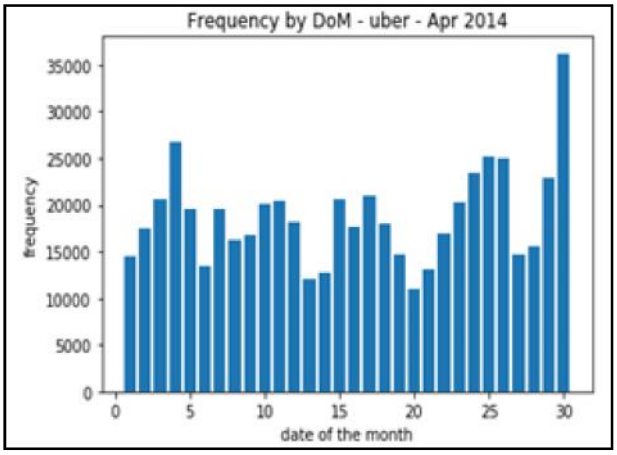

Fig.4 Frequency by Date of the month

Calculating the frequency by hour is useful for finding the peek time in which most trips has taken place.

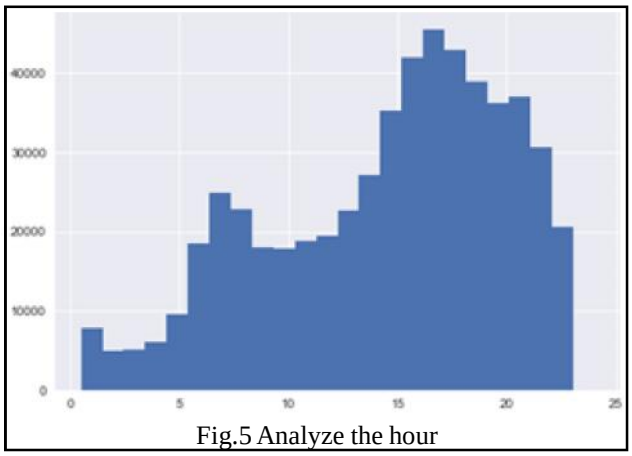

Fig.5 Analyze the hour

Next we are analyzing the weekday in which most trip has taken place.

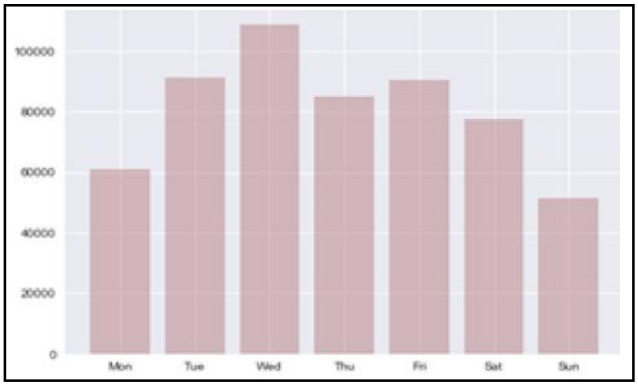

Fig.6 Analyze the weekday

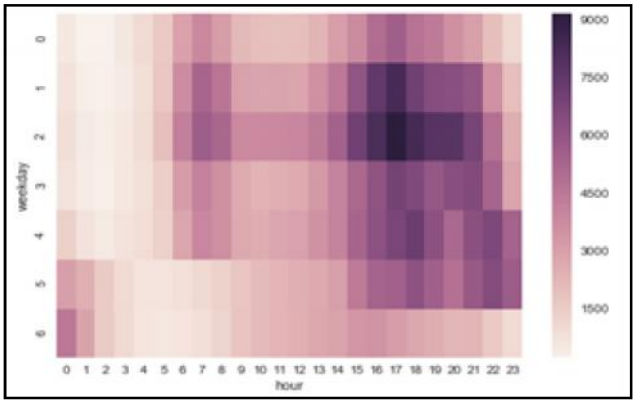

Fig.7 Cross analysis (hour,day)

Cross analysis is performed over hour and date of weekday with the help of heatmap. Seaborn python packages are used to create Heatmap.

Figure 8 shows the number of transactions in the corresponding latitude.

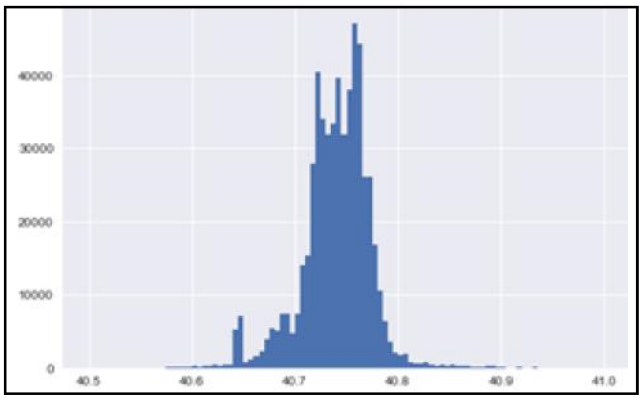

Fig.8 Frequency by latitude

Figure 9 shows the number of transactions in the corresponding longitude.

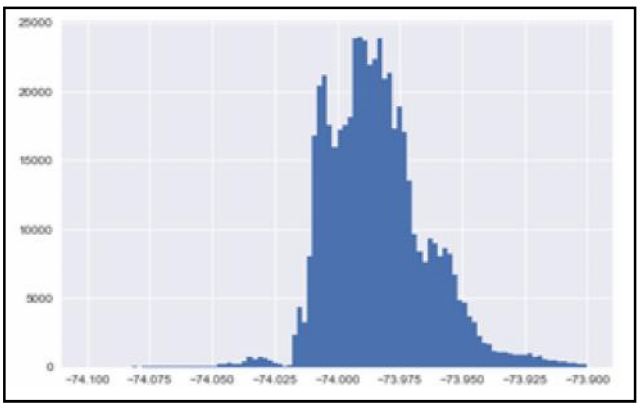

Fig.9 Frequency by longitude

Figure 10 shows the number of transactions over considering both latitude and longitude.

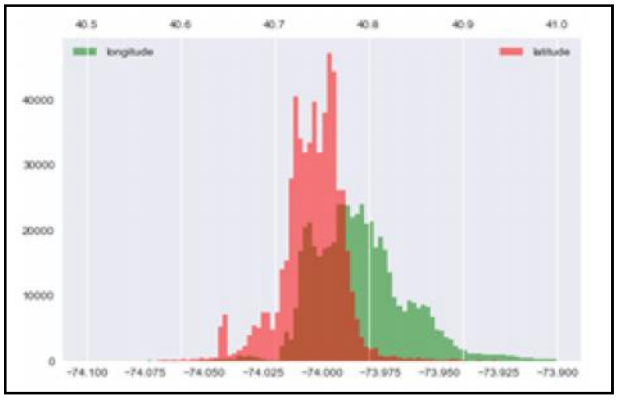

Fig.10 Frequency by considering both latitude and longitude

6. CONCLUSION

In this paper made an attempt to use histogram based approach to analyze an Uber dataset and find the number of transactions taking place at each day of the month, the number of transactions taking place in each day of the week, the number of transactions taking place in each hour of a day and also the number of transactions taking place in any latitude, longitude coordinates. Using these details, we had predicted the busy zone, peak hours and city regions.

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Prediction of Heart Diseases Using Machine Learning Techniques

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Abstract

Heart disease is the most threatening problem which causes sudden death. It has increased the number of deaths since the past ten years. Hence, prediction and earlier treatment has become necessary. The prediction methods used now are not satisfactory. This paper gives various algorithms on using machine learning and data learning techniques to predict heart disease and treat the patients at the early stages. The accuracy rate of prediction using machine learning techniques are also considerably high. The most commonly used algorithms are SVM, ANN, KNN, Feature Selection Mechanism and so on.

Keywords: *SVM, ANN, KNN, Feature Selection*

1. INTRODUCTION

The heart is a muscular organ which pumps blood through the blood vessels of circulatory system. In humans heart is located between the lungs, in the middle compartment of the chest. Heart conditions that include diseased vessels, structural problems and blood clots. The most common heart diseases are heart attack, cardiac arrest, coronary artery disease and so on. Machine learning and data mining plays an important role in building an intelligent model for medical systems to detect heat disease using datasets of the patients , which involves a risk factor associated with heart disease.

2. LITERATURE REVIEW

Heart disease is prominent all over the world. The number of heart patients is increasing day by day especially due to bad consumption lifestyles. Hence, it is imperative to develop some means to detect and predict heart attacks easily and instantaneously. Hence six machine learning techniques were introduced to detect heart attacks and were assessed on receiver operated characteristic curve. The earlier we predict heart attacks the easier to save a human's life. This paper provides the way for predicting the presence or absence of heart disease using an assortment of parameters like tenfold cross validation which can be used for operational heart disease prediction. The highest accuracy level of this technique is 85%.

Cardiovascular disease is one of the most scandalous disease which affects the person all of a sudden and is not easily diagnosed. The root causes for the need of proficient heart disease detection systems are the lack of specialized doctors and rise in the number of wrong diagnosed cases. Hence an assortment of machine learning techniques and medical data mining are being implemented. However, the precision of the results are not satisfactory. This paper proposes a heart attack prediction system using Deep learning techniques, particularly Recurrent Neural Network , a classification algorithm, to forecast the probable possibilities of heart related diseases of the patient by deep learning approach in artificial neutral network. This study incorporates deep learning and data mining to provide accurate results with minimum errors. We have been through many projects and algorithms beginning from ML algorithms to deep learning algorithms and different algorithms had different accuracy which kept on increasing but we were not able to obtain superior results for silent heart attack prediction. RNN and GRU can be used to make the system more accurate and efficient to predict the silent heart attacks and inform the user at the earliest possible. This system has augmented the accuracy to 92% , and thus has proved to be an outstanding source in predicting silent heart attacks.

Health care has become very important these days increasing the need of medical science in health care business which contains a huge amount of hidden informations, which are being tested on patients. Data mining reduces this effectively. Data mining acts as a solution to many healthcare issues. Classification sets a class label to a set of unclassified class. The result of three data mining tools are being used in this paper.

diverse data mining tools are used for giving different consequences regarding same data set with different classification algorithm. WEKA and ORANGE are showing best classification accuracy and Recall. more disease dataset can be used for classification methods ,and also for preventing heart diseases.

