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International Conference

On

"Global Convergence in Technology, Entrepreneurship, Computing and Value Engineering: Principles and Practices"

(ICGCP—2021)

Certificate

This Certificates Acknowledges and Honors

Prof. /Dr. /Mr. /Ms. _____Rekha B Venkatapur_____ of _____

_____KSIT_____ has Participated and Presented Paper Titled

" _A Survey on Application of Deep Learing:_
unsupervised Auto Encoder
"

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Dr. Shripad Markande
Conference Co- Chairman

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Conference Chairman

Sri. G. Dayananda
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A Survey on Application of Deep Learning: Unsupervised Auto Encoder

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Abstract – Deep Learning is playing an increasingly important role in our lives. Deep learning is not a restricted learning approach, but it abides various procedures and topographies which can be applied to an immense speculum of complicated problems. Deep learning methods have made a significant break-through with appreciable performance in a wide variety of applications with useful security tools. It is considered to be the best choice for discovering complex architecture in high-dimensional data by employing back propagation algorithm. Deep learning has already made a huge impact in areas, such as cancer diagnosis, precision medicine, self-driving cars, predictive forecasting, biological image classification, speech recognition, smart city and many more. This paper mainly focuses on the working of unsupervised autoencoders and its applications.

Key Words: Deep Learning, back propagation, unsupervised learning, autoencoders,

I. INTRODUCTION

Machine learning is a subsection of Artificial Intelligence that imparts the system, the benefits to automatically learn from the concepts and knowledge without being explicitly programmed. Neural Network is a machine learning technique that is inspired by and resembles the human nervous system and the structure of the brain. It consists of processing units organized in input, hidden and output layers. The nodes or units in each layer are connected to nodes in adjacent layers. Each connection has a weight value. The inputs are multiplied by the respective weights and summed at each unit. The sum then undergoes a transformation based on the activation function, which is in most cases is a sigmoid function, tan hyperbolic or rectified linear unit (ReLU).The implementation of neural networks consists of the following steps:

1. Acquire training and testing data set
2. Train the network
3. Make prediction with test data

Deep learning technology works on the Artificial Neural Network system (ANNs). These ANNs constantly take learning algorithms and by continuously increasing the amounts of data, the efficiency of training processes can be improved. Deep learning is also known as deep structured learning and hierarchical learning that consists of multiple layers which includes nonlinear processing units for the purpose of conversion and feature extraction.

In the Deep learning methodology, the term "Deep" enumerates the concept of numerous layers through which the data is transformed. It must be noted that there is a difference between Deep learning and Representational learning. Representational learning includes the set of methods that helps the machine to take the raw data as input and determines the representations for the detection and classification purpose.

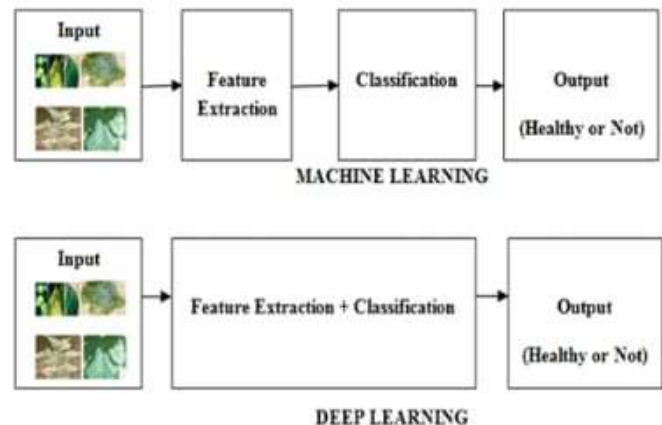Figure 1 depicts the differences between the Machine learning and Deep learning.

Figure 1: Difference between Machine Learning and Deep Learning

Deep learning techniques use nonlinear transformations and model abstractions at a high level in large databases. It also describes that a machine transforms its internal attributes, which are required to enumerate the descriptions in each layer, by accepting the abstractions and representations from the previous layer.

Deep learning paradigm uses a massive ground truth designated data to find the unique features, combinations of features and then constructs an integrated feature extraction and classification model to figure out a variety of applications. The meaningful characteristic of deep learning is the data that uses general purpose methods, various extensive features and no intervention of human engineers.

The key factors on which Deep learning methodology is based are:
 ➢ Nonlinear processing in multiple layers or Stages.
 ➢ Supervised or Unsupervised learning.

Nonlinear processing in multiple layers to a hierarchical method in which the present layer accepts the results from the previous layer and passes its output as input to the next layer. Hierarchy is established among layers so as to organize the importance of the data. Here Supervised and Unsupervised learning are linked to the class target label. Its availability means a supervised system and absence indicates an unsupervised system.

The structure of this paper is organized as follows: Section II is about the Basic Architectures of Deep Neural Network (DNN). Section III provides detailed explanation about the working of unsupervised autoencoders architecture.Section IV provides advantages and applications of Unsupervised autoencoders and finally Section V is the conclusion of this paper.

MULTISCALE RECURRENT YOLO (MSRYOLO) OBJECT DETECTION FOR VIDEO SURVEILLANCE SYSTEM

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Abstract: Applications such as autonomous vehicles and surveillance systems would play a big role in our life in the very near future. Nowadays, the increasing amount of car accidents and the identification of abnormal events are needed to be addressed. In order to attain these goals, Smart systems must be developed for monitoring and understanding our surroundings using images, videos, sensors, or depth cameras. The area of Computer Vision and object detection has evolved to extract vital information regarding moving objects from sequences in continuous image based surveillance systems. In recent days, Object detection has become more challenging extension of image recognition. In the present research paper, a comprehensive analysis of YOLO (you only look once) over Road - object detection and orientation estimation benchmark is performed and then a memory map based on a multi-scale recurrent Neural network is implemented. The proposed system divides the whole image into multiple grids, each grid predicts bounding boxes and each box has the probability of containing an object. Finally, an input image is taken from the ImageNet dataset, which could directly regress from input image to object class scores and positions. It processes individually despite of the fact that the object position changes continuously in the driving scene. Comparing to the best state of-the-art-methods, the proposed system detects multiple images and corresponding labels at the same time. It maintains better speed when compared to other models and it detects not only images from an image but also images from running videos.

LUNG CANCER DETECTION FROM COMPUTED TOMOGRAPHY (CT) SCANS USING CONVOLUTIONAL NEURAL NETWORK

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Abstract: Cancer is one of the leading reasons for death worldwide. Lung cancer results in most cancer deaths worldwide, accounting for 2.1 million new cases and 1.8 million deaths annually. The death rate can be reduced if early diagnosis is done so that proper treatment can be carried out by the clinicians within the specified time. With increasing patients of Lung Cancer every year, it is important to detect Lung Cancer so as to give proper medical treatments. CT Scan images are used for the detection of Lung Cancer. The first step is to detect the pulmonary nodules in lungs. A 3D Convolutional Neural Network (CNN) is used to detect nodules using these cubes. For Lung Cancer detection, Data Science Bowl 2017 Kaggle competition data is used. It has 1595 CT scans. Lung nodules are predicted on this data using the nodule detector by running on the CT scans as grids. An ROI mask for lungs is applied to the CT scan using Image Processing. The predicted nodules coordinates are used to make cubes around nodules as the same size as before and a second 3D CNN is used to predict cancer using it. A system is developed which detects the lung cancer from the given input CT scanned lung images which are in DICOM (.dcm) format.

Nearest Neighbor Monitoring Mechanism for Efficient and Secure Data Aggregation in WSN Environment

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The Internet of Things has observed tremendous growth in the last two decades utilizing wireless sensor technologies and as the number of smart devices and applications increases, the need for data collection and analysis data becomes increasingly difficult. In general sensor nodes are powered through batteries hence it restricts the efficiency of Wireless Senor Network. Data aggregation is a top-most mechanism for redundancy discarding and improvising the network lifetime. It also possesses various advantages which include minimizing the energy consumption, minimizing the network traffic. Furthermore, as sensor nodes are deployed in hostile averments and transmit sensitive information, designed networks are prone to various attacks. As a result, the focus of this research work is on designing and developing the Nearest Neighbor Monitoring (NN-SDA) mechanism to provide secure data aggregation in an efficient and secured manner. Furthermore, the proposed mechanism allows the nearest neighbour node to monitor and detect the malicious node. Further, the NN-SDA-mechanism algorithm is designed by adding the anomaly and detecting the malicious nodes. The NN-SDA mechanism is evaluated in terms of malicious packet identification rate, average energy utilization, and system throughput and the comparative analysis is performed with the existing model.

Keywords: *Data Aggregation, Secure Data Aggregation, NN-SDA Mechanism, WSN,*

I. INTRODUCTION

Internet of Things (IoT) has been promoting several recent trending domains such as communication networks, Big Data, Artificial Intelligence, and so on. Furthermore, the recent development of these domains has elevated IoT to attract more and more investment in terms of commercial aspects, technical aspects, and improvisation of human life aspects. Generally, IoT can connect many devices and emerge in every application from critical to daily life applications such as smart homes, smart grid, intelligent transportation, and so on. It also requires an efficient network to perform optimally, which is normalized through Wireless Sensor Network (WSN). The IoT and WSN are parallelly interconnected and the growth has been analyzed.

WSN aka Wireless Sensor Network is a defined network that is deployed in inaccessible areas and performs data propagation; the main role of this constituted device in WSN is to sense the data, gather the data and transmit it to a base station for further process. The idea of WSN possesses various advantages in different applications like military service, agriculture, and so on. Furthermore, the implementation cost is very low for applications everywhere such as wildfire management, monitoring management, military surveillance, homeland security, and etc. Moreover, huge utilization of sensor networks contributed to huge data generation and processed and WSN possesses various restrictions such as network lifetime due to limited energy since most of the sensors are battery-based and recharging is highly improbable since it is deployed in remote areas.

Moreover, due to sensor node nature and deployment environment, WSN has different security issues than the traditional network. Some of them are:

A. Data confidentiality: Data confidentiality is one approach where the secrecy of the sensed data through a physical sensor device is secured and not disclosed to a third party.
B. Data integrity: Data confidentiality guarantees the security of data but it does not protect from data being altered; hence

Efficient Intrusion detection of malicious node using Bayesian Hybrid Detection in MANET

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Abstract. In the past several years there have been considerable interest developed towards study on distributed networks. The key underlying application under such technology is mobile ad hoc networks (MANETs), which have been exploiting the range of research opportunity. In MANET due to infrastructure less network and dynamic topology changes, security becomes one of the important issues. The defense strategies such as intrusion detection system (IDS) impose a method to build efficient detection of malicious nodes. Game theory is mainly used to study security problems identification in MANET. The Bayesian Hybrid Detection (BHD) is applied to detect the malicious nodes. A BHD allows the defender to adjust based on opponent observation. The simulation is carried out using the MATLAB for malicious nodes detection. The security degree is measured by the payoff index and system stability index (SSI). Also the processing vs. accuracy index level is measured to identify reliability of detection. The proposed system enables for enhancing security in MANET's by modeling the interactions among a malicious node with number of legitimate nodes. This is suitable for future works on multilayer security problem in MANET.

Keywords: Bayesian game, Cluster nodes, Game theory, Intrusions, genetic algorithms

1. Introduction

In the wireless networking the nodes are spatially and randomly distributed, leads to exploration field of mobile ad hoc networks (MANETs). MANET is a network that consist of set of mobile nodes that communicate each other over wireless link. These mobile nodes will always establish dynamically own network without any infrastructure to forward data in a multi-hop mode. In a MANET, each mobile node can separately organize and interconnect with each other over bandwidth uncomfortable wireless relatives where, safety has become one of the important issues. Some of the applications in

Efficient Two-Layer Image Protection with Wavelet Transform Compression

M. Vaneeta, V. Sangeetha, and S. Swapna Kumar

Abstract The encoding complexity of an image format is a vigorously updating area of study in the field of two-layer protection with wavelet transform compression. In the proposed method, hybrid 2D-FDCT watermarking and RSA encryption for multispectral images predicted an efficient system. This approach satisfies the encryption security, robustness and classification accuracy retention of an algorithm. The two-layer protection of encrypted and embedded watermark image followed by wavelet transform compression minimizes the file size in the exhaustive process for encoding. An important merit is that encoding time is very much reduced in contrast to other security and compression mechanisms. The enhanced value of PSNR as well as trade-off of MES, normalized cross-correlation, the average difference and structural content improves the storage large file size medical image and improves bandwidth to an acceptable level.

Keywords Compression · DCT · Encryption · Image processing · Watermarking

1 Introduction

The Internet of things (IoT) is considered as the interconnection of computing devices such as in factory machinery, medical equipment or domestic appliances, enabling

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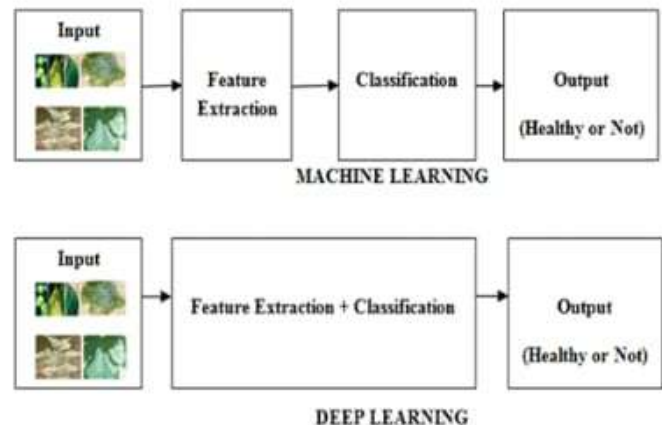Figure 1 depicts the differences between the Machine learning and Deep learning.

Figure 1: Difference between Machine Learning and Deep Learning

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An Exploratory Study for Process Optimization in IT Industry

H. Aditya Pai, Piyush Kumar Pareek, M. S. Narasimha Murthy, Sunanda Dixit, and Sneha Karamadi

Abstract Software defect prediction (SDP) is the method essential for testing during life cycle of the software development (LCSD). It finds out those stages of the software which are more prone towards defect and requires extensive testing. In this way, the testing can be without usage of extra resources. Though SDP is an essential step in the testing, it is not always easy to do the prediction of which stage of the software is having defects. There are various reasons which barriers for the smooth performances of defect prediction. In this paper, we carried out the survey on different IT companies and analyzed their software process model by performing SWOT chart. The chart gave us the idea to perform value stream mapping (VSM) that identifies the non-value added process activities in the IT companies. Also failure effective analysis model (FEAM) to know the outcome or threats over the defects identified. We also came up with the hypothesis for the delay in software development process. ANOVA analysis was carried out to understand the turbulence in the business environment.

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A Study on Secure Software Development Life Cycle (SSDLC)

S. G. Gollagi, M. S. Narasimha Murthy, H. Aditya Pai,
Piyush Kumar Pareek, and Sunanda Dixit

Abstract This article analyzes how estimation can be applied to programming headway techniques and work products to screen and improve the security characteristics of the item being made. It is centered on specialists—organizers, engineers, necessities geniuses, coders, analyzers, and managers—who need bearing concerning the best way to deal with push toward estimation for secure improvement. It does not address security measurements of system or network operations. At this moment, it has focused on understanding secure programming improvement life cycle.

Keywords Secure programming · Headway techniques · Measurements products

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An Exploratory Study for Process Optimization in IT Industry

H. Aditya Pai, Piyush Kumar Pareek, M. S. Narasimha Murthy, Sunanda Dixit, and Sneha Karamadi

Abstract Software defect prediction (SDP) is the method essential for testing during life cycle of the software development (LCSD). It finds out those stages of the software which are more prone towards defect and requires extensive testing. In this way, the testing can be without usage of extra resources. Though SDP is an essential step in the testing, it is not always easy to do the prediction of which stage of the software is having defects. There are various reasons which barriers for the smooth performances of defect prediction. In this paper, we carried out the survey on different IT companies and analyzed their software process model by performing SWOT chart. The chart gave us the idea to perform value stream mapping (VSM) that identifies the non-value added process activities in the IT companies. Also failure effective analysis model (FEAM) to know the outcome or threats over the defects identified. We also came up with the hypothesis for the delay in software development process. ANOVA analysis was carried out to understand the turbulence in the business environment.