Heart is the most important organ in our human body .IT not only circulates oxygen and also vital nutrients through blood to different parts in our body. Even a small problem can affect each and every parts in our body. Now a days scientist are diverting a lot of data analysis work for assisting the doctors to prevent heart problem. So, an analysis of data related to various health problems and its functioning can help in preventing heart problems. From this paper we have Analysed the different prescribed data of patients from different parts of India. This model can help in the decision making along with doctor to treat the patient well and creating a bond between the doctor and patient . In a validation set of data , its not only the necessary that the model has to take **care** , rather true positive care and false negative rate along with AUC-ROC helps in preventing heart problems. The humanity rate in India and abroad is mainly due to heart attack. In this paper, a new metric called selection value is introduced to maximize the accuracy of the algorithm trying to give the doctor with the better option with the history similar data results. Using these data, the doctor can have a clearness with the patient and the patient won't feel cheated at the end. Bio medical and healthcare communitues have noticed a huge progress in big data which has resulted in a wide range of benefits in medical data such as disease recognition, patient and community services if whose data is incomplete, the quality of the study decreases. The disease prediction is weakened as different regions show existence of certain regional diseases. This technique provides machine learning algorithms for effective prediction of disease through proper analysis of real life hospital structured and unstructured data, whose incomplete data is built using latent factor model. This model uses Machine Learning Decision Tree Algorithm and Map Reduce algorithm. The disease prediction accuracy of this method is 94.8% . The convergence speed of this technique is faster than that of CNN-URDP algorithm.

Prediction of heart attack is necessary in today's world because it may lead to death. Although there are many traditional clinical methods like electrocardiography and blood test, nowadays cardiologists are using machine learning methods for diagnosis. The main aim is to determine the finest way of machine learning method and the best characteristic selection algorithm to foresee heart attacks. Machine learning methods with optimum parameters and selection methods were used and evaluated on the Statlog (Heart) dataset. As per experimental results, the best machine learning algorithm is the support vector machine algorithm with the linear kernel, while the best feature selection algorithm is the reliefF method. In the proposed model, four feature selection algorithms from two different categories were used. Amongst the four different feature selection methods, the reliefF algorithm gave the best model accuracy according to the mean accuracy value. The accuracy with feature selection was 84.81% and without feature selection was 82.59%. 84.81% is the accuracy given by SVM-linear and na¨ύve Bayes. In this study, the feature selection algorithms amplified the success rate in the SVM algorithm by 2.22%. In short, machine learning methods facilitate us to envisage the future and to divulge interesting patterns in the medical data.

One of the most life intimidating diseases which have become a common disease is Coronary artery disease. The cost of detection and treatment for this disease is high. As information technology has developed in health care sector, the medical hospitals are using a huge volume of data including patient's details, medications, ECG, etc. One of the best methods for diagnosis of disease is coronary angiography which can be achieved by technical expertise and requires high end tests. So the surgeons are using best computation methods for detection of the disease. The treatment of diseases like diabetes, cancer, thyroid, hepatitis, kidney diseases, and heart diseases has become easier using this method.

Nowadays heart diseases is becoming more threatening and it causes sudden death. To make health systems to properly use the data and analytics, data mining plays a very important role in health care industry. On the basis of healthy and sick individuals heart diseases are being classified. Linear classifier as a Naive Bayes (NB) is relatively stable with respect to small variation or changes in training data. Particle Swarm Optimization (PSO) is an efficient evolutionary computation technique. By developing a novel algorithm maximizing the classification performance and minimizing the number of features, the main aim was achieved. The suggested model with PSO as feature selection increases the predictive accuracy of the Naive Bayes to classify heart disease.

Datamining has found its application in research as it helps in unshielding many new trends in healthcare organisation. Heart disease has increased the number of deaths since the past ten years. Heart disease refers to irregular heart condition which affects heart and all the parts. Data mining techniques are used to analyse data from different sides and discover information from data that is not mined. It solves the trouble of handling huge loads of data for prediction by providing big data prediction. HDFS is used for storing large data in various nodes. Algorithm is executed using SVM.

Cardiovascular diseases have become a steady problem in medical science. In this paper OLPP (Orthagonal Local Preserving Projection) method to decrease the input high dimensional data. Prediction accuracy is increased using hybrid classifier. GSO combine with LM (Levenberg-Marquardt) training algorithm is used to solve problems and analyse best network parameters. Best weight is acquired by LM algorithm when it is linked with GSO algorithm. It was based on neural network and was prepared under a network of iterations which improved the accuracy. This method minimises error and predicts heart disease with high accuracy.

3. CONCLUSION

Studies propose new classifications and predictions schemes for heart disease data in the system. Studies overcome the problems by applying the effective, enhanced and most suitable machine learning technique. This gives rise to a wide range of algorithms. The above presented survey deals with algorithms including Levenberg-Marquardt algorithm, SVM algorithm, D ta mining and Feature selection algorithms. This makes prediction of heart disease easier and with high accuracy.

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Experimental Study On Construction Of Water Tank By Using Ferrocement Technique

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Abstract

Ferrocement technique is one of the oldest forms of reinforcement concrete. Ferrocement is relatively a new material consisting of wire meshes and cement mortar. Ferrocement technique is used in the different elements of the structure like slab, roofs, lining of tunnels, security guard sheds etc., Most commonly it is used in the water bodies related structure like water tanks, boats etc., It has a high strength and durability as same that of normaltanks. It is good resistance to cracking because wall thickness is small in this method of construction so there is a usage of very little cement. When we compared to the RCC structures Ferrocement structures are easily repairable. It is a thin wall reinforced concrete, reinforced with layers of mesh wires (small size wire mesh). The materials used for this construction work is mesh wires, steel rods, cement, fine aggregate, water and some water proofing admixtures. First the fabrication of the structure is constructed as per the detailed drawings. The fabricated structure has to be casted and plastered. After the completion of plastering work the tank is allowed to dry and cured for a period of 21days for a shorter period of curing steam curing is carried out. The casted tank is needed to test in the strength, water tightness and stability aspects. Cement Mortar is casted in the mould and get to test for its compressive strength. According to the Indian Standards the normal compressive strength of the 53grade cement mortar is 37Mpa (min). Ferrocement construction is 10-20% cheaper than the normal RCC water tanks.

Keywords*: Admixtures, Cement Mortar, Ferrocement,Ferrocement Tank, Mesh Wires, Reinforcement*

1. INTRODUCTION

Ferrocement is originated in the year 1840 in France and later it is developed into the reinforced concrete. It has a wide range of advantages over the normal concrete. It is less in weight, economical, lack of skilled labour, no need of frame work Etc., It has manyunique properties as high-tensile strength, lightweight, good resistance to cracking, moulded to any desired shape and non-corrosive nature. It has a wide range of application in the manufacture of boats, barges, biogas structures, prefabricated housing units, silos and tanks and in the repair and rehabilitation of the structures.Thickness of mesh wire layers in the Ferrocement ranges from 10mm to 60mm. Layers of mesh wires will provide a high strength to the structure. In constructing the water tanks with a capacity of higher ranger leads to large number of layers. Mesh wires are used in the midway between reinforcing bars so that there is a need of high rich in the cement mortar (ratio of cement to sand content is high). Cement mortar has a ratio of cement to sand is 1:2 or 1:3 and with a water / cement ratio of 0.4 to 0.45.Steel weight varies with a range of 300 -500kg per cubic metre of mortar.

Ferrocement technique has a versatile construction material and possesses high performance characteristic, strength, impact resistance and ductility. Ferrocement tanks are four times cheaper compared with the constructed tanks. Ferrocement technique is highly suitable for the pre-casting elements because of its easy adaptability to prefabrication and lesser dead weight of the units cast. Development of prefabrication techniques for Ferrocement is still not a widely explored area and a gap needs to be filled. Tanks made with Ferrocement are used in many countries for collection and storage of water for drinking, washing, for animal use and irrigation purpose. Ferrocement tanks vary in capacity, size and shape. They are built by hand-towelling layers of cement mortar onto a wire frame which is either free-standing or held in place by temporary or permanent structures known as 'formwork'. Cement mortar alone is strong enough to withstand the applied load and water pressure in the tank.The compressive strength was found to increase with the increase in the Silica Fume percentage up to 15% subsequent increase in the Silica Fume results in reduction of compressive strength of the structure.

2. STUDY OF LITERATURE

Continued hydration of cement and resulting increase in the maturity of the mortar in the exposure conditions. Drying, wetting and curing with 6% Nacl solution gives strength and stiffness of Ferrocement in direct tension and flexure. **R.Sri Ravindrarajah and P.Paramasivam[1986]**

Ferrocement could impact the strength of space trusses. Comparison between Ferrocement slabs without steel is good until failure on slab and steel. It gives investigation on composite action between Ferrocement slab and steel sheeting.**Boshra Aboul-Anen, Ahmed El-Shafey and Mostafa El-Shami [2009]**

Replaceof cement with silica fume is limited to 15% and it gives better strength compared to normal concrete. It has to be encouraged for the use of Ferrocement as low cost material. Interaction between mesh elements and cementitious binder results with kind of arterial with versatile, strong, durable and high ductility. **Y.B.I.Shaheen and A.A.Elsayed[2013]**

Ferrocement will strengthen all the corners and helps in reducing stress concentration at the corners. Ferrocement jacketing improves ultimate load carrying capacity and increase ultimate axial deflection. **A.B.M.Amrul Kaish, M.R.Alam[2013]**

Using recycled concrete as core material did not have significant drawbacks. U-shaped steel mesh gives permanent reinforced mortar with sufficient shear reinforcement. It gives higher first crack load, service load, ultimate load, absorption based on the type and number of layers of steel mesh. **Y.B.I.Shaheen Ezzat H.Fahmy [2014]**

Increasing in number of layers of mesh reinforcement in Ferrocement wrapping does not enhance the torsion strength. Reinforced beams with Ferrocement U wrapping show better rotation capacity compare to beams falling under other states of rotation. **Gopal Charan Behera, T.D.Gunneswara Rao, C.B.K.Rao [2016].**

Self Flow Mortar (SFM) can be used in the Ferrocement jacketing system to increase the strength of the structures. Constituent material of SFM dictates the strength and flowability of SFM. High strength flowable mortar with low cost.**Shamir skir, S.N.Raman, A.B.M.A.Kaish and A.A.Mutalib [2016]**

Ferrocement is more suitable for the storage tanks with a good strength as compared to the RCC structures. Construction of water tank is 10-20% economical, strength, rigidity, workability. Goal of the research is feasibility of Ferrocement. **B.Antonin Gnana Jenofer, U.Prem Anandh and R.Dhinesh [2018]**