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Voice Based E-Prescription

A system for Appointment Booking, Prescribing and EHR.

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Abstract - We all know that we are going through tuff times due to COVID-19 and this has made the fact of meeting anyone in person difficult. People in remote areas have difficulty traveling to a clinic. But as of now, we all know that most of the consultations are done online / over the phone, which results in miscommunication of the medicines prescribed. Also if the patient forgets the medicine name, dosage, he /she has to keep contacting the doctor again and again. Our idea mainly focuses on eliminating these errors and helping the doctors generate prescriptions by voice commands and send the same to the patient as SMS/PDF.

I. INTRODUCTION

The outbreak of Novel Coronavirus disease is a grave menace to the entire world affecting millions of people. Massive annual conferences to small society meetings alike have moved to the online mode. The new format (online mode) poses numerous technical and organizational challenges, but it also offers opportunities. Our application helps in reaching out to patients virtually and consulting them. Also, adverse drug effects are a major cause of death in the world with tens of thousand deaths occurring across the world each year because of medication or prescription errors. Many of such errors involve the administration of the wrong drug or dosage by caregivers to patients due to indecipherable handwritings, drug interactions, confusing drug names etc. The adoption of voice-based e-prescription could eliminate some of these errors because they allow prescription information to be captured and heard through voice response rather than in the physician's handwriting. This project presents a design and implementation of a voice-based E-Prescription along with the ability to book appointments using the IVR system as the main idea. This application helps the doctors to generate patient prescriptions using voice commands and send the same as an SMS for people who do not have the facility of a smartphone or as a pdf to the patients over social media. Furthermore, the application has features wherein the doctors can access records of patients and send messages. Patients can book appointments based on doctors availability on our app or using the IVR system. They can also use the CHATBOT feature to book tests prescribed by the doctor and access their records as well independent of the type of phone they use.

II. METHODOLOGY

The existing systems offer consultation facilities but it limits its facilities to only high end devices like smartphone/PC users. We propose a system where all the users will have to go through a one time registration process, which helps the system maintain patients' profiles as well as classify smartphone and basic cell phone users.

Once the user is registered, he/she can,

1. Book appointments
2. View prescriptions
3. Hear the audio version of the prescription

The Method is to process an audio file of prescription and reach out to people with smartphones or those with basic cell phones.

The system has 2 major entities

2.1 Converting the audio file to Text format and sending it as PDF/SMS to the patient.

The idea is to use the prescription audio file, recorded by the doctor, feed it as input to Google speech-to-text api and further process the prescription to a proper format.

The API being used is Google's Speech-to-Text API, The Speech-to-Text API synchronous recognition request is a way of performing recognition on speech audiodata. After Speech-to-Text processes and recognizes all of the audio, it returns a response.

2.2 Storing the audio file of prescription in the database.

The audio file can be played either on the application or

Human Activity Recognition in Videos Using SVM

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Authors Details

Sanket S Kulkarni, Dr. Sahana D Gowda, Dr. Rekha B Venkatapur

JyNConTR201

TR2 In Possession is known to be 9/10ths of the Law in the modern world. It is therefore imperative that one be able to protect one's properties from worldly harms such as thefts and security breaches, property damage, individuals with malicious intent, etc. The methodologies used by the intruders and hackers for stealing have been exponentially improving due to the advent of technology in the modern world. The monitoring techniques also need to improve with the changing world. With the improvement in mass media and various forms of communication, the environment can now be monitored and controlled to the advantage of the property owners. The new techniques used to tackle fraud and destruction include video surveillance and tracking. By using the technologies every inch and second of the area can be monitored and captured in interest. However, so far the technologies used are passive in nature, i.e. the monitoring systems only help to detect the crime but do not participate actively in stopping or curbing the crime while it takes place. We have also developed a technique for detecting motion in a video stream environment and this is an idea to ensure that the surveillance systems not only engage effectively in preventing the crime, but do so when the crime is taking place. Therefore, a system is used to detect any motion in a live streaming video and the software will activate once motion is detected in the live stream.

Selection of particular activation functions in different research fields

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TR2 Activation functions play a very important role in the success of deep learning models. In this paper we will review the performance of different activation functions in different scenarios. Accuracy of deep learning models is high due to the concept of hidden layers. Considering the fact to improve the performance of different deep neural networks, status, development and the result of different activation functions is required. More specifically, advantages and disadvantages of different activation functions in different research fields will be outlined in this paper. This paper will also give you a brief idea about which activation function is better than the other activation functions in terms of performance.

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Abstract - An Android Mobile Application that provides an simple way to access your mobile contacts, helps users convert the audio profile of the mobile(silent to ringer), tracks the location of the mobile, enables users to lock the mobile, fetch battery status and latest OTPs remotely just through a simple SMS without Internet Connectivity.

1. INTRODUCTION

We are in a society where everything is happening at the speed of a light. Keeping track of quite demanding essentials in this expeditious life. Here comes the use of our application called 'Remote Access'. It's a personal offline assistant to help you with the frequent problems faced in daily life.

Remote Access application performs the following operations:

1. Fetches the required contacts from the phone.
2. Changes the sound profile if it is in silent mode.
3. Track your phone's location if you lost it.
4. Lock your phone if you feel it is insecure.
5. Fetch the battery status of the mobile.
6. Fetch the latest OTPs from the mobile.

All the above features can be implemented by just sending a simple SMS from any phone remotely with the correct passcode and required action to be performed. Then the app reads the message received and performs accordingly by sending back the message with the required details. Here the passcode is used for the purpose of the security.

2. PURPOSE

Humans often tend to forget their phone and get into trouble. This becomes serious in some situations when people can't find their phones in some important situations or if they feel that their phone is insecure. There are many people who want an alternative to access their phones remotely.

Here's where our application comes into use. Remote Access is a light weight offline Android application that can help everyone with the common problems faced in day-to-day life. Upon installing this application on the remote mobile then you can just send a simple SMS from any mobile with the required keyword, access key and action to be performed. The response will be sent back to you from your mobile. Also in the same way we can also track the location, change the sound profile and also lock the phone by just sending a simple SMS.

3. LITERATURE SURVEY

Upon a Survey, A person on an average loses his nine items daily. That nearly comes into 3,300 items per year close to 2.5 days. Over an average of 60.5 years of adult life, that's nearly 200 thousand items lost and over 150 days wasted in a lifetime. The most commonly lost items in the UK survey are mobile / smartphone, house keys, car keys, paperwork, sunglasses/ glasses.

So its clear Mobile phones are misplaced a lot. What if we had misplaced/forgot the mobile and had gone out without knowing it. We can't imagine this situation, without our mobile and having to make some important calls, or want to know the OTPs received/

Based on going through online references we thought of conducting a very own survey. Upon surveying a group of around 100 people varying from teenagers to elderly persons through Google forms the results were as below:
Google Form link:
- https://forms.gle/LYs1zJLorBW85zHC8

Critical Survey for Scheduling and Resource Allocation Methods in Hadoop-MapReduce on Clouds

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ABSTRACT

Cloud computing is defined as the computing platform which hosts the various services and application for the users and businesses. It provides the access to the users with less cost and easily accessibility from any part of the world and works on the theory of Pay as you go service. In cloud environment computing resources provided as they demanded. It forms upon developments of virtualization. Cost of computing resources, highlighting towards resource scalability and provided on-demand services. It permits business consequences to upgrade and degrade their resources based on requirements. Meanwhile an open source Hadoop performance MapReduce has become a widespread model for data-intensive application for short job and low response time. IN this paper, we study the works on scheduling and resource allocation for matching the processing load .We provide the comparison of the same, comparison includes the various methodology along with their shortcomings.

Keywords : Hadoop, Mapreduce, Survey, Scheduling, Resource Allocation.

I. INTRODUCTION

Cloud environment is a recent technology to offer services to clients at a little time that is fast serving time . As growing number of current applications develop data-intensive in nature. In the past era, the World Wide Web has been embraced as an perfect platform for emerging data-intensive applications, meanwhile the communication model of the Web is more open and powerful[1]. Search engines, online auctions, webmail, and online retail sales are illustrative data-intensive Web applications where data mining and web indexing necessity to entree expanding data sets which ranges from few gigabytes to several terabytes or now a days petabytes. For example, in Google the MapReduce model processing parallel nearly twenty petabytes of data per day. Cluster computing environments for parallel data processing with high-performance MapReduce is an attractive model. The scalability of MapReduce is verified as high, since a job in the MapReduce model is segregated into abundant block, the appearance of section headings, document margins, column width, column spacing and other features.

Small tasks successively on several machines in a large-scale cluster. Hadoop is popular open-source implementation of the Google's MapReduce model is mainly developed by Yahoo [3]. Yahoo servers using

Ransomware Attack Prediction using Machine Learning Techniques

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Abstract—**The Tremendous growth in current world technology has increased malware variants to exhibit polymorphic attacks. Ransomware is a category of malware that is the biggest threats in cyber security today. Ransomware capture victims' computer by encrypting or locking files and demand the payment of some ransom in crypto-currency for the restoration of the files. This attack causes significant amount of financial loss to individuals, institutions, and businesses. Ransomware performs many file-related operations in a small amount of time to lock or to encrypt files of a victim's machine. Hence, to handle ransomware attacks more efficient methods need to be developed. The three types of ransomware detection techniques available are: static, dynamic and hybrid. In this paper, we present static ransomware prediction model using benign and exploit dataset of log files. Random Forest, Artificial Neural Networks and Support Vector Machine algorithms are used to analyze our model. Our work analysis shows that random forest gives best accuracy of 99.476% compared to Artificial Neural Networks and Support Vector Machine with accuracy of 98.200% and 97.776%.**

Keywords— Artificial Neural Networks, Malware, Ransomware prediction, Random Forest Support Vector Machine.

I. INTRODUCTION

The use of digital devices is increasing day by day in this modern era. The threats on these digital devices are also rising. Virus, worms and malware are malicious programs that can attack and cause trouble by gaining access to digital devices. There are many malicious programs, such as virus, worm, or spyware released in the wild, which can seriously harm digital systems. Among the current malicious software, ransomware is a recent kind of malware that has blowout mainly in last couple of years. Ransomware is created from two words payment and product. Webster's word reference described Ransom as "cash that is paid with a specific end goal to free somebody who has been caught or grabbed" and as "a thought paid or requested for the arrival of somebody or something from top captivity"[1].

Locker and Crypto are the two main types of ransomware attacks[2]. Locker ransomwares do not manipulate the victim's files but it locks the system by preventing users accessing the computer. In contrast, Crypto ransomwares encrypt the victim's files to restrict the user's access to their files and it also does not manipulate the files. Crypto-ransomware searches for files with specific extensions and encrypt only those files. It does not encrypt the whole hard-disk. The attacker releases the encryption key to the victim if and only if the ransom is paid through secret payment mechanisms, such as cryptocurrencies. Compared to locker ransomware crypto ransomwares are more hazardous. Thus, the ultimate goal of the attacker is to earn money. Therefore, ransomware detection mechanism should be very effective and efficient to avoid loss of money or data.

Ransomware attack victims are enterprises, Small-Medium Businesses (SMB), and individuals. As per the survey conducted in 2016, out of 290 selected organizations, 50% were its victims, and around 40% of its target victims have paid millions of ransom in a year[3]. Some examples of Crypto ransomware comprise of CryptoWall [4], CryptoLocker [5], Locky [6] and SamSam [7]. Examples of Locker ransomware include: CTB-locker [8]. Recently in 2017, Wannacry the most well-known and destructive ransomware variant locked the data and demanded a ransom of about £92 million from many organizations including Britain"s National Health Service, some of Spain"s largest companies like Telefónica, and computers through Russia, Ukraine, and Taiwan [9]. The growing danger of ransomware attacks requires way out for prevention, detection and removing ransomwares programs. Even though various malware detection and classification approaches have been proposed, these approaches are not suitable to defend against ransomware because these approaches generally focus on distinguishing malware from benign files. Therefore, a new detection mechanism specialized for ransomware is needed, and the mechanism should focus on ransomware-specific characteristics to distinguish ransomware from other types of malware as well as benign files. Moreover, considering that a key characteristic of ransomware infection, it is necessary to

Comparision between K-Means and Expectation Maximization algorithm using Iris plant

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Abstract— **Nowadays many courses in machine learning will start with clustering, as everyone knows clustering is very simple and important in many application. Clustering is an unsupervised learning problem. An unsupervised learning is a machine learning technique in which the model is allowed to work on its own to discover data. Unsupervised learning always deals with unlabelled data and can be more unpredictable compared to other learning techniques. Clustering is a technique that will find pattern in a collection of unlabelled data. Clustering algorithms will process and find clusters in given data. There are many clustering algorithm to utilize. In this paper, two clustering algorithms like K-means and Expectation Maximization(EM) algorithm is utilized for examination of the species in iris plants. K-Means clustering algorithm is partitioning method. Gaussian mixture model(GMM) is multivariate distribution which is consists of a mixture of one or more multivariate Gaussian distribution component. This paper considers Iris plant as the fundamental object, in which we distinguish various classes: Setosa, Versicolour, and Virginica. We apply Kmeans and EM algorithm to compare clustering performance using parameters like sepal and petal length and width. The main observation in the paper is that EM-GMM algorithm performs significantly better than k-means.**

Keywords— *algorithms, cluster, data, kmeans, machine learning.*

I. INTRODUCTION

Clustering is a procedure of collection of data points into incoherent groups with the goal that the data in a similar group are comparative, however information having a place with various group contrast[1]. A cluster is an assortment of data that are like each other are in same group and not at all like the data in different clusters. At present the utilizations of PC innovation is expanding quickly which made high volume and high dimensional informational collections. These information is put away carefully in electronic media, in this manner giving potential to the improvement of programmed information examination, order and information recovery. The clustering is significant piece of the information examination which apportioned given dataset in to subset of comparable information focuses in every subset and unlike information from different groups. The Clustering[2] is helpful with expanding in computerized information to draw important data or drawing fascinating patterns from the informational indexes consequently it discovers applications in numerous fields like bioinformatics, design acknowledgment, picture handling, information mining, advertising and financial aspects and so forth.

There have been many clustering techniques proposed yet K-means[3] is one of the most seasoned and most well known grouping procedures. In this technique the quantity of group (k) is predefined before examination and afterward the determination of the underlying centroids will be made arbitrarily and it followed by iterative procedure of appointing every information highlight its closest centroid. This procedure will continue rehashing until assembly rules met. Nonetheless, there are deficiencies of K-implies, it is critical to proposed procedures that improve the conclusive outcome of examination. In this paper some significant enhancements towards the precision and proficiency of the grouping strategy is done.

Machine learning method Unsupervised Learning techniques consist of clustering algorithm that works by finding the comparable information for unlabeled model by isolating the information as indicated by their comparative nature[4]. Clustering intends to partition the dataset into a majority of the group's information by sharing some attribute of every subset. In such expresses, the separation work technique is utilized to quantify the closeness or nearness of every information thing. There are several

LISTEN FOR VISION

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Abstract—Blind is one who is unable to see because of injury, disease, or a congenital condition. The biggest challenge for a blind person is to navigate around places. There are around 253 million people worldwide who are blind and these people face lots of challenges to perform their day to day activities especially related to moving and navigation. In this context we came up with this model of android application that is simple and easy to use to help blind people in navigation by detecting surrounding obstacles and giving the audio instructions regarding the same.