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3. ORIGIN OF THE PROJECT

Generally, all the construction work is carried out through the RCC method. When the construction is done with the Ferrocement method there is many advantages as compared to the RCC. It is economical one and it is also eco-friendly, the cement content used in this technique is small so it results in the less emission of CO_2 gas and on the same side it is 20-30% economical to the normal concrete. Ferrocement structure is a light-weighted one so it can be easily portable from one place to another. In this technique saving of materials is 70-80% less as compared to the RCC and it is easy to repair the elements in case of crack or any other failures. It is simple to implement, cheap and semi-skilled construction workers can learn it with ease. It can be used for the storage of water tanks and also for the rain water harvesting tank etc., and there is a possibility of manufacturing tanks with large amount of capacity. Ferrocement tank can be used for domestic over-head water tanks due to its lightweight, flexibility, easy transportation and can be lifted without much difficulty. The pipe connections for this tank are very easy with the help of chemical adhesive like “m-seal”. It can be used for storing grain silos in villages and it helps in preserving the grains from moisture. Ferrocement tanks can be used as septic tank units. Ferrocement container can be used as gas holding unit in “Gobar gas” plants. Number of layers of mesh wires used in this technique is Minimum of 2 with a maximum of 10 layers but when we go for a large no of layers it will results in increase in the thickness of the wall. Layers of mesh wires are also based on the capacity of the water tank for large capacity tank maximum layers have to be used. Generally the water tanks are built in circular or rectangular shapes but the circular shape is good. In the rectangular shape the stress is more in all the corners and the load is not distributed equally but in the case of circular tank load is distributed equally to the entire portion. Admixture is used for the suppression of galvanic action between galvanized steel and cement is achieved by chromium trioxide approximately 300ppm in mixing with water and admixture can also be used for halting the leakage of water.The goal of this project is to solve the problems

due to huge requirement of raw material in nature for the manufacturing of conventional building material. The finding of alternatives low cost and environmental sustainable building materials is a best economic way to overcome from the problems. Importance must be given to cheap, locally available and eco-friendly building materials during the construction process.

4. MATERIALS USED

The materials used in this Ferrocement technique are,

i. Cement
ii. Fine Aggregate
iii. Water
iv. Wire Mesh
v. Steel Rods
vi. Binding Wire
vii. Admixture

4.1 Cement

The cement used is **Portland Slag Cement(PSC).**The properties of the cement are specific gravity is 3.12, consistency is 34%, Initial setting time is 45Min, Final setting time is 420min and Compressive strength is 35N/mm^{2}for 7 days.

4.2 Fine Aggregate

The specific gravity of FA is 2.63 and aggregates passing through 4.75mm sieve are used. The fineness modulus of the aggregate is 2.75.

4.3 Wire Mesh

Fine wire mesh reinforcement is the basic element of Ferrocement it controls the specific surface which is an important factor in design. Two types of mesh wire is used in this project work is hexagonal wire mesh (chicken mesh) and square mesh wire. Chicken mesh is in the size of 0.5mm Dia with 10mm spacing andhas yield strength of 310N/mm^2. Square mesh is in the size of 1mm Dia with 2mm spacing and has yield strength of 450N/mm^2.

4.4 Steel Rods

Steel rods used in this project work are 10mm, 8mm and 6mm diameters. Main rod is used as 10mm and 8mm is used as distribution in base slab and 6mm is used as distribution in retaining wall. The steel rods are used as per the design requirements.

4.5 Binding Wire & Admixture

Binding wire of 18 to 24 gauges is used. Admixture in Ferrocement serve four purpose they are water reduction in increases the strength and reduce permeability using super plasticizers, waterproofing for water tightness, air entraining agents increase the resistance to freezing and thawing and suppression of galvanic action between galvanized steel and cement is achieved by chromium trioxide approximately 300ppm in mixing with water. In this work we used a water proofing admixture as Araldite for halting the leakage of water. It has to be added 100ml for each 50kg cement bag.

4.6 Water

The mixing water should be fresh, clean and potable. It should be free from organic matter, oil, sugar, chlorides, silt and acidic materials. Value of PH is close to7.0and salt water is not acceptable but chlorinated drinking water is acceptable.

5. METHODOLGY

The following processhas to bedone for the construction of Ferrocement water tanks,

- Fabrication of reinforcement
- Mortar Preparation
- Plastering
- Curing

5.1 Fabrication of Reinforcement

Mild steel rods are commonly used for the construction. The reinforcement is fabricated as per the detailed drawing. Reinforcement for the base slab is fabricated and vertical rods are used in the side walls. Then the mesh wires are covered midway between the rods. The large number of layers of mesh wires will give a high strength to the structure. Mesh Wires are provided both in the inner and the outer portion. In a circular tank horizontal rods are provided in the inner side of the walls.

5.2 Mortar Preparation and Plastering

The ratio of mortar is 1:2 or 1:3 (ratio of cement to sand). For yielding a higher strength 1:3 ratio is used.

The ratio of cement mortar 1:3 is good resistance to cracking as compared to 1:2 ratio. The admixture is also added to the mortar based on its property and allows it to mix thoroughly 2-3 minutes.

The base slab is constructed after the fabrication process and allows it to dry. The outer layer of the side wall is plastered and allowed to set or dry for a day and the inner portion of the wall is plastered. After plastering within 2 or 3 days finishing work being done.

5.3 Curing

Normally curing of Ferrocement concrete is considered for a period of 7 to 14 days. If the continuous work of curing is not possible then the jute bags can be used for the curing and keep it as wet. Steam curing can be made for the short period of curing.

5.4 Water-Cement Ratio

The ratio of water to cement has an important parameter on the final strength of the mortar. A ratio of about 0.4 to 0.45 (water / cement ratio) is ideal, which is equivalent between 20 to 25 litres of water for each 50kg bag of cement.

6. EXPERIMENTAL SETUP

Tank Type	**Circular**
Tank Height	**1.09m**
Tank Diameter	**1.09m**
Tank Wall Thickness	**0.06m**
Tank Capacity	**1000 litres**
Grade of Cement	**53 Grade**
Grade of Concrete	**M20**

Water Capacity:

Volume = $\pi r^2 h$

= π X 0.545^2X 1.09

= **$1.01m^3$**

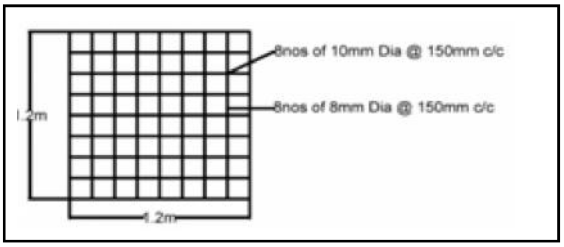
1cu.m = 1000 litres

7.TESTING

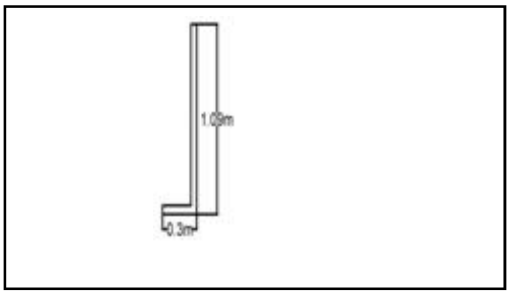
The strength of the tank is determined by the compressive strength of the mortar. It is important to determine the water tightness. Water is filled in the tank and observes the tank for 10days. After the completion of 10days record the water level in the tank if the water gets reduced then there is an leakage of water in the tank. If the tank is opened then there is an possibility of evaporation so consider20ml water evaporates for a day.

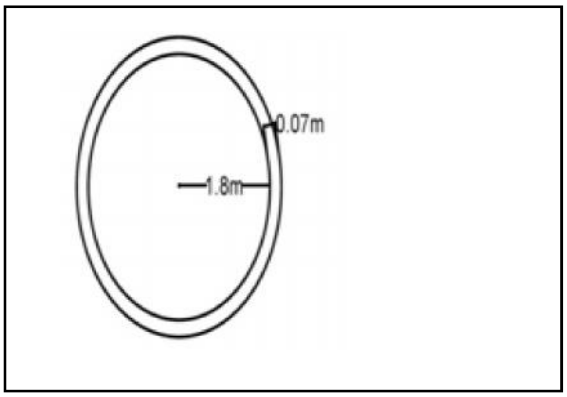
7.1 Reinforcement Details

BASE SLAB



VERTICAL ROD **HORIZONTAL ROD**





TEST ON STEEL RODS

FABRICATION OF REINFORCEMENT

PLASTERING

8. CONCLUSION

The following conclusions are made based on the experimental studies. Ferrocement will increase the capacity of all the existing elements. It is good against lateral displacement, fire resistance and economically there is no need of skill labour.The study of this Ferrocement tanks is economical and on the other side there is no compensation in its strength, workability and rigidity. The foregoing feasibility shows that Ferrocement can be used as a construction material for water tanks with simple construction techniques suitable for rural applications. The constructed water tank shows a good characteristic performance and gives a compressive strength of 50N/mm^2. The water tank is observed for its water tightness test and there is no leakage of water and there is no cracks are developed in the water tank. Technology transfer and information dissemination activities should be intensified to promote Ferrocement technology and its applications.

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Flexural and Compressive Behaviour of I-Steel Section Strengthened by Stainless Steel Plate

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Abstract

Stainless steel is widely used in construction due to its combination of excellent mechanical, durability, and aesthetic properties. Towards the development of sustainable infrastructure, stainless steel is expected to be more commonly specified. This study investigates the Experimental and analytical study on flexural and compressive behavior of steel sections strengthened by a duplex stainless-steel plate. DSS-plate of different thickness with three different lengths is arc welded to ISMB125 section. A standard 3-point bending and axial compressive test are conducted using a standard loading frame test, the results including the load-displacement, ultimate load, stress, and strain are observed. After performing experimental study all the specimens were analyzed by the finite element method by using ANSYS and results are compared with those obtained experimentally. The optimum stainless-steel plate length and thickness for strengthening steel beam and column are determined.

Keywords: *Duplex stainless-steel, I-section member, Strengthening of beam and column*

1. INTRODUCTION

Significant developments have occurred in processing different grades of stainless steel to meet the various demands of engineering and architectural applications, particularly where durability and aesthetics are of the major concern. Corrosion resistance is one of stainless steel's major advantages eliminates the need for applying the protective coating and reduces the overall maintenance cost leading to economic savings [1,2]. Additionally, stainless steel shows distinctive mechanical properties compared to carbon steel, such as rounded stress-strain curve, significant strain hardening and high ductility making it well suited for impact resistant structures, fire, and explosion resistant walls, seawalls, piers and other coastal structures and structures under aggressive environment [3]. Despite its superior advantages compared with carbon steel, the high initial cost attributed due to nickel content for the most commonly adopted austenitic grades (8"11)% is one of the major drawbacks which hinder the widespread use of structural stainless steel in construction industries.[4] An improvement is further accomplished with the recent development of a new grade of stainless steel, called Duplex Stainless Steel, DSS (EN 1.4162) which has a lesser nickel content of ~1.5% resulting in lower cost [5,6]. Conventional repair and strengthening methods such as replacement of damaged steel member, installation of the intermediate support, reinforcement of steel beams by addition of angle stiffeners are still used successfully [7,8].In corrosion rich environment situations like coastal areas and marine structures, corroded steel beam can be retrofitted by duplex stainless steel .this research concentrates on the perspective of elevating the flexural and compressive strength of the corroded steel beam by a duplex stainless steel plate. The complete experimental and analytical study is exhibited and the optimum stainless-steel thickness and length is concluded in this paper.

2. SPECIMEN PREPARATION

In this study, A standard ISMB 125 steel member is used for the flexural and compressive study, the geometry of the section is adopted from the seel tables. The ISMB125 is collected from a scrap yard where the member will be exposed to a corrosive environment, which is retrofitted by DSS plate. Duplex stainless-steel plate of 1mm, 2mm, 5mm, and 7mm is purchased and the plate is chopped to specified length using laser cutting. For a flexural member, the plate is welded to the flange in the tension face similarly for compression member the plate is welded to both the flanges. the specified dimensions of the retrofitting plate are provided in **Table**

1. where the CB, CC are controlled beam and control column respectively. For beam B1.1-B4.3 the duplex stainless-steel plate is welded to the bottom flange of the member in order to increase the tensile capacity of the beam. In case of compression member, specimen C1.1,C2.1,C3.1,C4.1 is strengthened by welding the DSS plate to the full length and width of the flanges.C1.2,C2.2,C3.2,C4.2 the plate is welded at the top middle and bottom of the flange for 250x75mmm length .C1.3,C2.3,C4.3,C5.3 DSS plate of full length of width 35mm is welded to the flanges.

Table 1 List of Specimens

SPECIMEN	PLATE mm	THICKNESS
CB	-	-
B1.1	500X75	1mm
B1.2	800X75	1mm
B1.3	1000X75	1mm
B2.1	500X75	2mm
B2.2	800X75	2mm
B2.3	1000X75	2mm
B3.1	500X75	5mm
B3.2	800X75	5mm
B3.3	1000X75	5mm
B4.1	500X75	7mm
B4.2	800X75	7mm
B4.3	1000X75	7mm
CC	-	-
C1.1	1000X75	1mm
C1.2	250X75	1mm
C1.3	1000X35	1mm
C2.1	1000X75	2mm
C2.2	250X75	2mm
C2.3	1000X35	2mm
C3.1	1000X75	5mm
C3.2	250X75	5mm
C3.3	1000X35	5mm
C4.1	1000X75	7mm
C4.2	250X75	7mm
C4.3	1000X35	7mm

3. EXPERIMENTAL STUDY

3.1 Flexural Behaviour

A standard Three-point bending tests were conducted to obtain the basic flexural response characteristics of I-section beams strengthened by duplex stainless steel. Figure 1 indicates the loading pattern of the beam specimen. A total of thirteen 3-point bending tests were carried out. The beams had a total length of 1000 mm and were simply supported at the ends, which were placed 100 mm inward from each end of the beam and allowed axial displacement of the beams ends, resulting in 800 mm clear span between the centrelines of the supports. The load is applied in the mid-span by a hydraulic jack, the strain gauge is placed below the mid-point obtain the maximum deformation at the ultimate load. The ultimate load, stress, strain and percentage increase in ultimate load for each specimen is enclosed in Table 2.A comparative bar chart is prepared based on the ultimate load, stress, strain and percentage increase in the ultimate load of the various beam specimen is represented in Figure 2.

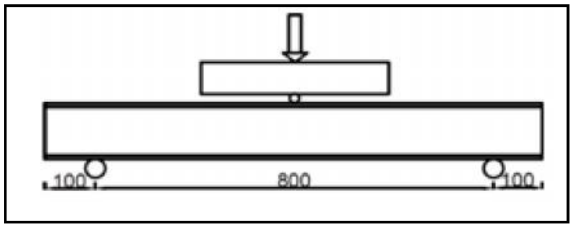


Fig.1 Flexural testing

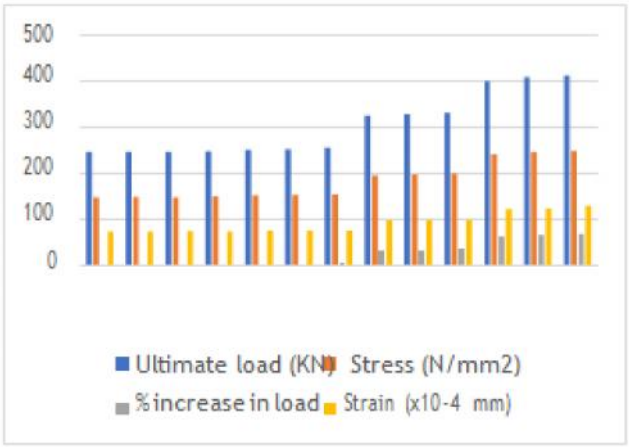


Fig. 2 comparison on flexural response of beam specimens

3.2 Compressive Behaviour

In order to study the behavior of I-section column under axial compression, sixteen specimens with various stainless-steel plate length are arc welded to ISMB 125X75 steel section. A 200x200mm structural steel plate of 5mm thickness is attached to the top and bottom of the column in order to distribute the axial load uniformly to the entire cross section of the column The test is performed in a standard loading frame testing which provided essentially fixed end condition to the bottom

and free end at the top. The specimen was subjected to formly increasing load until the failure mode is absorbed. The ultimate load, stress, strain and percentage increase in ultimate load for each specimen is enclosed in Table 3. A comparative bar chart is prepared based on the ultimate load, stress, strain and percentage increase in the ultimate load of the various column specimen is represented in Figure 3.

Table 2 Results on Flexural Behaviour of Beam

Specimen	Ultimate Load (KN)	Stress (N/mm^2)	% Increase in Lcoad	Strain ($x10^{-4}$ mm)
CB	245.68	148.12		74.23
B1.1	246.28	148.79	0.245	74.58
B1.2	246.56	148.26	0.359	74.91
B1.3	248.12	149.87	0.993	74.5
B2.1	250.56	151.56	1.986	75.5.76
B2.2	251.94	152.78	2.553	76.20
B2.3	255.49	153.26	3.993	76.50
B3.1	324.19	195.76	31.95	97.5
B3.2	328.12	197.26	33.55	98.5
B3.3	331.25	199.86	34.83	99.5
B4.1	400.01	240.1	62.81	122.6
B4.2	408.76	246.6	66.38	123.6
B4.3	412.28	248.56	67.81	129.4

Table 3 Compressive Test Results

Specimen	Ultimate load (KN)	Stress (N/mm^2)	% Increase in Load	Strain ($x10^{-4}$mm)
CB	522.67	148.25		7.4
C1.1	527.01	149.16	0.83	7.5
C1.2	525.62	317.28	0.564	15.85
C1.3	524.81	316.85	0.993	15.8
C2.1	550.01	331.49	5.23	16.55
C2.2	546	329.64	4.46	16.45
C2.3	540.89	326.91	3.48	16.3
C3.1	623.51	375.82	19.29	18.75
C3.2	609.61	367.46	16.63	18.35
C3.3	600.71	362.85	14.93	18.1
C4.1	779.67	469.16	49.17	23.45
C4.2	700.91	422.23	34.1	21.1
C4.3	681.04	410.1	30.3	20.5

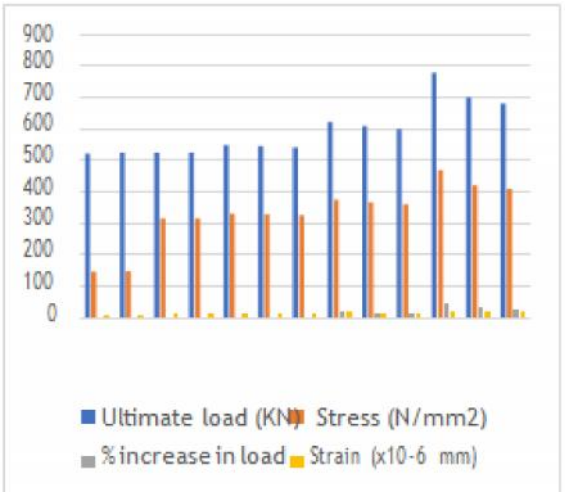


Fig.3 Comparison of compressive behaviour on a steel column

4. NUMERICAL STUDY

4.1 FLEXURAL BEHAVIOUR

The experimental study conducted in the research is stimulated in the analytical analysis software called ANSYS. Based on the finite element analysis the model is stimulated to flexural and compressive loading and maximum deformation is obtained. The beam model is created using solid works software where ISMB125 section is created accurately to the geometry. The beam section is then imported to ANSYS where the material properties such as ultimate tensile strength, yield strength, compressive strength, Young's modulus, and poisons ratio are assigned. A tetrahedron, a fine sized mesh is generated in the beam with a fine smooth finish to obtain accurate results. A simply supported three- point loading condition is stimulated by applying the load at the midpoint and deformation is obtained for the beam. Figure 4 represents the CB specimen which is simulated for simply supported loading condition under point load acting at the midpoint. Similarly, each 13-beam specimen is stimulated and the ultimate load, stress produced, strain induced is shown in Table 4.