Keywords—Visually impaired , Android

1. INTRODUCTION

Visual impairment is decreased ability to see or complete loss of sight (blind) and cannot be corrected by any normal means like lenses or spectacles. Visually impaired people face many problems among which detecting obstacles and navigating between places are important ones .With an intention to help such people we are building an android application that can be used for moving around conveniently. Visually impaired people have to deal with lot of challenging conditions due to their poor vision or complete loss of sight. Quality of life is affected for a visually impaired person due to his/her wanting to constantly depend on some other person for completing there day to day activities that increases the rate of depression and anxiety. With this application person can overcome the use of mobility aids like canes. In our android application we use a camera mainly that detects the surrounding objects and the instructions are given in form of audio signals. In simple this android application uses a smart phone with camera that's easily available to detect surrounding objects that can help navigating in unknown environments.

2. LITERATURE SURVEY

With vision being most vital sense organ for humans its disorder or loss affects the person in terms of his performance of day to day activities. In recent advancement of technology ,scientists are trying to develop various systems to make visually impaired individuals help feel more independent and get better awareness of their surroundings. These developments prove to be boon in lives of blind individuals. Various systems have been developed to help blind users understand about their surroundings.

A smart cane was built that alerts the blind people to get the obstacles ahead of him through voice alert and vibr

could help them in walking carefully with less accident. But this could cost a blind and it makes them uncomfortable to move in crowded environment.

Viziyon is a IOT based hand held device which detects the surrounding obstacles and alerts the user. Ruxandra proposed a smart phone based system which determines the type of object classifying as normal or urgent.

3. METHODOLOGY

Camera Access - Our application request for the permission to access the smart phone camera.

Camera2API is the latest Android camera framework API that replaces the deprecated camera framework libraries. Camera2API can customize phone camera automatically and takes images at faster intervals and applies effects and filters directly if required. This way it makes camera2 API more powerful.
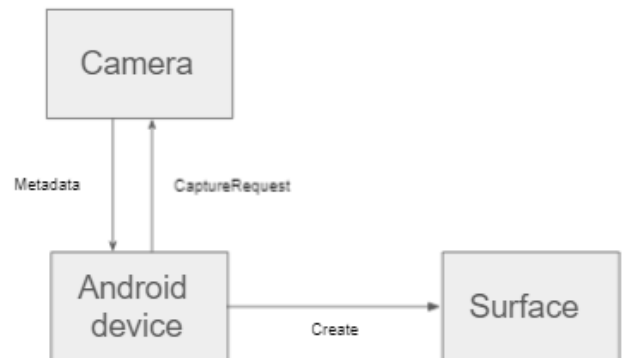

Fig 1 Camera2API Block Diagram

Dataset - Coco is a large-scale dataset featured with object detection, segmentation and captioning or labeling. COCO consist of 328,000 images with 2.5 million zlabeled instances and 91 object categories with 11 super categories. COCO has several features like object detection, object segmentation, stuff segmentation, recognition in context.

Object detection - Tensor Flow Lite is Tensor Flow's light solution for mobile devices. It enables inference called on-device machine

ANIMAL INTRUSION DETECTION USING MACHINE LEARNING

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Abstract:

In India agriculture is the prop of the economy and majority of the population depend on agriculture for their livelihood. But one of the common threats that is human animal conflict is causing a major damage to the farmland, which is responsible for the crop loss and this is leading to financial loss to the farmers. To overcome this issue the help of Machine Learning and Raspberry pi, we have proposed a digital surveillance system to monitor the farmland for any intrusion of animal and to divert them with the help of the siren. Our system is also used to alert the farmers and forest officials by sending an alert Twilio message.

Keywords: Machine Learning, Raspberry Pi, SMS Twilio

E-DEFENCE FOR PEOPLE SAFETY

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Abstract:

Every day in our society we come across so many issues like medical emergencies, accidents, kidnaps and many more. Where in people especially girls are into serious problems. This made us think about an application which basically is a system for detecting the problem and alerting the authorities using most commonly available electronic devices like smart phones.

Keywords:

Short Message Service (SMS), Global Positioning System (GPS), Global System for Mobile Application (GSM), Security.

DETECTION OF MELANOMA SKIN CANCER

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Abstract

Dermatology diseases are one of the biggest medical issues in 21st century due to its highly expensive and complex diagnosis. Skin cancer are mainly of 2 types – Melanoma and Non -melanoma. Early detection of this fatal Melanoma skin disease increases the curing rate to 90%. In diagnosis of medical images vision of computer can play a vital role and is also proved by many existing systems.

Keywords:

Skin Cancer, Melanoma, CNN, Inception v3, Firebase.

1. INTRODUCTION

SKIN- Jack of all trades meaning it performs various tasks like protects the body by covering all the muscles and other tissues, maintaining the body optimal temperature in extreme climatic conditions, helps as an excretory organ removing wastes through sweating. Melanocyte if present in human skin causes Melanoma. Our task is mainly centered around detection of this lethal type of malignant growth. Melanoma can be detected by straightforward visual assessment known as ABCDE examination where A stands for ASSYMETRIC cancerous mole tend to be irregular in shape. B stands for BORDER it appears to be ragged and notched while C stands for COLOR includes uneven shades of colors. D stands for DIAMETER. If a mole becomes greater than ¼ inch is cancerous and E stands for EVOLVING. High closeness between various sorts of skin lesions makes a visual appraisal troublesome and prompts wrong examination. Therefore, an automated system is proposed to ease out the skin lesions classification.

2. OBJECTIVES

The below are objectives:
- To design and develop novel image processing approached based system for melanoma detection.
- Segregating the available datasets into benign and malignant region based on training the network.
- Segment the region of interest effectively by removing the noise.
- Feature extraction for effectively extracting properties of benign and malignant region.
- Training Neural Network with variation in layers to find best efficiency.
- Test case to load the image and identify the test image is benign or malignant.
- Graphical User Interface to use the program functionality.

3. METHODOLOGY

The system consists of four stages:

3.1 DATASET COLLECTION:

The appropriate dataset was collected from International Skin Imaging Collaboration (ISIC) Archive. Goal of the archive is to serve as image resources for public for research and development, teaching, testing of diagnostic AI algorithms.
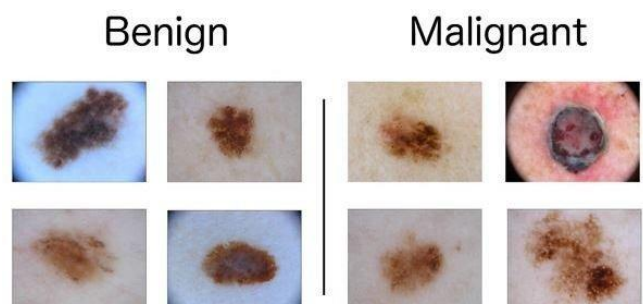

Fig 3.1 Sample images from Dataset

3.2 PRE-PROCESSING:

The Inception v3 architecture of Convolutional Neural Network is used to create a model. Image preprocessing is said to be crucial part of system and can directly influence accuracy that the model attains. Inception v3 offers many

Power-Cognizant Proactive Routing Protocol for Amending Energy in Ad-hoc Networks

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Abstract. The execution of an Ad hoc Wireless Network is controlled by a key factor "power", as it is the essential resource of any communication system. Utilizing such power effectively and efficiently is the most important Task. Power has to be optimized according to the requirement. In an ad hoc network, nodes exchange information with each other by forming a multi-hop wireless network & sustaining connectivity in a localized fashion. Optimizing power in such a network is a significant challenge ad hoc routing protocols are power hungry as they expend a substantially large amount of battery power contained in the nodes. Hence routing in an ad hoc network is eminently power restricted. Research has been done choosing the appropriate routing protocol at the network layer and power aware protocol at MAC layer. In this paper, a proactive routing protocol has been implemented which is power aware. FSR is the routing protocol chosen and MAC 802.11 standards have been used in combination of a routing protocol to optimize power. The simulation is executed using NS-2 and the power consumption has reduced.

Keywords: Ad hoc networks · Fisheye state · Manet · Mac · Power cognizant

1 Introduction

Wireless communication is the quickly expanding & most vital technological areas in the communication field. Our lives are unimaginable without Wireless communication like TV, Radio, Mobile, Radar, GPS, Wifi, Bluetooth, RFID etc. In Latin ad hoc means "for this purpose". Ad hoc networks are group of self-organizing nodes or terminals that exchange information with each other by combining a multi-hop wireless network and sustaining connectivity in a suburbanized manner in an infrastructure less environment. Several classifications of Ad hoc networks are MANET, VANET, FANET, WSN etc. Ad hoc network operate with IEEE 802-11 standards. Initially ad hoc networks were designed for military and disaster recovery applications, due to their fast deployment feature without the existence of any infrastructure. But with rapid growth of mobile communication, MANETs are regarded as important contemplate in the future inception of system technologies [1].

Various power optimization techniques are existent in Ad hoc networks. Optimization of power is of at most importance in Ad hoc networks as their structure is autonomous and non-existence of central governing body. Various layers are affected while optimizing power in ad hoc network like physical, network & MAC layer [2].

COVID-19 Apps: Privacy and Security Concerns

Surekha Borra

Abstract Today, with the rapid spread of COVID-19, many governments and start-ups are coming forward to develop smartphone apps that trace where we all are, whom we met and for how long, with a goal of interrupting new chains by informing potentially exposed people. These new platforms make use of anonymous use of Bluetooth technology and GPS, enabled either on smartphones or armbands in order to prepare maps corresponding to quarantine monitoring, contact tracing, movement tracking, social distancing and density reports. With different apps for different countries, one thing most of the apps facilitate is tracking. To save lives during an extraordinary crisis, many governments are willing to overlook privacy implications. Keeping in view that the sensitive data being collected is not exclusive to public health organizations and governments, this chapter explores different apps that were developed aiming to combat COVID-19, and the related personal data privacy concerns that arise in the post-coronavirus era.

Keywords Apps · Bluetooth · COVID-19 · GPS · Privacy · Security

1 Introduction

While the researchers around the world are busy developing COVID-19 related AI-driven tools [1, 2], forecasting methods [3–5], screening [6] and image-assisted decision support systems [7], COVID-19 mobile apps are being developed for a variety of reasons, ranging from quarantine monitoring, contact tracing, movement tracking, social distancing and density reports. All these mobile apps with or without the consent of the user collect user personal information, including location histories and stores the data on the third-party servers, which might lead to serious cyberthreats and associated fears. Hence, reporting the available apps and analysing the side effects including security and privacy concerns is the need of the hour.

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Automation of Anomaly Detection in Warehouses: A Machine Learning-Based Approach

P. Pratiksha, K. Pooja, Onkar Misra, and Surekha Borra

Abstract The warehouses offer its clients top notch services for a wide scope of items. To ensure the best conditions for the put away merchandise, the owners of warehouses must ensure faultless state. The warehouses must be operational on a day in and day out premise and need to offer storage for stocking seeds, pharmaceuticals items, etc. The focus of this paper is to survey the state-of-the-art technologies used for anomaly detection with respect to warehouse safety, and to propose an automatic alerting system based on machine learning techniques. After experimenting with several classifiers, the cubic support vector machine (SVM) classifier model exhibited highest accuracy for AlexNet-based features on the given dataset.

Keywords Machine learning · Sensors · Imaging · Warehouses

1 Introduction

Warehousing services are becoming more and more distinct based on the stored material and the type of warehouses. The stored materials require an ideal environmental set up to maintain quality of the products which depends upon the temperature, humidity, degree of light, presence of CO_2, etc. Each product demands its own arrangement of recommended temperature settings. To safeguard the temperature wide open to, the nature of protection is of extreme significance. Leakages in the

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Acute-Lymphoblastic Leukemia Detection Through Deep Transfer Learning Approach of Neural Network

Tali Veerappa Renuka and Borra Surekha

Abstract Manual examination of blood smears under microscope is observer subjective, time consuming, and labor intensive. A computerized system would be best choice for quantitative and qualitative inspection of blood smear images. This paper presents classification of white blood cells into healthy and unhealthy using SVM machine learning model. Features from images are extracted with transfer learning approach of deep convolutional neural network using Alex-net pretrained model. This approach validates the process of discriminating white blood cells into healthy and acute lymphoblastic leukemia affected unhealthy cells with 96.15% of accuracy and outperforms the existing methods.

Keywords Leukemia · Convolutional neural network · SVM · Alex-net · ALL

1 Introduction

One of the significant inventions in recent modern medicine is digital pathology. Cell morphology and tissue structure are studied using digital pathology and microscopy images. Disease diagnosis by medical practitioner is fully dependent on pathological investigations. Manual analysis of microscopic blood smear images by highly expert pathologists is very labor intensive, time consuming, and subjected to inter-observer variations. Recent innovations in image processing and computer vision techniques have improvised digital pathology in terms of objectivity and reproducibility. Hence, since past decades, many researchers and practitioners have diverted their focus on

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Secure Anti-piracy System

Junaid Khan, Akshatha Shenoy, K. M. Bhavana, Megha S. Savalgi, and Surekha Borra

Abstract This paper proposes a secure movie distribution and playing system which can avoid piracy in theaters. In the proposed system, an IR LED based anti-piracy screen is set up for discouraging illegal recording of movies. The optimization of power is achieved through progressive activation and deactivation of IR LEDs. Copyright protection of movie file is provided using invisible watermarking, and confidentiality and security are provided by encrypting the movie file as well as by enabling the decryption based on the authorized location verification of theaters. The system is also designed to allow only the authorized personnel to operate the system upon receiving the one-time password (OTP) from the owner. The experimental results proved that the developed system is secure and discourages the illegal video recording by creating artificial degradation in the recoded video. The system also helps to resolve rightful ownership via invisible watermarking.

Keywords Piracy · Watermarking · Encryption · Global positioning system (GPS) · Security · Copyright protection

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B

Biometric Sensors

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Synonyms

Biometric detectors; Biometric scanners; Biometric transducers

Definition

A biometric sensor is an electronic device that captures raw biometric samples in a form that is suitable for generation of a biometric template, which can further be used for verification or authentication of an individual's identity. Examples include cameras, computer keyboards, microphones, fingerprint readers, and iris scanners.

Theory

Biometric sensors are the heart of any biometric identity system. Sensors range from a simple microphone for voice capture to a high-definition camera for face capture or are specially designed to scan the iris, vein pattern, retina, signatures, and gait motion.

Biometric sensors capture reflected, transmitted, or projected acoustic or light signals, capacitive levels, or pressure differences proportional to the biometric trait. The transducers inbuilt within the sensors convert sensor measurements into electrical signals for further processing, digitization, storing, and matching.

The selection of biometric sensors and their classification depends upon the application, the biometric modality, technology, user acceptance, shape and size, connectivity, installation type, capturing distance, interface, contact type, capture mode, capture time, operating temperature, storage temperature, depth of field, illumination, resolution, device dimensions, weight, power source, power consumption, cost, false acceptance rate (FAR), and false rejection rate (FRR).

Most biometric sensors act like scanners to convert an individual's physical characteristics into images at different spatial resolutions, pixel resolutions, frame rate, compression levels, pixel depths, and imaging wavelengths. Multispectral imaging sensors generate multiple images at varying wavelengths and differing levels of

ORIGINAL RESEARCH

SN

Electronic Gauge for Micron Measurement and its Relevance to Industry 4.0

B. A. Prathima[1] · P. N. Sudha[1] · P. M. Suresh[2] · M. Mruthunjaya[3]

Abstract

Micron measurement of the manufactured part is an integral part of production process. This decides qualification of the manufactured part's acceptance or rejection. First principle methods are well established to measure the manufactured parts with utmost certainty. In the advent of Industry 4.0 in the digital revolution era of manufacturing, an electronic measurement of various dimensional parameters is gaining prominence. The shortcomings of measurement by first principle methods such as written documents, inability to automate the analysis and hence cloud connectivity, etc., can be achieved with electronic gauging. In the proposed work, an electronic gauge with micron resolution and cloud connectivity is devised for measurement of outer diameter of a mass production component. The measured readings are validated using statistical methods for the Gauge Repeatability and Reproducibility (GRR). The electronic gauge registered greater stability in the key parameters of gauge capability such as Equipment Variation (EV), Appraiser Variation (AV), Part Variation (PV) and %GRR over its conventional measurement counterpart. The electronic gauge recorded %GRR of 7.81% against conventional gauge's %GRR of 14.47%. This made the electronic gauge acceptable without any conditions for the measurement of a critical parameter in mass production environment. The paper extended the scope to record the measurement readings in cloud-enabled platform to make the measurement system ready in the context of Industry 4.0. The proposed model has been implemented and validated in a mass production set-up, engaged in manufacturing of precision auto components.

Keywords Electronic gauge · Metrology · Micron measurement · Industry 4.0 · LVDT · GRR

Introduction

Digitalization is the new revolution in the manufacturing world. Manufacturing industry is compelled to shift towards digitalization to increase productivity, performance and

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competitiveness. Mechanization, electrification, automation have contributed significantly during their first, second and third revolutions respectively. Digitalization is termed as the fourth industrial revolution. This is all set to play a major role in close looping many aspects of manufacturing activity by carrying big data from shop floor to the management through the Cyber Physical System (CPS) and coming back to the shop floor in the form of meaningful decisions to enhance productivity, performance and finally clocking higher degree of competitiveness.

Various degrees of digitalization have happened in different areas of the manufacturing industry. However, to reap the maximum benefits of industry 4.0 capabilities and possibilities, all areas of manufacturing such as production, quality, maintenance, supply chain, human resource management, supplier integrations, etc., also are expected to attain fair levels of maturity in digitalization.

In this paper, measurement of manufactured part is taken up for digitalization. Measurement of micron resolution dimension using electronic gauge equipped with Linear

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Security and Authentication for IoT Devices

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Abstract

Internet of Things (IoT) is a network of all devices that can be accessed through the internet and controlled using the existing infrastructure. IoT devices are known for improving accuracy, efficiency with inconsiderable human involvement. These devices allow an explicit integration of computing devices with the physical world. Uses of IoT devices are increasing faster than ever. These devices have dynamic and heterogeneous nature. So security and authentication of these devices have become a major concern. The information couldn't be accessed by a user (external party) until and unless mutual authentication happens between users and devices. In the proposed scheme, signature-based authentication scheme has been presented for the IoT environment. Implementation of proposed scheme is done in widely accepted Network Simulator (NS2). The simulation result shows the practicability of the proposed scheme. In the proposed scheme, the functionality features are enhanced, and communication and computational costs are also minimized compared to other existing approaches.

Keywords: Internet of Things, AODV, Security, Authentication.

1. Introduction

There has been huge progress in the field of internet of Things (IoT). IoT devices are networking devices which can be used with the help of existing infrastructure remotely. These devices have a capacity of computability and communication. These devices can be used without human involvement which leads to economical as well as time saving benefits. For this, multiple technologies are used like machine learning, new network protocols, wireless communication, and embedded system, etc. The IoT devices are used without human involvement so security risk also increases.

The main vitality of IoT idea is highly brunt on several aspects of everyday life. Domestic fields, e-health, educational Institute, agriculture, and industry are the possible application scenario in which this can play a vital role. It is estimated that by 2025, 20 billion devices are IoT devices. The IoT devices are relatively a new concept, and security related problems have not been addressed properly at its design level. An effective and efficient security mechanism is required to handle the problem of security, especially authentication and key agreement scheme to protect the privacy.

This paper proposed and implemented an authentication model. The network contains a smart device called sensor or accumulator. The sensor device which is connected to the network, detects the data, and sent to Gateway of Network. The gateway does the Deep inspection of packets and sends data to the corresponding department. The nodes in each network are connected to the internet through the gateways. Different type of users like Doctors, Police, and Fire-department people can access the data with relevant IoT devices.

Several threat models for IOT devices are considered, one of them is called Delve-Yao Threat (DY) model. Under the DY model communications between devices are performed under the public channel and adversaries have the opportunity of eavesdropping, the messages and modifying in the original messages. It further assumes that the adversary can physically capture the device and detect the sensitive information using power analysis.

The proposed scheme is an authentication model for IoT devices in which various security concerns are taken into consideration. A signature based authentication model and key agreement scheme have been proposed to solve these issues. Finally, it has shown that proposed scheme is efficient and cost effective in terms of communication efficiency and computation costs.

2. LITERATURE REVIEW

The authentication schemes for IoT devices are considered as the dynamic and heterogeneous behavior of IoT devices. Public key cryptography like RSA is suitable for broadcast and multicast, but it has high communication and computation overhead. These overheads make it unsuitable for applications where resources are limited. Development of wireless communication has helped in developing security and

Authentication scheme for IoT devices. For IoT applications Datagram Transport Layer Security (DTLS) handshake protocol has been proposed. This scheme depends on the Markel hash tree which has the advantages of balancing the communication overheads and storage overheads. But there is a lack of scalability. Elliptical curve cryptography (ECC) based authentication scheme is susceptible toattack on the radio-frequency identification (RFID) tag. Current research shows that 160 bit ECC is more efficient compared to 1024 bit RSA. Thus, ECC based Security and Authentication scheme is more efficient compared to RSA based scheme.

Symmetric key based approach is one of the earliest proposed schemes which use mainly hash functions. Despite slashing energy consumption by using hash functions, it is susceptible to Denial of service (DoS) attack because of waited authentication, and also do not audit for data integrity. There are some other symmetric key schemes which are based on key ring in which there is no prior knowledge of deployment scalability. Hence, this is not suitable for a dynamic and heterogeneous environment like IoT. In protocol design it was considered that the protocol must not be overhead of communication. If the protocol header length is greater than the messages size, then there are loss of bandwidth and other resources.

The signature based scheme provides the fast generation of the certificates and quick authentications using these certificates. In this method, an immediate authentication is guaranteed and synchronization is not required. Long signature and key length are used to make application suitable for those which are not frequently used. Low power sensor network using cryptography is wide field inwhich continuous research is going on. The overhead of distribution and transmission of keys are some problem in this approach. Second is vulnerability of high power consumption overhead. Indeed, low power-wide area network (LP-WAN) IoT devices that can stand for 10 years without any failures even the minor increase in power decrease the lifetime of the battery. In this approach, IoT devices authentication have done purely at base station with no modification of low power adversaries. The computation complexity of network devices can be reduce by offloading training of deep natural network to clouds.

In the last few years, Long-short-term memory (LSTM) architecture has been proposed to make the network efficient and reduce the computation complexity. In LSTM, each layer contains the hidden memory block that is connected via cell state. This cell state contains the history of sequentialinput and contains the information of update. Each LSTM state contains the gates, which mainly does the control of information flow. One of the gates called Fore gate which has some special task. After receiving the information from the previous cell, Fore gate takes the decision that which information has to be dropped and which has to be transferred to the next cell. Other gates include the input and output gates that control that control the input activation to the next block. These are responsible for generating input for the next block cell. This is a deep learning authentication mechanism for IOT devices.

3. Proposed Method

This paper discusses a new signature-based authenticated key establishment scheme has been developed for IoT devices. The users communicate with each other via smart devices (IoT) in the network. These smart devices have Gateways to ensure communication security. The proposed scheme can be enforced over wired and wireless communication networks.

Recently, an increase in availability of bandwidth and computational power of network devices leads to significant performance improvement in IoT devices. A legal node in the network can send the data to sensor and after mutual authentication, the data sent to gateway node. After mutual authentication, a secret session is established between users and sensor nodes for further communication.

Proposed scheme consists system set up phase, sensing device registration phase, new packet creation phase, data encryption for security, authentication phase in by certificate of each entity of network, analysis of performance of the proposed scheme. Gateway nodes (GWN) are nodes in the network, which forwards the packet to destination as per addresses set by the smart node in each network. For example, in first network there is a node SD1 which receives the messages sent by each node in that network. SD1 will set the flags of the packet and send to the GWN and GWN forwards the packet to the respective department.

The proposed scheme uses Ad-hoc on demand distance vector (AODV) routing algorithm. As the name suggests AODV protocol builds roads between the nodes when source node request. That's why itis called on demand and benefit is that it doesn't create any extra traffic in the network. The routes are maintained as long as source required that route after that path destroys. If a same source request for

path then may be a new route established by this protocol. In AODV, network nodes are silent until connection established between them. Nodes in the network which need a connection broadcast request for connection. The remaining nodes forwards the request and record the root node that request for connection. In this way they create the series of temporary routes back to the requesting nodes..

AODV protocol is free from loop messages and scalability is also high. When source nodes intend to send its route, it sees its routing table to check whether the route is valid or not. AODV is free from topological changes because it's adaptively been very high in dynamic networks. AODV protocol supports both multicast and broadcast in a network. It has lower set up delay to detect the shortest route in the network. There is no extra communication overhead communication. It doesn't need any central administration for handling the routing processes. This protocol does not require central administration for handling the routing processes.

4. IMPLEMENTATION AND RESULTS

4.1 Implementation

Security and authentication for IoT devices scheme implementation contains the following phases – Network formation phase, new packet format creation phase, registration phase, data encryption phase, authentication, and performance analysis phase. A wireless sensor network (WSN) includes a large number of small sensor nodes. These nodes are set up in the network where information is to be monitored. In WSN, energy model is one of the optional attribute of a node. The energy level denotes the level of energy of a mobile node. The component required for designing energy model includes intialEnergy, txPower, rxPower and idlePower. The intialEnergy represent the level of energy a node has at initial time of simulation. The txPower and rxPower represent the power consumption in transmission and receiving the packet. The sensor node the energy model includes a special component called sensePower. It represents the energy consumed during the sensing operation. Apart from these, there are some important factors which specify the communication range of nodes and sensors in the network. The priority based deployment model is used in the proposed scheme. In this proposed scheme sensor nodes are configured with distinct communication and sensing range. A Base station is configured with a highest communication range. The registration and authentication phase generates the certificates for each node in the network, so that they can be authenticated using this certificate. Random number from 999 to 99999 is generated and assigns it to a node which in a vector set. The vector set has been shared among the nodes including sensor node. When data packets are coming from a node, they are searched in the vector set and if a matching entry is found in the set, then a packet is sent to GWN or else the packet is dropped.

4.2 Performance Analysis

Performance analysis of proposed scheme is done on the basis of the number of received packets, packets loss, packets delivery ratio, and end to end delay.

Packet Delivery Ratio (PDR): - It is defined as the ratio of the number of packets delivered to destination successfully and number of packets that has been sent out by the sender.

$$PDR = N_R / N_S \qquad (1)$$

N_S – The number of packets sent by sender and $\qquad$ N_R – The number of packets received by receiver

End To End Delay (E2E): - End to end delay refer to the time taken to deliver the packet from source to destination across the network. It is often half of the round trip time. End to end delay in the network come from several sources, including the transmission delay, Propagation delay, queuing delay and processing delay.

Transmission Delay (D_T): - It is time required to push all packet's bits into the wire.

$$D_T = N / R \qquad (2)$$

Where N denotes the number of bits, and R denotes the rate of transmission (in bits per second)

Propagation Delay (D_P): - It is time required to travel packet's data from source to Destination.

$$D_P = D / V \qquad (3)$$

Where D denotes the length of physical link and V denotes the propagation Speed In Media.

Queuing Delay (D_Q): - It is the time a job waits in a queue until it can be executed. It is network infrastructure dependent.

Processing Delay (D_{PR}): - It is time required to process header of the packet by nodes in the network.

E2E is defined as the average time taken by a data to reach destination. This includes all the delays caused by buffering during the route discovery latency, queuing at the interface queue. Mathematically it defined as-

$$E2E = D_T + D_P + D_Q + D_{PR} \qquad (4)$$

$$\text{Avg. E2E Delay} = S/N \qquad (5)$$

Where S denotes the sum of the time spent to deliver packets for each destination, and N denotes the number of packets received by all the destination nodes.

Throughput (T_H): - It is defined as the total number of packet, delivered over the total simulation time. Mathematically, it can be defined as:

$$T_H = N/S \qquad (6)$$

Where N- The number of bits received successfully by all destinations and S- The total simulation time.

Table 1 Performances Comparison

	Existing scheme			Proposed Scheme		
Number of Nodes	5	15	26	5	15	26
llocated MPR Set	4	12	18	4	12	18
Generated Packets	101	143	167	101	143	167
Received Packets	96	121	110	99	139	147
Packets Loss	5	22	57	2	5	20
Packet Delivery Ratio (%)	95	84.62	65.87	98.01	97.20	88.02
End-To-End Delay (ms)	56.5	69.44	143.67	20.72	23.68	61.16
Throughput (Bits/sec)	5.05	6.37	5.78	5.21	7.31	7.73

The packet delivery ratio during the simulation time (140 seconds) is given below. The X-axis indicates Times (in seconds) and Y-axis indicates the packet delivery ratio (in %). The graph is shown below in fig 1. The graph is almost linear means as the number of nodes in the network increases; the packet delivery ratio is also increase. If the number of nodes in the network increased, the probability of packet drop also increases due to increase in traffic in the network. Ad-Hoc on Demand Distance Vector (AODV) protocol sends the data without appending header also or it will only send the size of a packet not the actual data.

Fig 1: Packet Delivery Ratio
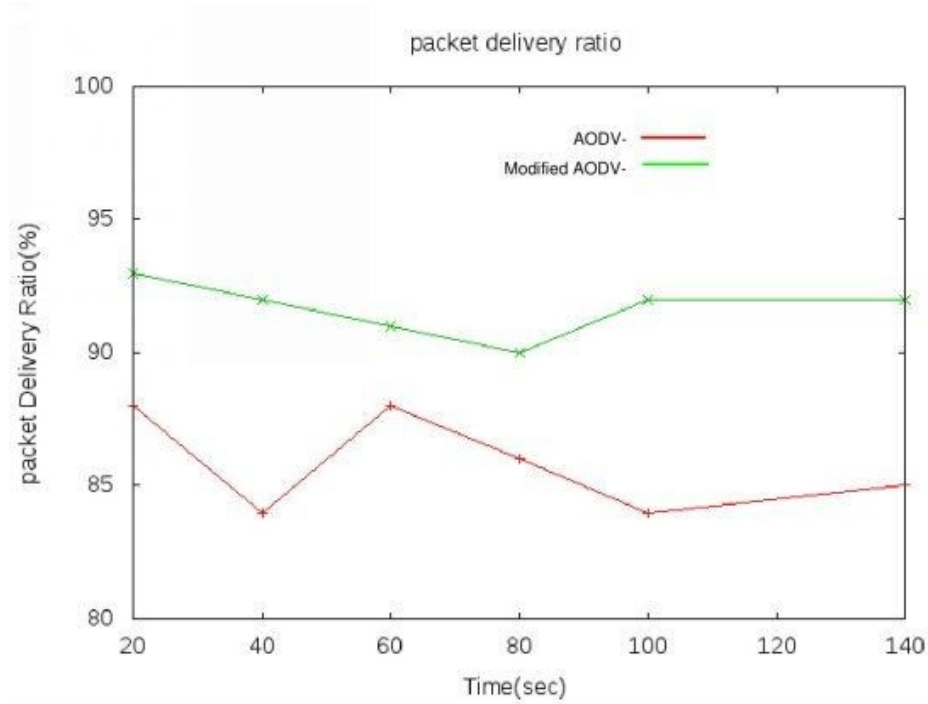
Throughput refers to the average data rate of successful data or messages delivered over a communication network throughput measure in terms of bits per second. Here X axis indicates the Time (in seconds) and Y axis indicates the throughput (in kbps). The graph is shown below in figure 2. As the time spent, Data sent by nodes in network also increases. So Throughputalso increases as graph's output is showing.