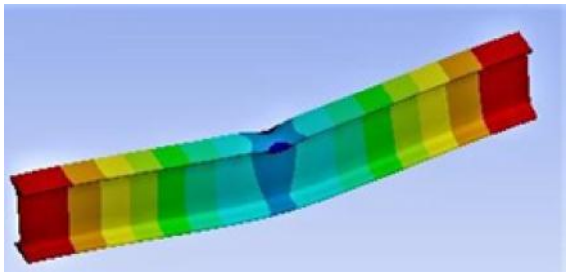


Fig.4 Deformed CB beam under point load

Table 4 Analytical Results on Flexural Behaviour of the Beam

Specimen	Ultimate Load (KN)	Stress (N/mm^2)	% Increase in Load	Strain ($x10^{-4}$ mm)
CB	247.68	149		7.45
B1.1	247.81	149	0.053	7.45
B1.2	248.12	150	0.177	7.5
B1.3	250.01	151	0.941	7.55
B2.1	252.24	151.95	1.841	7.59
B2.2	253.81	152.89	2.47	7.65
B2.3	256.89	154.75	3.718	7.74
B3.1	326.97	196.96	32.01	9.49
B3.2	331.46	199.67	26.96	9.99
B3.3	337.28	203.18	36.181	10.16
B4.1	402.98	242.76	62.701	12.14
B4.2	412.56	248.53	66.57	12.47
B4.3	415.01	250.01	67.595	12.50

4.1 COMPRESSIVE BEHAVIOUR

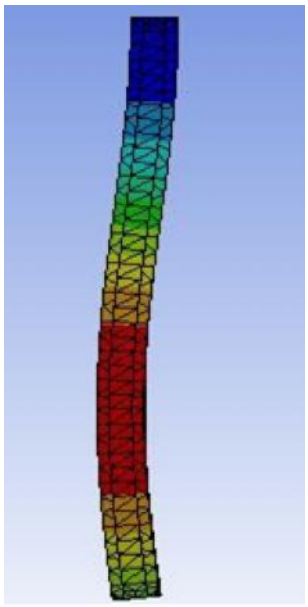
The experimental study conducted in the research is stimulated in the analytical analysis software called ANSYS. Based on the finite element analysis the model is stimulated to axial compressive loading and maximum deformation is obtained. The beam model is created using solid works software where ISMB125 section is created accurately to the geometry. the beam section is then imported to ANSYS where the material properties such

as tension ultimate strength, tensile yield strength, compressive yield strength young's modulus and poisons ratio are inputted. A tetrahedron, a fine sized mesh is generated in the beam with a fine smooth finish to obtain accurate results. An axially loaded column setup is made by bottom end fixed and another end free condition and the load is applied vertically, similarly, each 13-beam specimen is stimulated and the ultimate load, stress produced, strain induced is shown in Table 5.

Table 5 Analytical Results on Axial Compressive Behavior of Steel Column

Specimen	Ultimate load (KN)	Stress (N/mm^2)	% Increase in Load	Strain ($x10^{-4}mm$)
CB	525.67	316.26		15.81
C1.1	526.95	316.86	0.245	15.84
C1.2	527.55	317.80	0.359	15.89
C1.3	530.88	319.80	0.993	15.99
C2.1	536.11	322.95	1.986	16.14
C2.2	539.28	324.84	2.553	16.24
C2.3	547.32	329.71	3.993	16.48
C3.1	684.00	412.04	31.95	20.52
C3.2	704.48	424.38	33.55	21.21
C3.3	709.65	427.5	34.83	21.37
C4.1	848.69	511.25	62.81	25.56
C4.2	872.61	525.66	66.38	26.28
C4.3	882.12	531.39	67.81	26.56

Table 5.the column subjected to ultimate axial load undergoing ultimate failure mode of bulking is represented in Figure 5



4. RESULT AND DISCUSSION

The experimental and analytical results show that the flexural and compressive strength of the ISMB125 increases with increasing thickness of the duplex stainless-steel plate. Yet the percentage increase in the load varies at different rate for each specimen it can be absorbed that, for plate thickness 1mm and 2mm there is only upto 3.99% increase in ultimate load before failure, but with plate thickness 5mm and 7mm the there is a drastic increase of 34.83% and 67.81% in flexural strength and 34 and 67 percent in axial compressive strength.In the case of length variations of the plate, the optimum length for retrofitting the corroded beam or column is by using the using duplex stainless-steel plate of full length which in this case is 1000mm. although a considerable increase in strength can be seen plate length 500mm,800mm, and 75mm and 250mm in beam and column respectively, the corrosion protection of the beam must be taken into consideration to avoid further corrosion full-length plate recommended.

5. CONCLUSIONS

Based on the experimental and numerical results, for flexural member the optimum length of the duplex stainless-steel plate is 1000mm of thickness 7mm. This combination of the plate can retrofit the corroded beam up to 67.81% of its original strength, For compressive member DSS plate of the full length of thickness 7mm plate is concluded as an optimum combination it has a

67% increase in load carrying capacity of the column. Although the strength will be increased with increase in thickness, the material cost will increase simultaneously, which will become uneconomical.

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Identification of Groundwater Location Using Geophysical Method

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Abstract

Groundwater is a natural water source for fresh water. Geologist and hydrologists assess groundwater for its quantity and quality using different methods and models. Here, in this study, the groundwater is assessed for its location or depth using a geophysical method. Geophysical methods are the prominent methods for locating the table. The study involves a new principle, which is basically a slightly modified method of Electrical Resistivity method. The important differences between the two principles are, (i) the circuit is simplified from 4 electrodes to 2 electrodes. (ii) the primary parameter 'resistivity' is neglected as the current supply and voltage are of standard inputs for all the trials of the project. The layers of the soil composition are identified using the output to input voltage ratio. The groundwater data can be interpreted with ArcGIS software for mapping the selected location, i.e., Mookan Lake, Kannankurichi, Salem.

Keywords : *Electrical conduction, Geophysical method, GIS mapping, Groundwate, Soil exploration*

1. INTRODUCTION

The groundwater identification is a necessary procedure that assists many other fields such as agriculture, hydrology, environmental monitoring and analysis. Here in this study, the principle is set on the Electrical conduction. The building up of circuit and instrument setup is simplified from the Electrical resistivity method. The two types of electrodes – inner and outer are not followed but a simple serial connection of battery, electrodes, resistor and in certain cases, transistor is set up. The groundwater affects the environment and human- resource relation for exploitation. Recently, Cape Town in South Africa has become the first city in the world and in the history to run out of the groundwater. The continuous monitoring of Groundwater can be understood from the human activities and the seasonal changes. Once the database for the groundwater is created, it can be shared for monitoring and analysing in ArcGIS Explorer or other similar software tools. Also mapping various locations on the basis of Groundwater quantity can be done for many other future references.

2. CIRCUIT AND INSTRUMENTAL SETUP

The circuit formation was done from taking numerous trials, modifying and neglecting various components of the circuit. Majorly there were three circuits that were considered. Each one overcame the defects of the preceding. The first circuit was a simple battery-connected circuit which failed to limit the current supply to the LED indicator especially in the saturated soil samples. The second circuit included resistors to limit the supply, however, the amplification was needed when kept in dry soil samples. The third and the final circuit had the inclusion of transistor, preferably NPN transistor. The amplification can be provided by the transistor and also be used as a switch in the circuit. The arrangement of other circuit components along with the transistor was properly made with the understanding of base, emitter and collector theory.

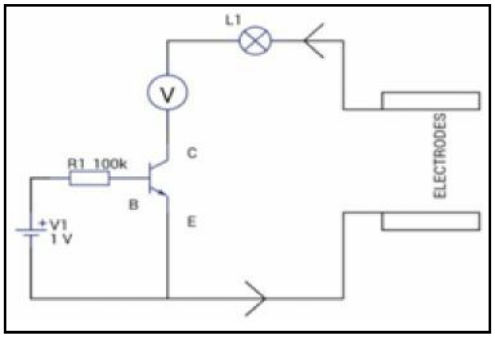

Fig.1 Final circuit diagram

The instrumental setup was done with the reference of the Wenner setup of Electrical Resistivity method, explained in the code book IS 7808 1975. However slight modifications are made and are kept standard throughout the project. The spacing between the electrodes is kept 1m standard throughout the project. The spacing between the electrodes is kept 1m throughout all the trials. The depth of electrode can be as small as (1/20)th of the spacing.

3. SPECIFICATIONS OF THE COMPONENTS

The battery used is similar to that used in the four-wheelers. The standby power comes around 168 watts of power. When used in periodic cyclic mode the voltage changes around 13 volts.

Table 1 Specifications of Components

Description	Feature / Value
BATTERY	
Battery name	12v 14ah sealed lead acid Battery
Voltage	12 volts
Power	168 watts
Terminal type	T2 (suitable for 2 electrodes)
Dimensions	5.94" x 3.86" x 3.74"
Battery type	Rechargeable
ELECTRODES	
Material	Iron
Length	15 centimeters
Terminals	Two
Cross sectional area	0.05 sq.cm
RESISTOR AND TRANSISTOR (IN CERTAIN CASES)	
Resistance	100 kilo-ohms
No. Of resistor	1 in series with battery
Transistor type	NPN transistor
INDICATORS	
Type of indicator	Led
No of indicators	Mostly 1

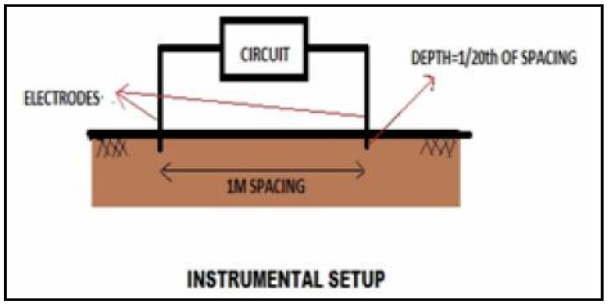

Fig 2 (a). Instrumental setup – Diagram

Fig 2(b). Instrumental setup - Field

Thus the circuit and instrumental setup framing was the major part of the phase 1 of the project. The specifications of the components used in the project were chosen from the recommendations and also the factors affecting the suitability for the applications on the field.

4. TESTS CONDUCTED

4.1. Lab Tests and Results

The lab tests were conducted after the instrumentation to understand the voltage readings for three types of soil, namely, cohesive, cohesionless and organic soil. The soil samples are taken and the readings are done by predetermining the soil type and the water content, which is determined by oven dry method. The readings were understood for different types and studied by plotting the voltage ratio values against the type of soil.

4.2 Field Tests and Results

Location- Mookaneri, Kannankurichi

The field trials were done in the selected points. Four lines of points was selected on the same side of the lake. On each line, numerous points were taken at regular intervals. And at each point, three depths were chosen at which the tests were conducted. The surfaces points, 2feet depth and 5feet depth were the considerations. The input voltage was measured earlier and during the trials at each point, the output voltage was measured for the same supply voltage. The ratio between these two parameters i.e., input to output voltage ratio was the primary parameter from which the soil type and groundwater table can be identified and located.

The ratio for different trials are being collected and the ranges for different types of soil medium can be found out with the reference of the resistivity values of different soil layers that were already found from the electrical resistivity method. The different soil medium will be displayed in graphical forms such 3d block using Visible Geology Online software. The mapping will also be done in ArcGIS software with the focus on the depth of the groundwater located in the particular location. The data from the ArcGIS Explorer tool can also be assessed for reference, sharing or even for analysing. In addition, an android app called ATS GeoSUITE can be used to find out the soil composition which is done by an alternate, simple method. Thus the data from both the methods are compared for appropriate results.