Fig 2: Throughput
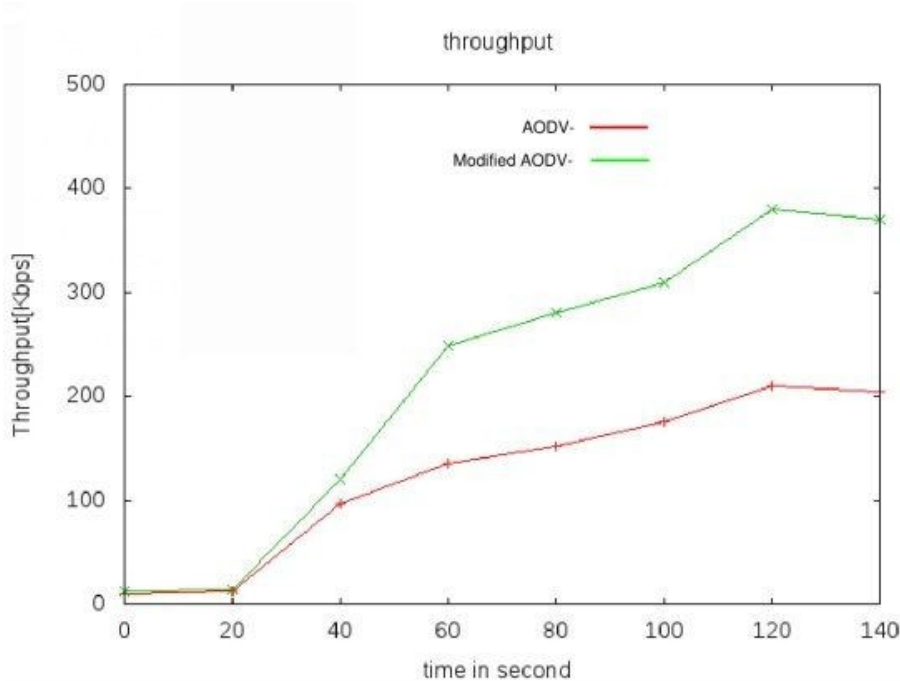
End to end delay refer to the time taken to deliver the packet from source to destination across the network. Here X axis indicates the Time (in seconds) and Y axis indicates the end to end delay (in secs). The graph is shown

below in figure 3. In case of Modified AODV packet format, only change flag bit are checked rather than entire flag. AODV check the flag for 20 seconds and if modified flag bits are constant then next 20 seconds it does not check the flags of remaining packets which leads to minimization of E2E Delay.

Fig 3: End to End Delay
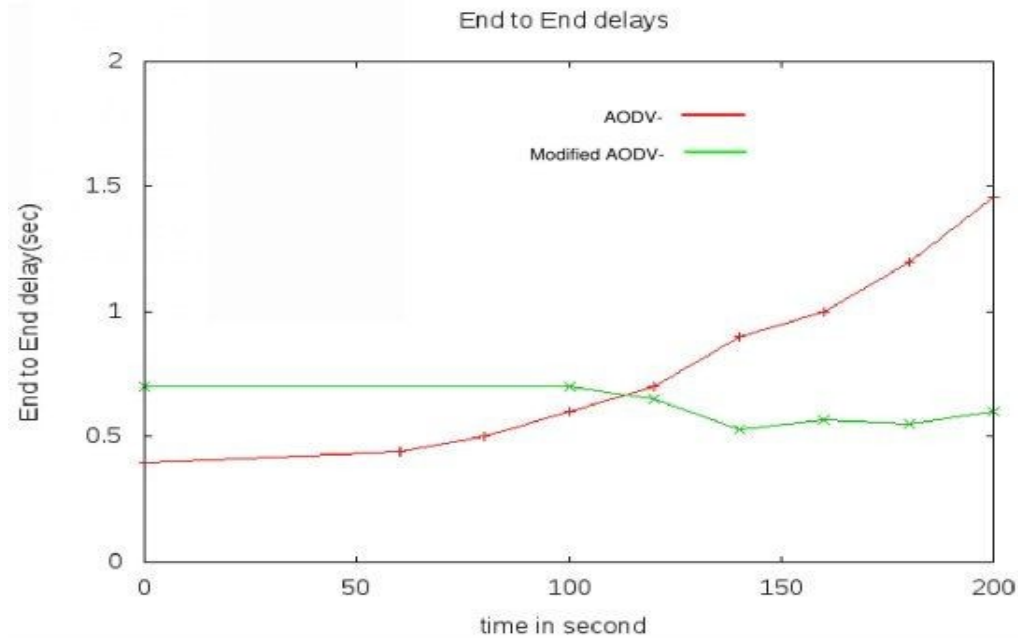
This is the intermediate output for authentication of nodes in the network. Gateway checks the certificate in the vector. If it is found, then it is authenticated otherwise not. To make the search efficient in the vector hash mapping with the node id has been done.

For example: If the Node id=94082, certificate=477,

Hash index=94082%26=14

If vector [14] = 477, then the node is authenticated otherwise not authenticated.

Screenshot of node authentication output is shown below in the figure 4.
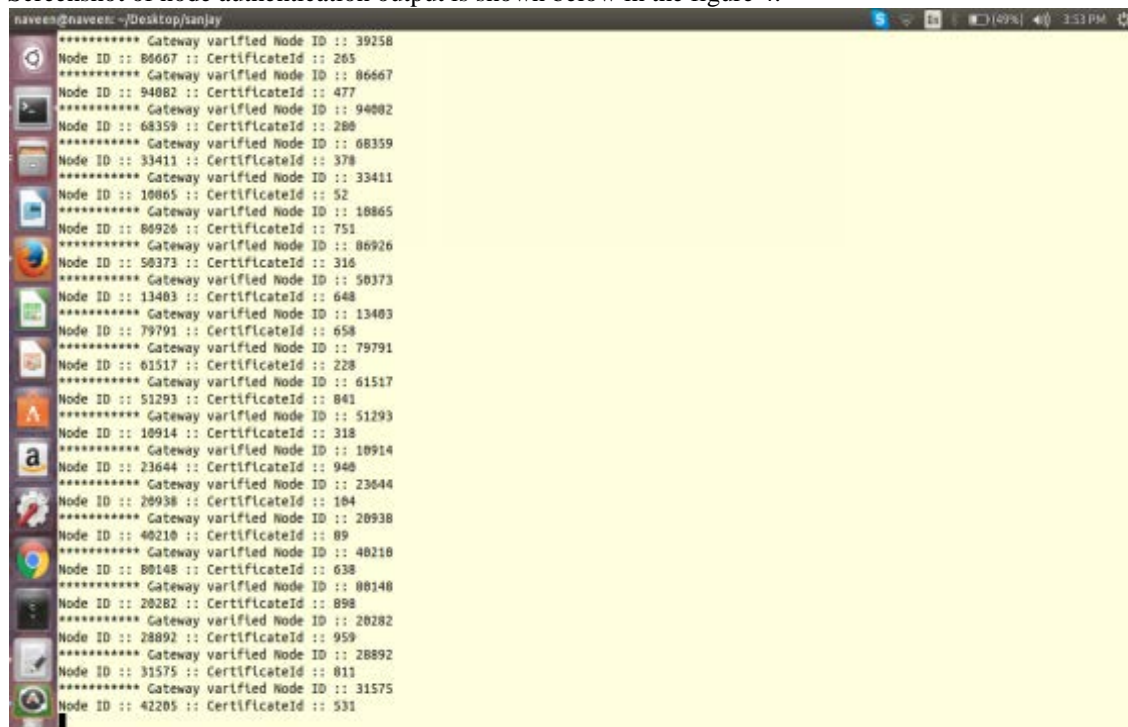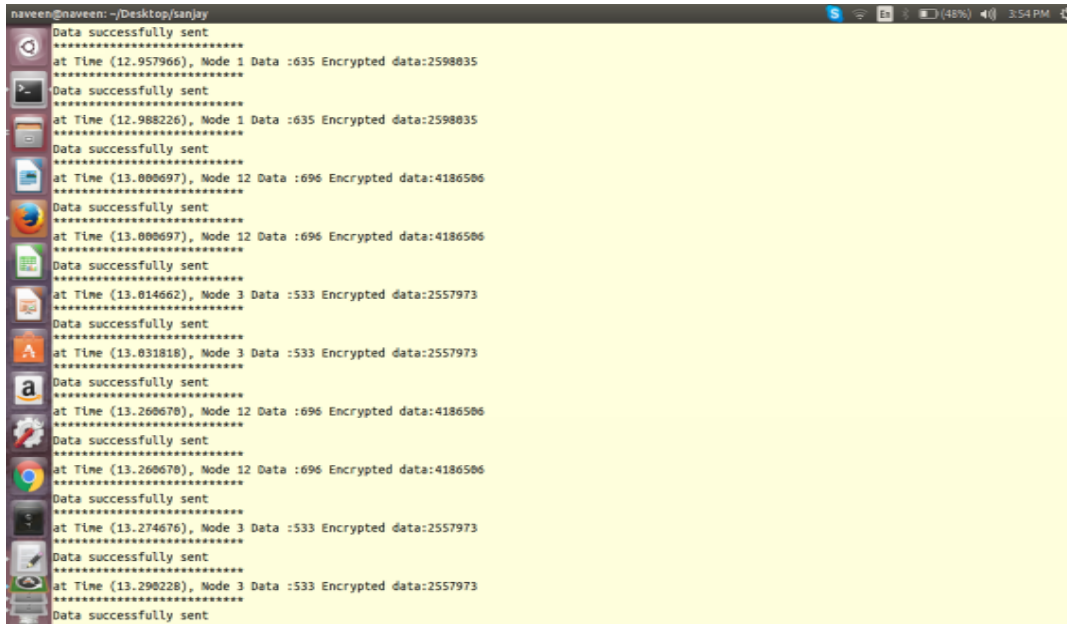
Figure 4 Node authentication

This figure 5 result shows the output of Data Encryption. For encryption proposed scheme uses MD5 cryptographic technique.

Figure 5 Data Encryption

5. Conclusions

In this proposed scheme, authentication of IoT devices are analyzed using the mutual authentication. For communication security, MD5 encryption technique has been used. The output of proposed scheme shows that this scheme is efficient than the existing schemes. The proposed scheme has been implemented on NS2 simulator. The various network parameters are measured and analyzed. The analyzed output shows that the proposed scheme is better in terms of efficiency and computation power. The efficient communication and low computation cost show that, the proposed scheme is suitable for practical applications in IoT environments.

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Comparing the effect of injecting urea, NACL and distilled water on emissions of diesel engine with after treatment devices

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ABSTRACT

The experimental investigations on existing diesel engine adopted with two after treatment devices viz; Diesel particulate filters, Diesel oxidation catalyst with injection of fluids at the exhaust pipe were carried out. In the first part of the experimentation, only DPF and DOC were fixed; performance and emissions were measured at all the loads. Injecting fluid viz; urea solution, sodium chloride and distilled water separately at the exhaust pipe was second part of the experimentation keeping same DPF and DOC. From all the emission values, the optimum condition leading to least emission value is engine having both DPF and DOC and injecting urea solution at the exhaust pipe. Running the existing diesel engine with this suggested optimum condition would lead decremental of 79.3% in smoke, 41.1% in CO and 30.3% in NO_x emissions.

1. Introduction

The post combustion techniques for diesel engine to reduce emissions includes usage of after treatment devices viz; SCR, DPF, NO_x trap, DOC etc. Daniel Hayes *et.al*. reveals excellent in-service daily NO_x conversion, averaging at 96% over this period. The SCR catalyst temperature remains high throughout the two-month monitoring period, averaging at 300°C. The SCR system performance drops on a few occasions over this monitoring period. These occur during vehicle idling which reduces the exhaust gas temperature [1]. Magdi Kair *et. al.* claimed that DOC, SCR is not enough to reduce NO_x, but additional Clean up catalyst (CUC) which used NH_3 is needed to meet NO_x level norms. The arrangement should be in the order such that exhaust from engine passes through DOC, DPF, SCR and CUC before leaving to atmosphere [2]. Matias Bastman *et. al.* study has concentrated on the regeneration of diesel particulate filter, emission reduction of two different after treatment systems: Set B (DOC, DPF and SCR) and DOC+SCR. As a physical filter, DPF needs to be regenerated with heat and NO_2 or O_2. Again, emission standards have helped DPF to become the main reduction

method of particulate matter (PM) and after EURO VI standard, the use of DPF was basically forced on to the industry [3]. After treatment DPF accumulates soot during engine operation. Soot is oxidised during regeneration creating ash. Ash accumulates in the DPF over service life of unit. When ash load reaches full value, the DPF needs to be dissembled and ash is removed by special cleaning process [4].

Tim Dallmann et. al. suggested the total cost of emission control technologies is proportional to engine rated power. For some engine rating categories, the incremental cost is insignificant, as can be observed for engines rated below 19 kW. The most popular agricultural tractors in India are fitted with engines rated between 19 and 37 kW; for this particular segment, the incremental cost to reach Tier 4f from Tier 3 is estimated to be less than $785 and reaching Stage V would require around $1,000 [5]. Youngho Jun et. al. stated, diesel vehicles that use of a diesel particulate filter (DPF) generally require periodic active regeneration. While operating active regeneration by in-cylinder post injection, the fuel impinging on the cylinder wall would become the cause of oil dilution. Study tested engine overrun by overflowing engine oil diluted with fuel on various engine operating conditions and clarify the engine

control factors effect on engine stalling or unintended acceleration using regression analysis [6]. Timothy V. Johnson review as engines become more efficient and regulators get more concerned about low-load NOx emissions, better low temperature SCR system performance will be required. Currently good performance is limited by urea injection issues (evaporation and hydrolysis, evaporation) at temperatures <200°C. Improved mixers allow urea injections at temperatures as low as 180°C and thus drops NOx ~30% over the US cold HD transient cycle relative to no mixer [7]. Patrik Soltic et. al. remarks was that while the NOx and CO emissions of an engine can be efficiently reduced using known after treatment technologies such as SCR, the methane emission are a problem which is not yet solved. An efficient lean methane reduction technology which works at a comparably low temperature level has to be developed before such a combustion concept can be transferred to on-road use [8].

Yan-xiang Yang et. al. view was unlike the application to fuel injection systems for IC engine operation, DEF dosing does not require the same frequency as the operating engine, but an a verage dosing rate. Under the appropriate condition of the dosing rate range (mL/h or g/s), the dosing unit can keep the same mass discharge rate per cycle and adjust the dosing frequency to meet the dosing rate requirement for higher metering precision and less complicated control [9]. Mingyu Guo et. al. stated that main challenges for marine SCR applications are sulfur resistance and low temperature activation. SCR catalyst mainly relies on V_2O_5–WO_3–TiO_2, but V_2O_5 is a kind of highly poisonous material and the active temperature is above 300^{0}C. The size of NH3-SCR system in use is also a problem, urea is usually used to instead of NH3 because of the difficulty to store [10]. David Dunnuck et. al. in the tasks of meeting 'Near-Zero' emissions, emissions from 25 Tier 4 final machines equivalent to just one Tier 1 machine. Dramatic reduction of 98% in mass, 90 to 99% reduction in ultrafine particles and substantial reduction in carbon particles [11]. Andrea Trevisan et. al. told low soot combustion means: 6 to 9 mg/kWh soot on cycle. SCR and DPF thermal management is required. SCRF can be used thanks to the high NOx/Soot ratio and the mainly passive regeneration with reduced risk of thermal deactivation [12]. Suverna Trivedi et. al. utilized the four-way catalytic (FWC) system integrates all the separate control systems into a single compact unit. FWC technique using a combination of oxidation–reduction catalysts under various

strategies has been investigated to simultaneously remove CO, HC, PM and NOx emitted from diesel engines. An oxidation catalyst ($La0.6K0.4CoO3$) was prepared by two different methods (sol–gel and co-precipitation). The reduction catalysts: Ag/Al_2O_3 and Cu-ZSM5 were synthesized by impregnation and ion-exchange method, respectively [13]. Janice Chan done test runs and stated that tuning is required to make engine operate after removal of EGR, filters and catalysts. It prevent OBD from activating the check engine light and/or limp mode. Even with EGR, filters and catalysts intact, tuning can substantially increase tailpipe emissions of NOx [14].

2. Experimental Setup

Experiments were conducted on a four-stroke single-cylinder, water-cooled compression ignition engine. The bore and diameter of engine is 80 mm and 110 mm respectively. The specifications of the diesel engine are shown in the Table 1. The measuring of fuel consumption (For diesel), speed and emissions has been recorded manually. All tests are conducted at different loads viz, no load, 4kg and 6kg load. The engine speed is maintained at 1380 rpm. After every load, the engine is allowed to attain steady state for duration of about 15 minutes. The specification of DPF and DOC has been in Table 2 and 3 respectively. The properties of Diesel exhaust fluid have been shown in Table 4. The photograph of DPF and DOC has been shown in Figure 2 and 3 respectively. Figure 4 & 5 shows Diesel exhaust Fluid used for injecting at the exhaust pipe of a Diesel Engine.

3. Results and Discussions

This section explains the emissions of the diesel engine equipped with DPF and/or DOC. Also the emissions measured when urea solution, NaCL and distilled water are injected separately at the exhaust pipe. Finally, the optimum condition is

Table 1
Specifications of diesel engine.

Type of Ignition	CI
No. of Cylinders	1
Rated Power	3.68 KW
Rated Speed	1500 rpm
Bore x Stroke	80 mm x 110 mm
Compression ratio	16

Table 2
Specifications of diesel particulate filter.

DPF core	150mm X 150mm
Volume	2 Liter
Cell Density	100 cpsi
Material	Cordierite
Chemical Composition	Al_2O_3 35.2 ±1.5% SiO_2 50.9±1.5% MgO 13.9±1.5%
Compressive Strength	≥ 10 Mpa
Porosity	≥45%
Maximum Use Temperature	≥1200°C
The average of pore diameter	7-10μm
Can thickness	1.2 mm
Total Length	400 mm
PGM	15g/ft Pt/Pd=3/1
PGM loading	15gm/ft3

Table 3
Specifications of diesel oxidation catalyst.

Cell Density	400cpsi
Material	Cordierite
Total Length	320 mm
Volume	2 Liter

Table 4
Properties of urea solution.

Odour	Slight ammonia scent
Density	1.33 g/cm³
Specific gravity	1.33 at 25°C 1.225 at 132.7°C
Viscosity	2.58 cp at 132.7°C
Melting point	132.7°C
Specific heat at 25°C	0.321 Kcal/ Kg°C

Fig. 3. Diesel oxidation catalyst.

Fig. 1. Diesel engine with dpf, doc and injecting diesel exhaust fluid.

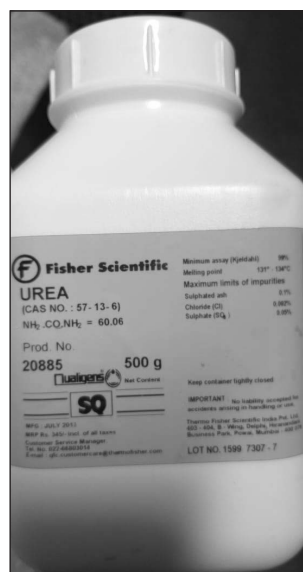**Fig. 2.** Diesel particulate filter.

Fig. 4. Photograph of urea solution used for injecting at the exhaust pipe.

decided by using the NO$_x$- smoke tradeoff graph plotted with emission values measured during all the test runs.

3.1 Comparing the effect of injecting urea, NaCL and distilled water on emissions

- **Smoke emission**

Smoke emission of engine when urea solution, NaCl and water injected separately at exhaust pipe fixed with DPF and DOC are shown in Figure 6. Smoke value decreased with DPF and increased slightly when DOC is used. Adopting both DPF and DOC, the least smoke emission was found when urea solution is injected. Smoke emission reduced from 97 HSU to 20 HSU when DPF, DOC and injecting urea solution. However, smoke emissions values were 20 and 24 HSU for NaCl and distilled water.

- **HC emissions**

HC emissions for two loads when the engine is fuelled with diesel engine adopted with DPF, DOC and injecting the fluids in exhaust pipe as shown in Figure 7. As per reading recorded on engine at both the loads, HC emission increased while using DPF by 12% and decreased with DOC further by 11% in the absence of any fluid injection. Meanwhile, when urea solution, NaCl and distilled separately injected along with DPF and DOC, the further reduced marginally by

4%, 8.5% and 12% respectively. With all the test runs, it is suggested that utilizing only DPF is not advisable and combination of both DPF, DOC and fluid injection is essential. The lowest value of HC was found to 41 ppm when distilled water is injected in exhaust pipe, which is having DPF and DOC.

- **CO emissions**

CO emission of engine when urea solution, NaCl and water injected separately at exhaust pipe fixed with DPF and DOC are shown in figure 8. CO emission of existing engine was found to be 0.85%, the value reduced when DPF and DOC
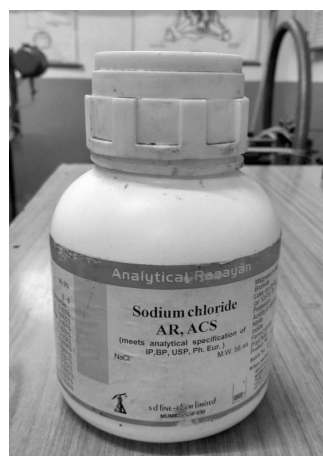

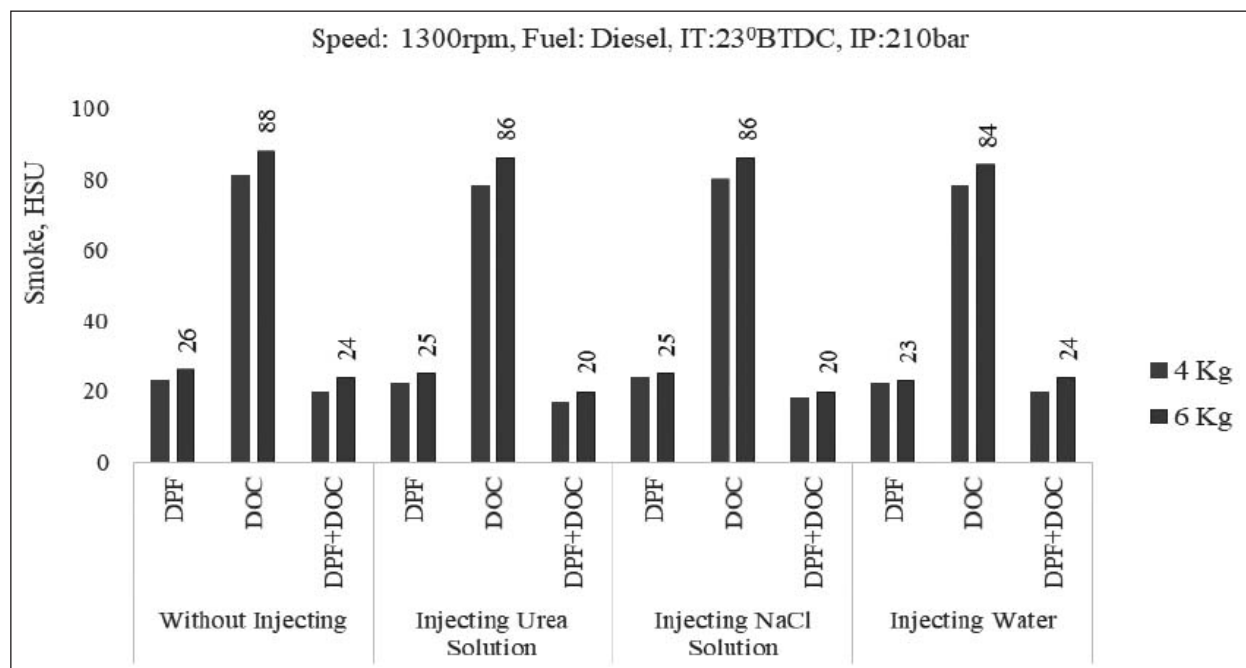**Fig. 5.** Photograph of NaCl solution used for injecting at the exhaust pipe.

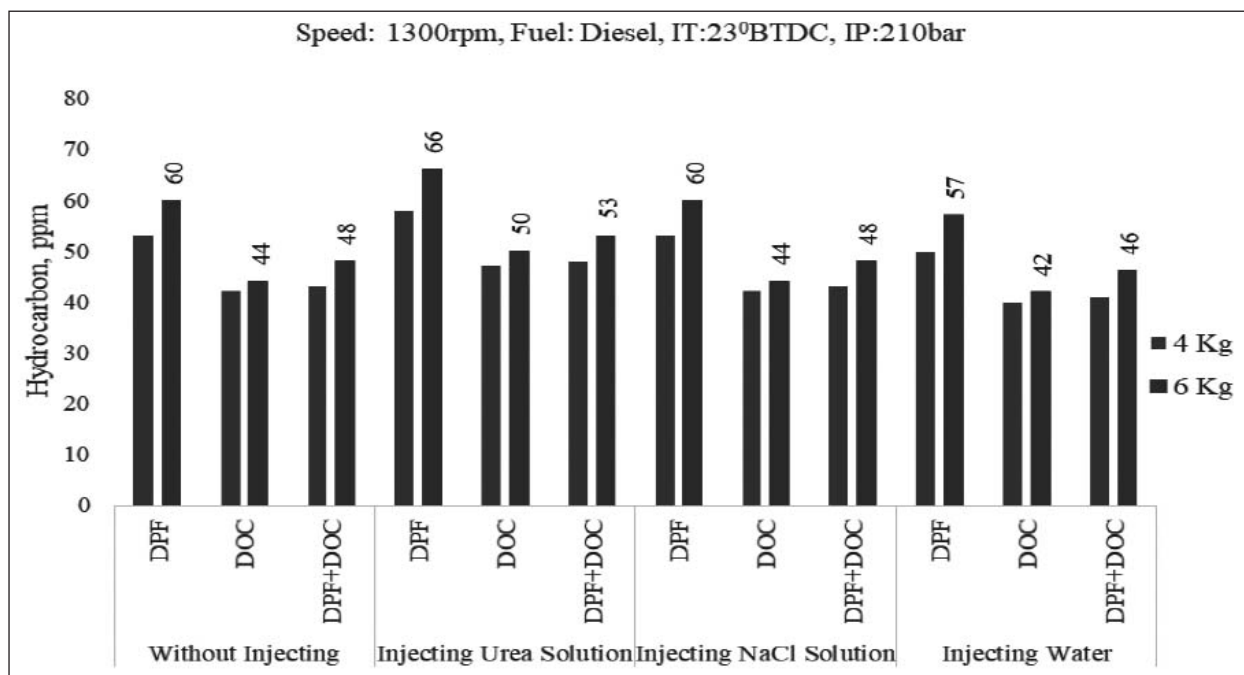**Fig. 6.** Smoke values when urea, NaCl and distilled water is injected at exhaust pipe.

Fig. 7. HC Emission when urea, NaCl and distilled water is injected at exhaust pipe.
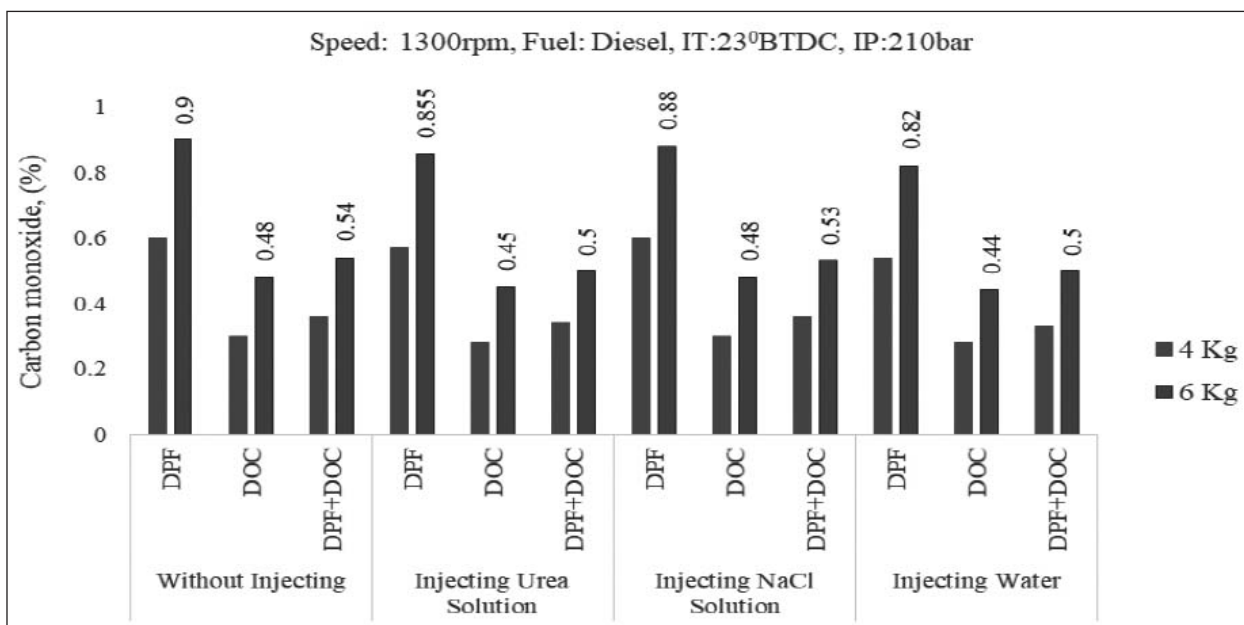

Fig. 8. CO Emission when urea, NaCl and distilled water is injected at exhaust pipe.

is adopted. The value reduced further to 0.5%, 0.53% and 0.5% respectively for injection of urea solution, NaCl and distilled water at exhaust pipe. Comparing to all the injected fluids, the urea solution resulted in lowest value of CO.