Table 2 Sample Readings for Cohesionless Soil

A. Water added in ml	*B.* Water content of the soil	*C.* Output Voltage		
		D. At surface	*E.* Half inserted *F.*	*G.* Mostly inserted
H. 100	*I.* 9.48%	*J.* 1.82	*K.* 1.79	*L.* 1.74
M. 200	*N.* 9.61%	*O.* 1.7	*P.* 1.68	*Q.* 1.65
R. 300	*S.* 9.7%	*T.* 1.61	*U.* 1.59	*V.* 1.58
W. 400	*X.* 9.79%	*Y.* 1.44	*Z.* 1.42	*AA.* 1.39
BB. 500	*CC.* 9.92%	*DD.* 1.35	*EE.* 1.33	*FF.* 1.32

Table 3 Sample Readings for Points at 3m from the Lake Bank

GG. Depth (ft)	*HH.* Input voltage(V)	*II.* Output voltage(V)	*JJ.* Ratio *KK.* ($x10^{-2}$)
LL. Surface	*MM.* 12.34	*NN.* 4.21	*OO.* 34.11
PP. 2 feet	*QQ.* 12.34	*RR.* 4.19	*SS.* 33.95
TT. 5feet	*UU.* 12.34	*VV.* 4.08	*WW.* 33.06

5. CONCLUSION

The results from this method can deduce the following ideas and conclusions,

- The reference electrodes can be neglected with proper setup and arrangement of the components in the circuit.
- With the absence of the extra 2 electrodes, the circuit has become simpler and economical without sacrificing the end results.
- Although the circuit and procedure have become simpler, the values of voltage, current and spacings between the electrodes should be kept standard through the project. Thus, the method cannot be adopted universally.

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Experimental Behaviour on Shear Study of Slurry Infiltrated Fibrous Concrete

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Abstract

Slurry infiltrated fibrous concrete (SIFCON) is one of the recently developed high performance fibre reinforced concrete (HPRC). It is a high strength concrete with large volume of fibre incorporation than conventional fibre reinforced concrete. Cement sand ratio of 1:1 is adopted for obtaining slurry and conplast 430 superplasticizer is used. The fibre used in this study was flat crimped steel fibre of length 50mm and effective diameter 1mm having aspect ratio 50. The mechanical properties of SIFCON was investigated in two fibre volume of 6 % & 8%. The mechanical properties is improved for 8% volume fraction. The shear behaviour of sifcon is studied using Z type push off specimen ofdimension 540x20x125mm.The objective of this work is to compare the shear behaviour of SIFCON and M30 grade concrete using push off test specimen.

Keywords: *Aspect ratio and Push off specimen, Sifcon, Slurry, Steel fibre.*

1. INTRODUCTION

In general, macro fibre content in concrete is limited up to 3% due to segregation, difficulty in mixing and decreased workability. In 1979, Prof. Lankard carried out significant research on SIFCON which incorporates 6-12% of fibre content. In SIFCON, the matrix consists of slurry or flowable mortar with no coarse aggregates. The slurry is poured to infiltrate into the pack of preplaced fibres in the mould. In SIFCON crack width is reduced to about 10 times than the conventional rebar. It is a very high energy absorption and impact resistant material. The mechanical properties of SIFCON increased with the replacement of cement by mineral admixtures. Even though SIFCON is a new construction material, it has found applications in the areas of pavement rehabilitation and precast concrete products, overlays, bridge decks and protective revetments, seismic and explosive-resistant structures, military applications such as anti-missile hangers, under-ground shelters ,sea-protective works, primary nuclear containment shielding, aerospace launching platforms, repair, rapid air-field repair work, concretemega-structures like offshore and long-span structures, solar towers etc. It is already established by the authors that SIFCON specimens shows excellent behaviour in flexural strength and punching shearing strength when compared to FRC, reinforced cement concrete (RCC) and plain cement concrete (PCC) specimens. Structures subjected to impact and dynamic loading gaining excellent ductility characteristics. There are four main design factors such as slurry strength, fibre volume, fibre alignment, and fibre type and aspect ratio. The fibre volume depends on the fibre type, aspect ratio and the vibration effort needed for proper compaction.

The ability of cracked reinforced concrete to transfer shear stresses is of major importance for concrete members designed to sustain high shear forces.The shear behaviour of concrete depends on numerous factors including a phenomenon referred to as aggregate interlock (Collins and Mitchell, 1991). This paper reports the preliminary results from an experimental program whose objective is to compare the shear behaviour of conventional and SIFCON concrete.

Commonly, the following types of specimens are used to investigate direct shear response of plain and reinforced concrete

a) Z-type push-off specimen
b) Double notched push-through specimen
c) Single notched FIP-type specimen

2. THE PUSH-OFF TEST CONCEPT

In this study, a Z type push-off test is selected because of its simplicity and its ability to represent the behaviour of design cases such as the interface between two bodies of concrete which can slide across each other.In this study, the dimensions of Z type push off specimen is adopted from the previous literatures as

540mmx250mmx125mm with two notches of 20mm thick, 125mm width and 125mm depth.

3. EXPERIMENTAL PROGRAM

3.1 Materials

3.1.1 Cement

KCPOPC 53 grade was used in the experiments. The specific gravity of cement wasfound using Le Chatelier flask as 3.15. The initial and final setting was found using vicat apparatus as 40 and 340 minutes.

3.1.2 M-sand

M Sand passing through 4.75 mm IS sieve was used in the experiments. The sand was found to confine in Zone II after grading. The specific gravity was found to be 2.62.

3.1.3 Coarse aggregate

Coarse aggregate of 20 mm maximum size and typical particle shapes “average and cubic” was used as the coarse aggregate sample.

3.1.4 Superplasticizer

To improve the workability of SIFCON, Conplast SP-430, a high –range water reducing agent has been used.

3.1.5 Fibre

The fibre used in this study was flat crimped steel fibre of length 50mm & effective diameter 1mm having aspect ratio 50.

Fig.1 Flat crimped steel fibres

Table 1 Details of Flat Crimped Steel Fibres

A. S.No.	*B.* Description	*C.* Value
D. 1	*E.* Type	*F.* Low carbon cold drawn wire
G. 2	*H.* Shape	*I.* Undulated along its length
J. 3	*K.* Length	*L.* 50mm
M. 4	*N.* Equivalent diameter	*O.* 1mm
P. 5	*Q.* Aspect ratio	*R.* 50
S. 6	*T.* Tensile strength	*U.* 800-900 MPa

3.1.6 Reinforcement

12mm diameter bars were given as longitudinal reinforcement and 8mm diameter bars were given for stirrups.

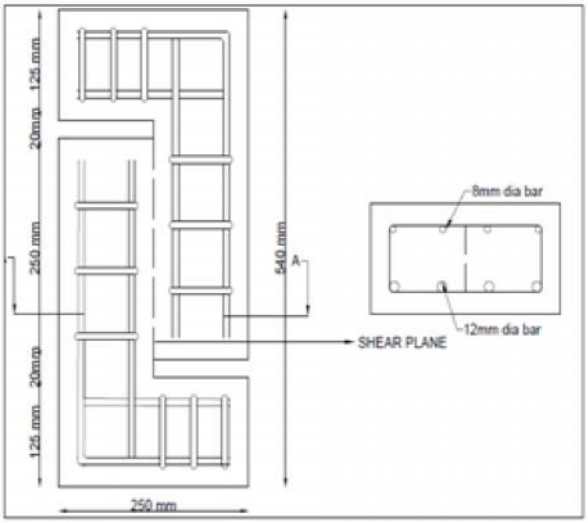

Fig.2 Reinforcement details of Z type push off specimen

3.2 Mix Proportion

Cement sand ratio of 1:1 is adopted for obtaining slurry. Fibre content of 6% and 8% by volume was adopted for SIFCON. Water cement ratio of 0.4 and superplasticizer about 1% was adopted.M30 grade concrete was adopted as conventional concrete.

Table 2 Mix Quantities of Sifcon & M30 Grade Conventional Concrete

V. Mix No	W. Cement X. (kg/m³)	Y. Sand Z. (kg/m³)	AA. Coarse Aggregate (kg/m³)	BB. Super plasticizer CC. (kg/m³)	DD. Fibre EE. (kg/m³)
FF. F1-6%	GG. 965	HH. 965	II.-	JJ.19.3	KK.471
LL. F2-8%	MM. 886	NN. 886	OO. -	PP. 17.7	QQ. 628
RR. C	SS. 450	TT. 613	UU. 1138	VV. 9	WW. -

4. EXPERIMENTAL RESULTS

4.1 Compressive Strength

The compression test was carried out as per IS 516:1959 for a cube size of 15 x 15 x 15cm.The compressive strength of the specimens was tested with the universal testing machine of capacity 1000kN. The following graph shows the comparison of average compressive strength of the SIFCON specimens and M30 conventional concrete at 28 days. The compressive strength increased to 15% in 8% fibre volume content. The compressive strength of sifcon with 8% fibre content is 30MPa. So M30 grade conventional concrete is adopted for casting control push off specimen.

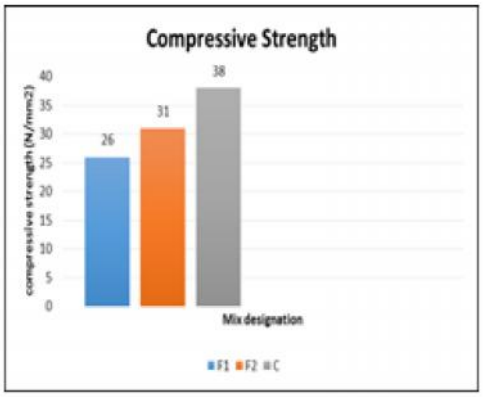

Fig.3 28th day compressive strength

4.2 Split Tensile Strength

The split tensile test was carried out as per IS 5816:1999. The size of the specimen was 15cm diameter and 30cm length. The test conducted at the age of 28th days after curing. The loading was applied continuously at a specific rate until the specimen reaches its ultimate load. The split tensile strength increased to 60% in 8% fibre volume mix.

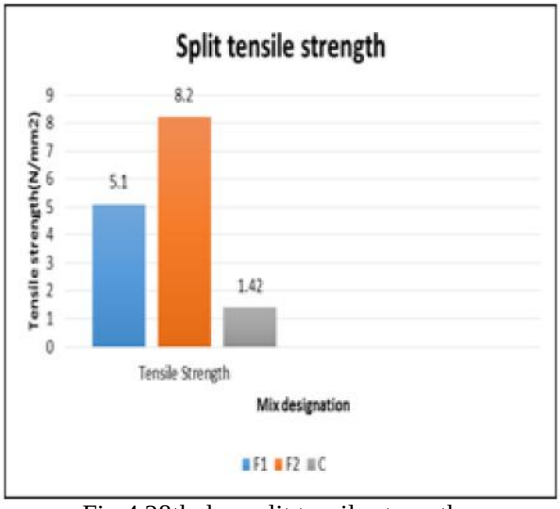

Fig.4 28th day split tensile strength

4.3 Flexural Strength Test

The flexural test was carried out as per IS 516:1959. Beam size of 10 x 10 x 50 cm was considered. The flexural strength test is performed to estimate the tensile load, at which the specimen may cracks. This is an indirect test for assessing the tensile strength at failure.The flexural strength increased to 16% in 8% fibre volume mix.

4.4 Push Off Test

Z type push off specimens of 8% fibre volume sifcon is compared with M30 grade concrete for studying the shear behaviour of sifcon. The shear strength is increased by 80% for sifcon than the M30 grade concrete.

5. CONCLUSION

The compressive strength of Sifcon is comparatively low than the M30 grade conventional concrete. The split tensile strength and flexural strength is increased in Sifcon in both 6% and 8% fibre volume content when compared to M30 concrete. The inference from this experimental study is that the mechanical properties are improved by increasing the volume fraction of fibres. The shear capacity is higher in sifcon specimen than M30 grade concrete indicating better aggregate interlock in sifcon.

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Microbial Concrete-A Review

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Abstract

This paper covers the use of various bacteria in concrete and how the cracks getting self-healed by using the application of bacteria. In all construction process cracking is the major issue to be resolved as it causes a serious problem which reduces the durability of buildings and it leads to many critical concerns. To resolve those problems the structure needs a periodical maintenance which in turn increases the cost of maintenance. Hence microbial concrete emerged as a solution to heal cracks in a reasonable width. In the presence of any carbonate source, a bacterium belongs to Ureolytic family has a potential to precipitate calcium carbonate (CaCO3). The above process comes under the concept of Bio-mineralization. Due to the calcium carbonate (CaCO3) precipitation the cracks get self-healed and checked for its enhancement in compressive strength as well as the durability of structures. Hence this literature shows the significance of various bacteria in self-healing process of concrete.

Keywords: Calcium carbonate (CaCO3), Compressive strength, Durability, Self-heal, Ureolytic family.

1. INTRODUCTION

Concrete is one of the most widely used influential materials in construction. Concrete is weak in tension and it is strong in compression. Because of its fragile properties, it is very common to expect cracks in concrete over time. Once the crack is formed in concrete it reduces the durability and strength of the building by causing reinforcement corrosion, plastic shrinkage, sulphate attack and alkali-aggregate reactions [1].Hence self-healing concrete is the solution by rectifying the foible. This increases the lifetime of concrete. Supplementary cementing materials (SCMs) are also added in concrete mixes which results in increasing workability, strength and enhance durability. One of the common means of achieving environment friendly concrete is by using crushed concrete to produce course aggregate [5]. Now a day microbiology induced calcite precipitation has become an alternative repair technique for plugging into micro cracks and pores in concrete. This technique of bacterial remediation prevails other techniques as it is bio based, eco-friendly, cost effective and durable. Urease positive bacteria have been found to influence precipitation of calcium carbonate (calcite) by production of urease enzyme [7]. The most desirable property of concrete is Compressive Strength. Thus by using this methodology we can ensure better compressive strength and durability. Water cement (w/c) ratio plays a vital role in early achieving of strength in concrete. The concrete mix with low w/c ratio gains strength more rapidly when compare to concrete with low w/c ratio [10]. The strength of concrete decides the durability of structures. Durability of concrete cannot be affected if the crack width is less than 0.2 mm [12]. This paper reviews how the cracks in the concrete getting self-healed by using the various kinds of bacteria which has the ability to precipitate calcium carbonate (CaCO3) at various percentages.

2. SELF-HEALING APPROACH OF BACTERIA

With the help of bacterial reaction, the process of self-healing of cracks or self-filling up of cracks in the concrete after hardening is known as Self-Healing Concrete.Once the bacteria is open to the air so that they become active and it causes them to toughen and fuse, filling within the crack that has formed, and stick to the limits of the crack to heal the cracks. The process of healing a crack will take as very little [14]. For rehabilitation of micro-cracks in concrete, Self-healing techniques are good approaches. The autogenously healing techniques show good results in healing of micro-cracks on the surface of the concrete. The addition of bacteria will form a pervious layer on the cracks of concrete, which confirms the precipitation of calcium carbonate. Micro biologically induces calcium carbonate precipitation helps to fill the micro cracks and bind the other materials such as sand, gravel in concrete.

Durability of concrete is increased by the involvement of microorganism in calcite precipitation. By converting urea into ammonium and carbonate Bacillus Sphaericus can precipitate CaCO3 in the high alkaline environment .Concrete itself can fill the cracks which are less than 0.2mm. But if cracks are greater than 0.2 mm then concrete fail to heal itself which create a passage to deleterious materials. In self-healing concrete, formation of any cracks, leads to activation of bacteria from its stage of hibernation. By the metabolic activities of bacteria, during the process of self-healing, calcium carbonate precipitates into the cracks healing them. Bacteria returns to the stage of hibernation when the cracks are completely filled with calcium carbonate, In future, if any cracks occur, the bacteria get activated and fill the cracks. Bacteria act as a long lasting healing agent and this mechanism of Calcium carbonates formation on bacterial cell wall is called as Microbiologically Induced Calcium Carbonate Precipitation (MICP).

3. INFLUENCE OF BACTERIA IN PROPERTIES OF CONCRETE

3.1. Compressive Strength

Compressive strength is the capacity of a material or structure to withstand axial forces acting on it. The strength of a concrete structures depends on cement, aggregate, bond, water-cement ratio, curing temperature, and age and size of concrete specimen. Concrete is a material with high compressive strength .When the concrete reaches the limit of compressive strength, materials are crushed. Treatment of waste foundry sand with Aspergillus sp. has positive effects on properties of concrete containing waste foundry sand. After 28 days, there is 15.6% increase in compressive strength of concrete having 20% WFS [2]. By using Sulphate Reduction Bacteria in concrete, it was found that there was an increase of compressive strength. The addition of specific bacteria with specific enzyme functions to precipitate calcium carbonate at the pore of the concrete. The process of plugging in the pores at the binder matrix improves compressive strength [8]. The use of Sporosarcinapasteurii bacteria leads to early strength gain and also leads to overall increase in the compressive strength of concrete. The highest gain in compressive strength was obtained when admixture which constitutes of sodium carbonate and calcium chloride was added to the concrete mix [10]. Increase in 26.37% and 19.54% compressive strength of cement mortar having 10% bacterial treated cement kiln dust (CKD) after 28 and 91 days, respectively, was achieved whereas above 10%, decrease in strength was observed due to lower cement content, reduced hydration and CSH gel formation [11].Maximum increase in compressive strengths was achieved at 105 cells/ml for all fly ash concrete; 103 cells/ml shows least compressive strength. With 10%fly ash + 10% silica fume, compressive strength of concrete with103 cells/ml bacterial concentration was 31 and 32 MPa at 28 and91 days respectively [13]. Average compressive strength of concrete-contained bacteria was increased up to 16.2 and 20.8% at the ages of 28 and 270 days, respectively, and 29.3% for sulfate submerged concretes at 270 days. Utilizing bacteria not only produced higher compressive strength but also improved the strength development. Furthermore, relative compressive strength of the sulfate exposed bacteria-containing groups compared to the corresponding water-submerged specimens with the same age was about 12.6% more than that of the control groups at 270 days. Thus, it is concluded that using bacteria in concrete can relatively prevent strength loss of concrete in sulfate exposure. Moreover, compressive strength improvement of concrete by utilizing bacteria was the same (almost equal) in both water and saturated sulfate solution. It may be, thus, concluded that sulfate exposure has no significant effect on bacteria performance [19].

Compressive Strength (N/mm2) = Ultimate load / Cross sectional area of specimen

3.2. Water Penetration

Water absorption and porosity has direct relation with the compressive strength of concrete. Increased water absorption capacity and pore size in concrete leads to decrease in compressive strength and vice versa. Control concrete specimen followed an increasing trend of water absorption with increase in CBFD partial replacement percentage for 28 days and 56 days curing. With the addition of bacterial cells, decrease in porosity was observed in concrete specimen at the age of 28 and 56 days. Formation of CaCO3 increases the compressive strength and result in decreased porosity [9]. Bacterial concrete have less percentage of water absorption than bacterial free concrete. The bacterial concrete prepared with 105 cell/ml has less percentage of water absorption after 28 days of curing is 0.576%. Percentage decreases in water absorption of bacterial concrete compared to bacterial free concrete after 28 days of curing are 16.65%,50% and 34.0% respectively for 104, 105, 106 cell concentrations [12]. With the inclusion of bacteria, water absorption capacity of fly ash and silica fume

concrete decreased. Bacteria played a significant role in decreasing the water absorption of fly ash concrete which decreased with increase in bacteria cell concentration upto 105 cells/ml, and then, there was reduction in the absorption capacity with 107 cells/ml of bacteria whereas 103 cells/ml was considered as optimum concentration of bacterial dose in decreasing the water absorption [13]. The influence of the surface treatment on the water absorption rate for mortar concrete cubes with a w/c 0.47. Over a period of 168 h, the cubes treated with Bacillus sp. CT-5 has absorbed nearly six times less water compare to control cubes. The presence of bacteria resulted in a significant decrease of the water uptake compared to untreated specimens. The crack sealing by B. sphaericus resulted in a decrease in water permeability [20].