• **NO$_x$ emissions**

NOx emissions for two loads when the engine is fuelled with diesel engine adopted with DPF, DOC and injecting the fluids in exhaust pipe as shown in figure 9. NOx emission was found to reduce slightly using DPF and DOC for all the loads. NOx emission was found to 525 ppm when engine is equipped with both DPF and DOC. At this condition, when urea solution is injected, the value reduced to 428 ppm. Comparatively, NOx emission reduced to 462 ppm and 470 ppm respectively for NaCl and distilled water. Hence, it suggested that urea solution is better fluid compared to NaCl and distilled water.
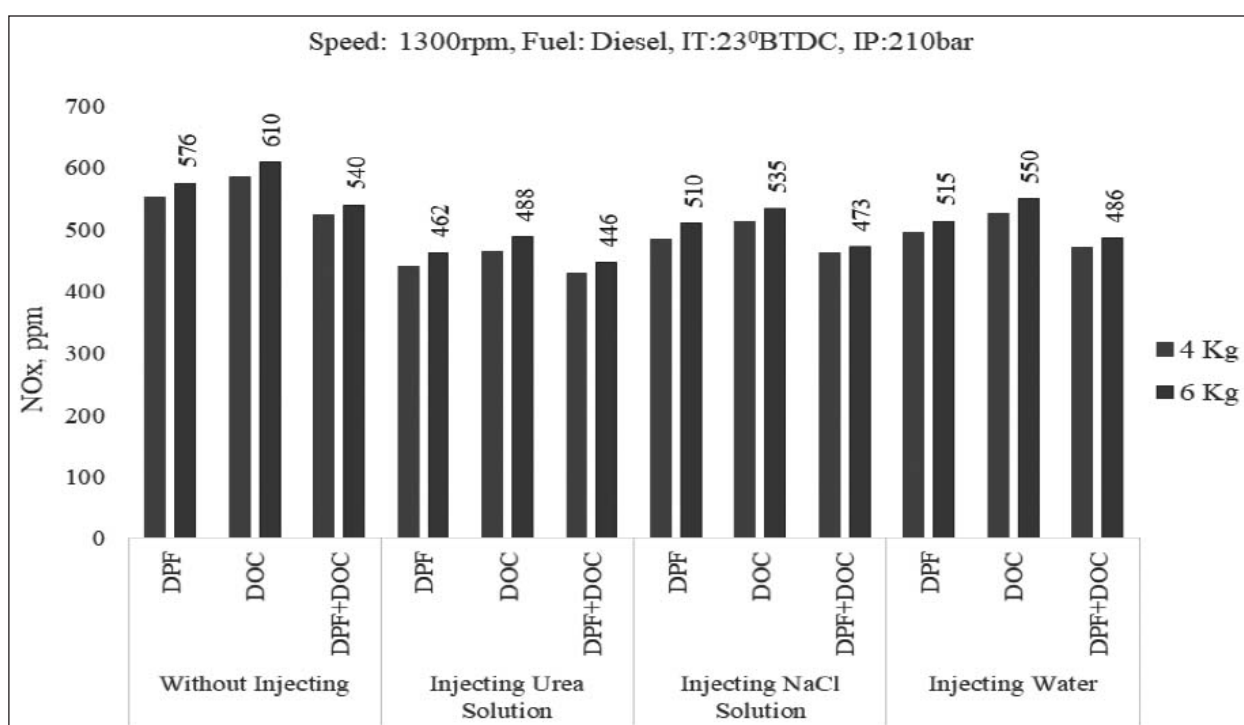
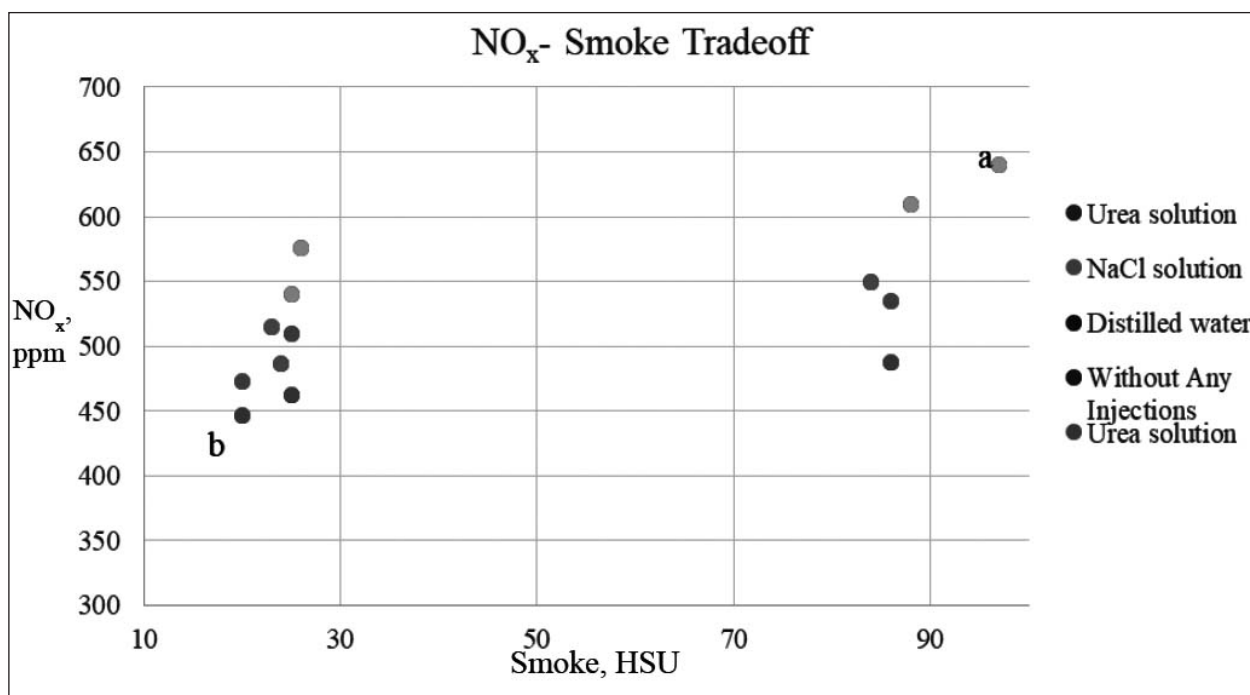**Fig. 9.** NOx Emission when urea, NaCl and distilled water is injected at exhaust pipe.

Fig. 10. NOx and Smoke emission at certain stage in all test runs.

3.2 NO_x – Smoke Tradeoff

The NOx and smoke emissions of engine for all the test runs under various operating conditions were plotted in figure 10. The values are reading recording when engine is without after treatment device, with only DPF, with only DOC and with both DPF and DOC. With these

same conditions, the values are plotted on the grapgh for fluid injection of urea, NaCl and distilled water. The point 'a' represents, the existing diesel engine emission values, which are NOx is 640ppm and Smoke is 97 HSU. The point 'b' is the closest point toward the origin, hence this is considred as optimal condition leading to least emissions among all the test runs. The optimum

Table 5
Performance and emission values.

Load	6 Kg
Brake Power	4.16 kW
Brake thermal efficiency	21.45 %
Smoke emissions	20 HSU
Hydrocarbon emissions (HC)	53 ppm
Carbon monoxide emissions (CO)	0.5 %
Nitrogen oxide (NO$_x$)	446 ppm

conition is adopting both DPF and DOC and injecting urea solution at the exhaust pipe.

4. Conclusions

Overall the optimum condition was found to be the Diesel engine adopting both Diesel Particulate Filter and Diesel Oxidation Catalyst and urea solution injection at the exhaust pipe. This is the best combination of after treatment devices and fluid injection for existing diesel engine leading to least emissions. The performance and emission values at this condition are mentioned in Table 5.

As compared to the performance and emission of existing diesel engine, running the diesel engine with this suggested optimum condition would lead decremental of 79.3% in smoke, 41.1% in CO and 30.3% in NOx emissions.

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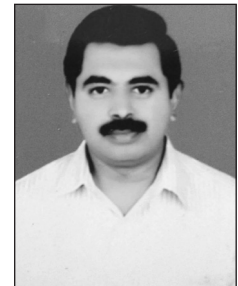
Effect of Injecting Urea and DEE Solution at Exhaust Pipe of Diesel Engine with DPF and DOC

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Abstract: In the present investigation, post combustion techniques are adopted for existing diesel engine to reduce the emissions. Two after treatment devices viz; diesel particulate filter (DPF) and diesel oxidation catalyst (DOC) were fixed at exhaust pipe of engine; and urea solution and Di-Ethyl Ether (DEE) are injected separately. Experiments were conducted on a four stroke single-cylinder, water cooled compression ignition engine. All tests were conducted at different loads viz. 4kg and 6kg load. The engine speed is maintained constant at 1380 rpm. Diesel engine has bore 80mm, stroke 110mm, running at 1380 rpm has compression ratio 16:1, rated power 3.68 KW. CO emission reduced by 36% combining DPF, DOC and injecting urea solution. NO_x emission reduced by 15% when DPF and DOC are combined and reduced by 30% when urea solution is injected. HC emission reduced by 9% when DEE is injected in exhaust pipe with DPF and DOC. Overall comparison of all the results, it can be concluded that the least emission level was observed when engine is operated at 4kg load and having combined DPF, DOC and injecting urea solution. At this condition, the emissions values are CO 0.5%, HC 53 ppm, NO_x 446 ppm. Hence, there is need for combined DPF, DOC and urea solution injection at the exhaust pipe for an existing diesel engine.

Keywords: **Diesel Engine, Urea solution, Di Ethyl Ether, Diesel particulate filters, Diesel oxidation catalyst.**

I. INTRODUCTION

Diesels are the most versatile fuel-burning engines in common use today. They are simpler, more efficient, more economical and safer, because diesel fuel is less volatile and vapour less explosive than other fuels. Pollution is one of the biggest drawbacks of diesel engines. They are noisy and they produce many unburned pollutants like Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Hydrocarbons (HC), Particulate Matter (PM), Carbon Dioxide (CO_2), Sulphur Dioxide (SO_2), aldehydes most harmful pollutants of diesel engine. Carbon and hydrogen construct the origin of diesel fuel. Vertin *et al.* [1] conducted a comprehensive investigation of B20 impacts on cordierite DPFs. They blended soy-based methyl ester biodiesel with ultra-low sulfur diesel fuel, and ran dynamometer tests to generate results. PM emissions were reduced 20% with B20 in transient tests, but were similar in steady state tests, indicating PM differences are cycle dependent. There is minor improvement in passive NO_2 regeneration with B20. No deterioration in catalyst performance was observed after 120 active regenerations. Mayer *et al.* [2] evaluated four types of partial filters that are reported to have 30-50% filtration efficiency. In a retrofit light-duty diesel application, they found the best filtration efficiency with one type was indeed 63%. However, under critical but realistic conditions filtration of the others measured substantially lower than the expected 30 %, depending on operating conditions and prior history, and could even completely fail. Ntziachristos *et al.* [3] Due to the stringent emission standards set worldwide, particulate matter (PM) emissions from diesel vehicles have seen significantly curtailed in the last decade, and are expected to be reduced even further in the future. This paper addresses these issues comparing the characteristics of particle emissions from a current diesel passenger car, gasoline one and two small two-wheelers. Abdul-Khalek *et al.* [4] in their work, exhaust particle number concentrations and size distributions were measured from the exhaust of a direct injection of the diesel engine. Conventional dilution tunnel systems have much slower dilution processes making more time available for nucleation and growth. Thus, it is likely that if this engine were tested in such a system, materials that are more volatile would be present in the nuclei mode and its mass, and possibly number, concentrations would be greater.

Johnson T V *et al.* [5] this paper will review the field of diesel emission control with the intent of highlighting representative studies that illustrate the state-of-the-art. First, the author reviews general technology approaches for heavy and light duty applications. Finally, system integration examples are provided. Majiewski A *et al.* [6] suggested that diesel particulate filters capture particle emissions through a combination of filtration mechanisms, such as diffusional deposition, inertial deposition, or flow –line interception. Collected particulates are removed from the filter, continuously or periodically, through thermal regeneration. Diesel filters are highly effective in controlling solid particulate emissions – including solid particle numbers – but may be ineffective in controlling liquid fractions of PM emissions. Filters were first commercialized as retrofit devices, followed by a wide scale adoption on new light –duty and heavy-duty diesel engines in both highway and non-road applications.

Miss Chaitali A. *et al.* [7] in their paper stated that many techniques now exist for the image compression and much effort is being expended in determining the optimum compression transforms. Various techniques of data compressions are available but mostly compression is done using cosine and wavelet transforms. In this paper also focused on the two technologies of image compression are highlighted and they are lossy compression, lossless compression and various technology included in them. Compression of the digital image data is the image compression process. Majeiwiski A *et al.* [8] urea –SCR technology has been adopted as a NO_x reduction strategy from mobile diesel engines. The application of SCR is more cost effective that the competing technologies, High NO_x reductions depend on the catalyst temperature window and on the urea injection control strategy, which remains a challenge under transient operating conditions.

Majeiwiski A *et al.* [9] in the Selective catalytic reduction (SCR) process, NO_x reacts with ammonia, which is injected into flue gas stream before the catalyst. Different SCR catalyst such as Vanadium oxide or metal substituted zeolites have different operating temperature windows and must be carefully selected for a particular SCR process. Ammonia SCR has been used in the industrial processes, in stationery diesel engines, as well as in some marine engines has been adopted for mobile diesel engines in both heavy and light duty applications.

Thompson N *et al.* [10] paper presents an overview of the results on heavy duty engines collected, which aimed at the characterization of exhaust particle emission from road vehicles. Measurements were made in three labs to evaluate a wide range of particulate properties with a range of heavy-duty engines and fuels. The measured properties included particle number, with focus separately on nucleation mode and solid particles, and total mass.

II. EXPERIMENTAL SETUP

Experiments were conducted on a four-stroke single-cylinder, water-cooled compression ignition engine. The specifications of the diesel engine are shown in the table 1. The measuring of fuel consumption (For diesel), speed and emissions has been recorded manually. All tests are conducted at different loads viz, no load, 4kg and 6kg load. The engine speed is maintained at 1380 rpm. After every load, the engine is allowed to attain steady state for duration of about 15 minutes. The specification of DPF and DOC has been in table 2 and 3 respectively. The properties of Urea solution and DEE have been shown in table 4 and 5. Fig. 5 shows the 4-Stroke Single Cylinder Diesel Engine used for the test runs. The photograph of DPF and DOC has been shown in Fig. 2 and 3 respectively. Fig. 4 shows urea solution and DEE used for injecting at the exhaust pipe of a diesel engine.

Fig. 1: Diesel Engine with DPF, DOC and injecting Diesel Exhaust Fluid

Fig. 2: Photograph of Diesel Particulate Filter

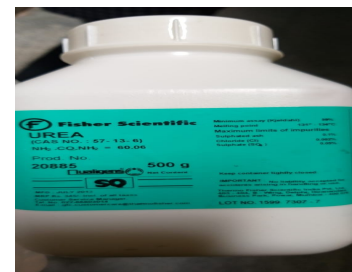Fig. 3: Photograph of Diesel Oxidation Catalyst

Fig. 4: Photograph of Urea solution and DEE fluid use

Table 1. Specifications of Diesel Engine

Type of Ignition	CI
No. of Cylinders	1
Rated Power	3.68 KW
Rated Speed	1500 rpm
Bore x Stroke	80 mm x 110 mm
Compression ratio	16:1

Table 2: Specifications of Diesel Particulate Filter

DPF core	150mm X 150mm
Volume	2 Liter
Cell Density	100 cpsi
Material	Cordierite
Chemical Composition	Al_2O_3 35.2 ±1.5% SiO_2 50.9±1.5% MgO 13.9±1.5%
Compressive Strength	≥ 10 Mpa
Porosity	≥45%
Maximum Use Temperature	≥1200°C
The average of pore diameter	7-10μm
Can thickness	1.2 mm
Total Length	400 mm
PGM	15g/ft Pt/Pd=3/1
PGM loading	15gm/ft3

Table 3: Specifications of Diesel Oxidation Catalyst

Cell Density	400cpsi
Material	Cordierite
Total Length	320 mm
Volume	2 Liter

Table 4: Properties of Urea solution

Odour	Slight ammonia scent
Density	1.33 g/cm^3
Specific gravity	1.33 at 25^{0}C 1.225 at 132.7^{0}C
Viscosity	2.58 cp at 132.7^{0}C
Melting point	132.7^{0}C
Specific heat at 25^{0}C	0.321 Kcal/ Kg^{0}C

Table 5: Properties of DEE

Molecular Weight	74.14 gm/mol
Freezing point	-116^{0}C
Boiling point	35^{0}C
Density at 20^{0}C, g/mL	0.71
Colour	Colourless
Flash point	-45^{0}C

III. RESULTS AND DISCUSSIONS

This section explains the performance and emissions of the diesel engine operated on diesel with when DPF, DOC were positioned and urea solution and DEE are injected at exhaust pipe. In all test runs, measurement of emissions has been done before gases are let to the atmosphere.