I. II. REFERENCES	IV. V. VI. BACTERIAL SOURCE	VII. VIII. GROWTH SOURCE	X. XI. XII CEMENT MORTAR / CONCRETE GRADE	XIII. XIV. XV. CELL DENSITY XVI.
	XVII. BACILLUS PSEUDO FIRMOUS	XVIII. -	XIX. M25	XX. l spores 1.7x105 g-1
	XXI. ASPERGILLUS SPP.	XXVI. POTATO DEXTROSE AGAR (PDA) MEDIA	XXIII. 43 grade/M20	XXIV. 1.7 x 107 spores per ml
	XXV. BACILLUS FAMILY	XXVI. NUTRIENT BROTH(PEPTONE 5.0 g/L, YEAST EXTRACT 3.0 g/L, AND DISTILLED WATER)	XXVII. M25	XXVIII. 30* 105 cells
	XXIX. BACILLUS SUBTILIS	XXX. -	XXXI. M20	XXXII. 105 cells
	XXXIII. BACILLUS SUBTILIS	XXXIV. -	XXXV. M25	XXXVI. -
	XXXVII. BACILLUS SUBTILIS	XXXVIII. NUTRIENT BROTH(2.10 gm), NaHCo3(1.50 gm), NH4Cl (7.00 gm), Urea(7.00 gm), Ca Cl2 (5.00 gm)	XXXIX. M25	XL. -
	XLI. BACILLUS PASTERUII ,BACILLUS SPHAERICUS AND BACILLUS MEGATERIUM	XLII. WHEAT BRANAS AN ALTERNATIVE SUBSTRATE FOR GROWTH OF BACTERIA	XLIII. M25	XLIV. 105 cells/ml
	XLV. SULPHATE REDUCTION BACTERIA	XLVI. NUTRIENT BROTH(PEPTONE AND A BEEF EXTRACT)	XLVII. M30	XLVIII. -
	XLIX. BACILLUS PASTEURII	L. NUTRIENT BROTH AND CORN STEEP LIQUOR MEDIA	LI. M20	LII. 105 cells/mL
	LIII. SPOROSARCINAP ASTEURII	LIV. NUTRIENT MEDIA(MOTHER LIQUOR SOLUTION)	LV. 43 grade ordinary Portland cement (OPC)	LVI. -

	LVII. BACILLUS SP. STRAIN KG1	**LVIII.** GLUCOSE (10 g/l), PEPTONE (10 g/l), YEAST EXTRACT (5 g/l), KH2PO4 (1 g/l), AGAR (15 g/l) AND pH 10.5 (ADJUSTED WITH 1 N NaOH)	**LIX.** 43 grade	**LX.** -
	LXI. BACILLUS MEGATERIUM	**LXII.** -	**LXIII.** M25	**LXIV.** 104,105 and 106 cells/ml.
	LXV. SPOROSARCINAP ASTEURII (S. PASTEURII)	**LXVI.** PLATED ON AGAR CONTAINING UREA (20 g/l), NaHCO3 (2.12 g/l), NH4Cl(10 g/l), NUTRIENT BROTH (3 g/l), CaCl2_2H2O (25 g/l)	**LXVII.** M20 **LXVIII.**	**LXIX. LXX.** 103, 105 and 107 cells/ml
	LXXI. BACILLUS SUBTILIS	**LXXII.** $CaCO_3$(CALCITE),$C_6H_{10}CaO_6$(CALCIUM LACTATE)	**LXXIII.** M20	**LXXIV.** -
	LXXV. LXXVI. BACILLUS SPHAERICUS	**LXXVII.** NUTRIENT AGAR (PEPTIC DIGEST OF ANIMAL TISSUE 5 g/l, SODIUM CHLORIDE 5 g/l, BEEF EXTRACT 1.5 g/l, YEAST EXTRACT 1.5 g/l, AND AGAR 15 g/l)	**LXXVIII.** 53 GRADE ORDINARY PORTLAND CEMENT (OPC)	**LXXIX. LXXX.** -
	LXXXI. BACILLUS PSEUDOFIRMUS	**LXXXII,** THE PURE CULTURE OF BACILLUS PSEUDOFIRMUS WAS OBTAINED FROM FERTILIZER INDUSTRY,RAU (M.P.).	**LXXXIII.** M20	**LXXXIV.** -
	LXXXV. SULPHATE REDUCTION BACTERIA	**LXXXVI.** SRB STRAIN THAT WAS ACCLIMATISED IN 3% OF SODIUM CHLORIDE WAS USED TO ENSURE GOOD SURVIVAL IN AN AGGRESSIVE ENVIRONMENT.	**LXXXVII.** G35 (BS 1881-125:2013) **LXXXVIII.**	**LXXXIX.** -
	XC. BACILLUS SUBTILIS JC3	**XCI.** A PEPTONE BASED NUTRIENTS SUPPLIEDALONG WITH BACTERIA CONTENT IN SUSPENSION HELPS IN PRODUCING CALCITE CRYSTALS.	**XCII.** M20	**XCIII.** 108 cells/ml WAS COLLECTED AND 103, 104, 105 and 106cells/ml OF BACTERIAL CONCENTRATI ON WAS MADE

	XCIV. BACILLUS SUBTILIS **XCV. XCVI.** BACILLUS PASTEURII XCVII.	**XCVIII.** BACILLUS SUBTILIS: 5.0 g PEPTONE,3.0 g MEAT EXTRACT, PER LITER OF DISTILLED WATER; TO WHICH 1.5% AGAR. **XCIX.** BACILLUS PASTEURII: PEPTONE/MEAT EXTRACT MEDIUM.	**C.** M25	**CI.** 1.3 × 107 ,4 × 106,6 × 109 and 9×107cells/mL .
	CII. BACILLUS SP. CT-5	**CIII.** $CaCO_3$(CALCITE),$C_6H_{10}CaO_6$(CALCIUM LACTATE) NUTRIENT BROTH-UREA (NBU) MEDIUM (8 g NUTRIENT BROTH, 2% UREA, and 25 mM CaCl2)	**CIV.** -	**CV.** -
	CVI. BACILLUS SPHAERICUS	**CVII.** NUTRIENT AGAR	**CVIII.** M20	**CIX.** -

3.3 Flexural Strength

In M25 grade concrete, with the addition of Bacillus subtilis the percentage of improvement in the flexural tensile strength is in the order of 13.19% to15.56% at different ages [6].The cantabro loss i.e abrasion resistance of bacterial concrete mixes is strongly influenced the flexural strength. The flexural strength and cantabro loss are good at10% of bacteria in bacterial concrete mixes. The flexural strength values are increased and cantabro loss is decreased upto10% of bacteria in bacterial concrete mixes [14]. The flexural strength of both the conventional and bacterial concrete prepared in two different concentrations. Among the two different concentrations of concrete specimen, the higher concentration (150ml) of Bacillus sphaericus (B2) culture proved to increase the strength of prepared bacterial concrete. The significant activity of bacterial culture in B1 and B2 concrete specimens, biochemically induced calcium carbonate precipitation between cement sand matrix, which in turn increased the load resisting capacity [15].

3.4. XRD Analysis

X-ray diffraction is the non-destructive technique (NDT) used to determine the crystalline phases present in any particular substance. X-ray powder diffraction technique is proved to be the most prominent technique used for unravelling the structure of the materials in bulk and thin film forms. Concrete samples of each mix (after 28 days curing) were taken and crushed into fine powder by pestle–mortar. The powder samples were analysed in a powder X-ray diffractometer (PANalytical X' Pro). The XRD spectrums were taken from 2h = 10h to2h = 80h. The peaks in the new positions of the spectrum were marked, compared and identified from the JCPDS data file. XRD analysis of concrete samples with or without fungal treated waste foundry sand shows some extra peaks of calcium silicate absorption (68.8%) and porosity (45.9%) of treated concrete. XRD reveals the fungal culture (Aspergillus spp.) is capable to form good C–S–H gel than untreated concrete containing WFS [2].It suggests that the bacterium is capable of formation new silicate phase within the concrete matrix. The microstructure in homogeneities can lead to serious effects on strength and other related mechanical properties because these properties are controlled by the micro structural extremes [13].

3.5. SEM Analysis

Scanning Electron Microscopy (SEM) is a test process that scans a sample with an electron beam instead of light source to produce a magnified image for analysis. It is also known as SEM analysis and SEM microscopy, and is used effectively in microanalysis and failure analysis of solid inorganic materials. Electron microscopy is performed at high magnifications, generates high-resolution images and precisely measures very small features and objects [4]. The scanning electron microscope (SEM) analysis of control and bacterial

concrete containing 0%, 10%, 20% and 30% CBFD (cement baghouse filter dust).SEM images show the formation of calcium silicate hydrate in concrete specimen. Micro-porous zones in the cement paste, pores or bubbles plugs the pores or voids thereby increasing the strength [9]. SEM was used in the emissive mode, which is the common mode of analysis. Samples used in SEM analysis were gold coated with a sputter coating Emitech K575 prior to examination. Presence of high amounts of calcium in the samples confirmed the presence of calcite in the form of calcium carbonate [13].Distinct crystals embedded in concrete are observed in SEM micrographs of the concrete containing 6×109 cells/mL of S. pasteurii which have completely filled almost all the pores [19].

4. CONCLUSION

This paper reviews the various types of ureolytic bacterium such as Bacillus subtilis, Bacillus plasturii, Bacillus pseudifirmus, Bacillus sphaericus used to remediate the cracks of structures by its self-healing approach. The advantage of using bacteria decreases water penetration and chloride ion permeability. Bacillus Subtilus can be produced from the lab which is proved to be safe and cost economic. It states that the bacterial approach has potential to contribute to self-healing capacity of concrete. The use of this biological repair technique is highly advantageous because the mineral precipitation induced has a result of microbial activities is pollution free and natural, however further experiments has to be conducted to examine the durability of this crack technique. This study has also identified that bacteria has a positive effect on the compressive strength of Portland cement mortar cubes and concrete.

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The manuscript should be about 8 pages in length, typed in double space with Times New Roman font, size 12, Double column on A4 size paper with one inch margin on all sides and should include 75-200 words abstract, 5-10 relevant key words, and a short (50-100 words) biography statement. The pages should be consecutively numbered, starting with the title page and through the text, references, tables, figure and legends. The title should be brief, specific and amenable to indexing. The article should include an abstract, introduction, body of paper containing headings, sub-headings, illustrations and conclusions.

References

A numbered list of references must be provided at the end of the paper. The list should be arranged in the order of citation in text, not in alphabetical order. List only one reference per reference number. Each reference number should be enclosed by square brackets.

In text, citations of references may be given simply as "[1]". Similarly, it is not necessary to mention the authors of a reference unless the mention is relevant to the text.

Example

[1] M.Demic, "Optimization of Characteristics of the Elasto-Damping Elements of Cars from the Aspect of Comfort and Handling", International Journal of Vehicle Design, Vol.13, No.1, 1992, pp. 29-46.
[2] S.A.Austin, "The Vibration Damping Effect of an Electro-Rheological Fluid", ASME Journal of Vibration and Acoustics, Vol.115, No.1, 1993, pp. 136-140.

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