A. Performance parameter

Brake thermal efficiency of diesel engine without devices and with devices and fluid injection in exhaust pipe of diesel engine at 4Kgs and 6Kgs loads are shown in Fig. 5. From Fig. 1, it can be seen that the brake thermal efficiency at 4Kg without devices is found to be 14.75% and remains unchanged with devices and fluid injection in exhaust pipe of diesel engine. At 6kg loads, the brake thermal efficiency without devices is found to be 21.45% and remains same with devices and fluid injection in exhaust pipe of diesel engine.
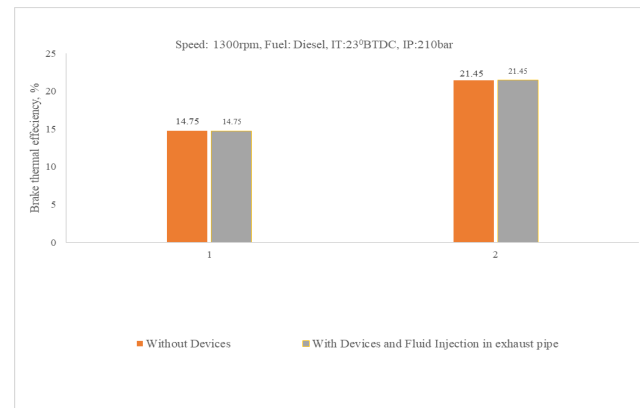

Fig. 5: Brake thermal efficiency with or without after-treatment devices

B. Effect of Urea Solutions on emissions

B.1 HC emissions

HC emissions for two loads when the engine is fuelled with diesel and adopted with DPF, DOC and Urea solution injection in exhaust pipe as shown in Fig. 6. As per reading recorded on engine at both the loads, HC emission increased while using DPF by 12% and when urea solution is injected with DPF, it further increased by 23% [1]. However, HC emission decreased with DOC; further by 11% when urea solution injected with DOC, HC Emission reduced by 8%. Meanwhile, HC emission reduced by 2% when urea solution is injected in exhaust pipe with DPF and DOC [1, 6]. Hence, utilizing only DPF is not advisable and combination of both DPF, DOC and urea injection is essential for such engine operation. Having these combined DPF, DOC and urea solution injection, overall reduction in HC is less as compared to that of existing diesel engine; the values are 58 and 43 ppm respectively.
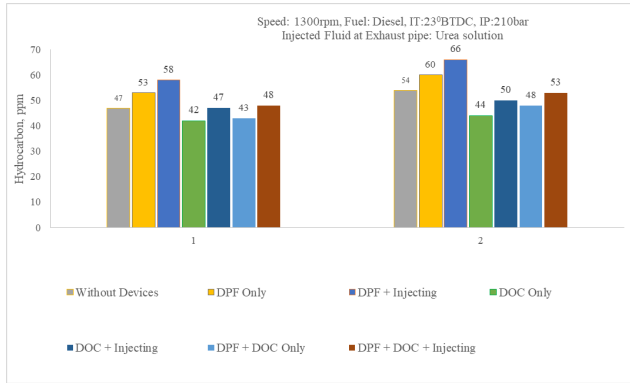
Fig. 6: HC emission at 4Kg and 6Kg loads for injection of Urea solution

B.2 CO emission

CO emissions for two loads when the engine is fuelled with diesel and adopted with DPF, DOC and Urea solution injection in exhaust pipe as shown in Fig. 7. For both the loads, CO emission increased when using DPF by 11% and when urea solution is injected with fixed DPF, it increased by 1%. CO emission decreased with DOC by 47% and when urea solution injected with DOC, CO emission reduced by 50%. It may be due to ammonia reacting with CO and reducing CO emission. During this reaction, the heat released may cause the CO_2 to split into CO and O_2, which further reacts with ammonia, and hence the CO_2 is reduced by injecting urea[1]. However CO emission reduced by 36% combining DPF and DOC; injecting urea solution along with DPF. Hence, utilizing only DPF is not advisable and combination of both DPF, DOC and urea injection is essential for such engine operation. The CO emission has decreased from 0.85% to 0.5% when this combination is adopted while running the engine at 6kg load.
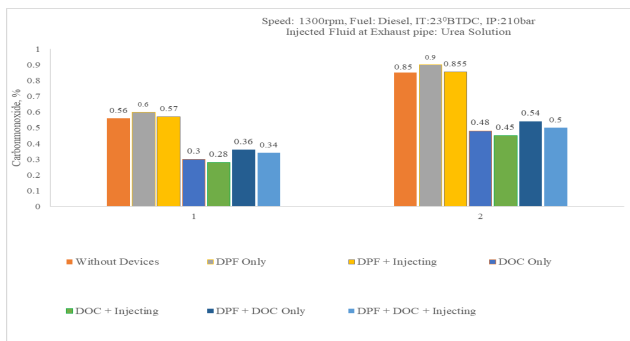

Fig. 7: CO emission at 4Kg and 6Kg loads for injection of Urea solution

B.3 NO_x emission

NO_x emissions for two loads when the engine is fuelled with diesel and adopted with DPF, DOC and Urea solution injection in exhaust pipe as shown in Fig. 8. NO_x emission decreased when using DPF by 10% and further injecting urea solution, NO_x emission reduced by 29%[25]. NO_x emission decreased with DOC further by 5% and further by injecting urea solution, NO_x emission decreased by 25%. As the urea in

the form of ammonia reacts with the exhaust gas and reduces its temperature leads to reduction in NO_x emission. However, NO_x emission reduced by 15% when DPF and DOC are combined and reduced by 30% when urea solution is injected in exhaust pipe. Hence, utilizing only DPF is not advisable and combination of both DPF, DOC and urea injection is suggested for better engine operation.
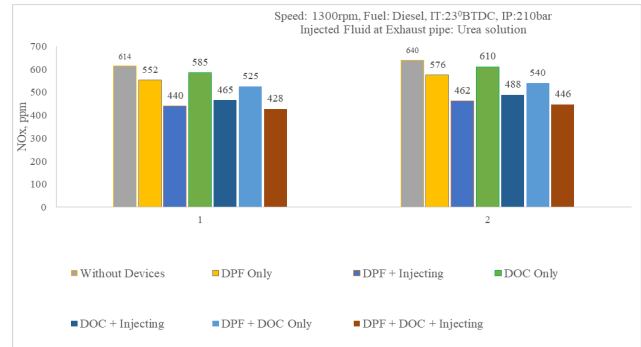

Fig. 8: NO_x emission at 4Kg and 6kg loads for injection of Urea solution

C. Effect of DEE on emissions

C.1 HC emissions

HC emissions for two loads when the engine is fuelled with diesel and adopted with DPF, DOC and DEE injection in exhaust pipe as shown in Fig. 9. As per reading recorded on engine at both the loads, HC emission increased while using DPF by 12% and when DEE is injected with DPF, it further increased by 34%. However, HC emission decreased with DOC further by 11% and when DEE injected with DOC HC Emission reduced by 4%. Meanwhile, HC emission reduced by 9% when DEE is injected in exhaust pipe with DPF and DOC. Hence, utilizing only DPF is not advisable and combination of both DPF, DOC and DEE injection is essential for such engine operation. Having these combined DPF, DOC and DEE injection, overall reduction in HC is less as compared to that of existing diesel engine; the values are 50 and 53 respectively.
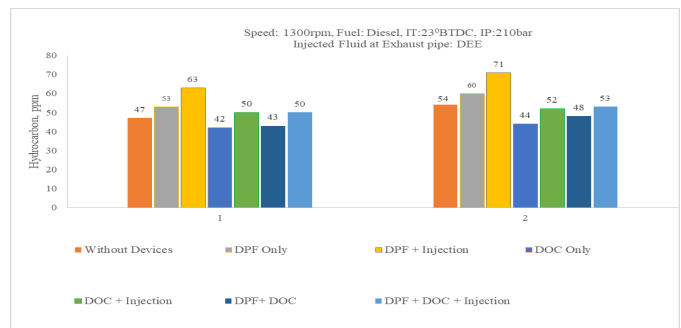

Fig. 9: HC emission at 4Kg and 6Kg loads for injection of DEE solution

C.2 CO emission

CO emissions for two loads when the engine is fuelled with diesel and adopted with DPF, DOC and DEE injection in

exhaust pipe as shown in Fig. 10. For both the loads, CO emission increased when using DPF by 7% and when DEE is injected with fixed DPF, it decreased by 9%. CO emission decreased with DOC further by 47% and when DEE injected with DOC, CO emission reduced by 56%. However CO emission reduced by 36% combining DPF and DOC; injecting DEE along with DPF and DOC CO reduced by 47%[14]. Hence, utilizing only DPF is not advisable and combination of both DPF, DOC and DEE injection is essential for such engine operation. The CO emission has decreased from 0.85% to 0.46% when this combination is adopted while running the engine at 6kg load.
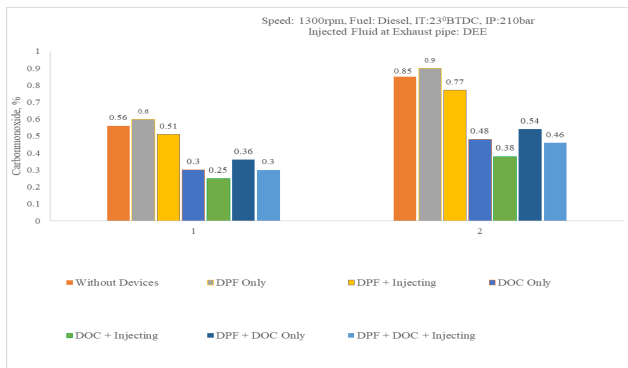

Fig. 10: CO emission at 4Kg and 6Kg loads for injection of DEE solution

C.3 NO_x emission

NO_x emissions for two loads when the engine is fuelled with diesel and adopted with DPF, DOC and DEE injection in exhaust pipe as shown in Fig. 11. NO_x emission decreased when using DPF by 11% and further injecting DEE, NO_x emission reduced by 18%. NO_x emission decreased with DOC further by 5%. and further by injecting DEE at this condition, NO_x emission decreased by 13% [2]. However, NO_x emission reduced by 15% when DPF and DOC are combined and when DEE is injected in exhaust pipe the NO_x emission was reduced by 22%. Hence, utilizing only DPF is not advisable and combination of both DPF, DOC and DEE injection is suggested for better engine operation.
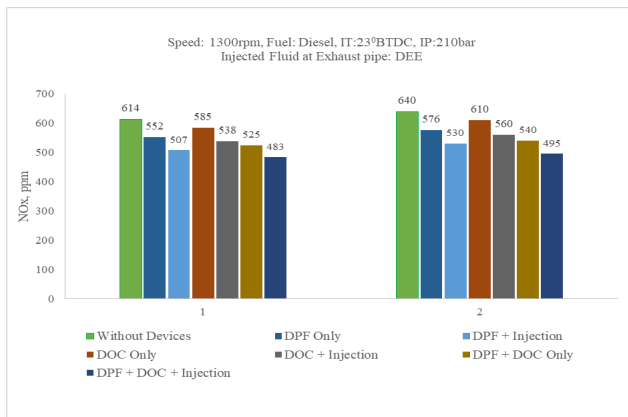

Fig. 11: NO_x emission at 4Kg and 6kg loads for injection of DEE solution

D. Overall comparison

The overall comparison of HC emissions without and with injecting of urea solution and injecting DEE is as shown in Fig. 12. There is a reduction in HC level from 60ppm to 48ppm during the test run of without fluid injection and 66ppm to 53ppm when urea solution is injected; 71ppm to 53ppm when DEE is injected at 6kg loads.
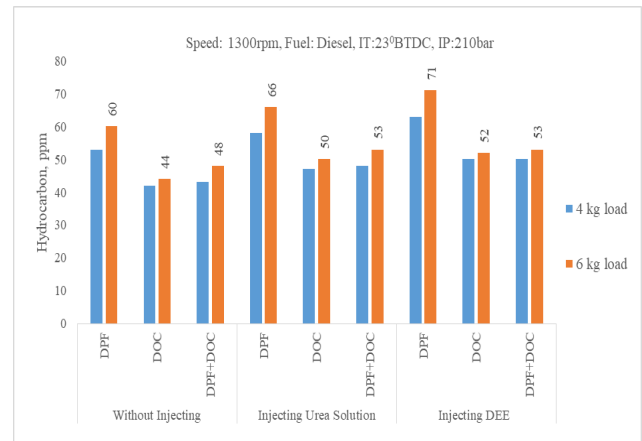

Fig. 12: Overall Comparison of HC emissions

The overall comparison of carbon monoxide without and with injecting of urea solution, and DEE is as shown in Fig. 13. There is a reduction in CO level from 0.9% to 0.54% during the test run of without urea solution injection and 0.855% to 0.5% when urea solution is injected. Meanwhile, when DEE is injected, CO level reduced from 0.77% to 0.46% at 6kg load.

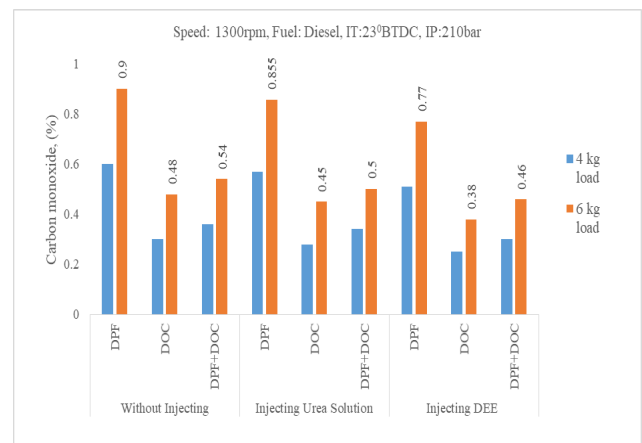Fig. 13: Overall Comparison of CO emission

The overall comparison of NO_x without and with injecting of urea solution, and DEE is as shown in Fig. 14. There is a reduction in NO_x level from 576ppm to 540ppm during the test run of without urea solution injection and 462ppm to 446ppm when urea solution is injected[1,3]. However, when DEE is injected, NO_x level reduced from 530ppm to 495ppm at 6kg loads.

Fig. 14. Overall comparison of NO_x emission

IV. CONCLUSIONS

The effects of injecting urea and DEE solution in the exhaust pipe fitted with DPF and DOC on engine emissions were investigated. . All the emission values are compared with the diesel engine without DPF/DOC/fluid injection, the following conclusions are drawn

1) At 6kg loads the brake thermal efficiency without devices is found to be 21.45% and remains same with devices and fluid injection in exhaust pipe of diesel engine

2) CO emission reduced by 36% combining DPF, DOC and injecting urea solution.

3) NO_x emission reduced by 15% when DPF and DOC are combined and reduced by 30% when urea solution is injected in exhaust pipe. Hence, utilizing only DPF is not advisable and combination of both DPF, DOC and urea injection is suggested for better engine operation.

4) HC emission reduced by 9% when DEE is injected in exhaust pipe with DPF and DOC.

5) NO_x emission reduced by 15% when DPF and DOC are combined and when DEE is injected in exhaust pipe the NO_x emission was reduced by 22%

6) When the load is increased, fuel consumption is more as it leads to high combustion and emissions, which has been realized based on measured emission values. Compared to 6 Kg load emission levels; the 4 Kg load emission levels were lower

Overall comparison of all the results, it can be concluded that the least emission level was observed when engine is operated at 4kg load and having combined DPF, DOC and injecting urea solution. At this condition, the emissions values are CO 0.5%, HC 53 ppm, NO_x 446 ppm. Hence, there is need for combined DPF, DOC and urea solution injection at the exhaust pipe for an existing diesel engine.

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A REVIEW ON STUDY AND USAGE OF COMBINING AFTER TREATMENT DEVICES INTO EXISTING DIESEL ENGINE

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Abstract -In this study, were the diesel engines produces lot of harmful pollutants to the atmosphere, the emission control method is used to prevent and reduce the emission of harmful gases. In order efficiently reduce the polluting emissions of engines by exhaust after treatment systems, We tried to control the reduction of emission implementation of post combustion techniques like Diesel particulate filter (DPF), Diesel oxidation catalyst (DOC), Selective catalytic reduction (SCR) are adopted for existing diesel engine to reduce the emissions and induce significant gain in emission reduction were tried. The paper summarizes developments in diesel emissions regarding regulations, engines, Particulate matter (PM) reduction, and hydrocarbon (HC), and CO oxidation.

Keywords- DOC, DPF, SCR, Diesel engine, New Catalytic converter.

I. INTRODUCTION

The usage of diesel engines are useful for the transportation services and other useful works, it produces lot of harmful pollutants which effects living organisms. Urban air pollution is mainly caused by automobiles which significantly contribute toward pollutants like hydrocarbons (HCs), carbon monoxide (CO), and oxides of nitrogen (NOx) in urban shed. These air pollutants have high impacts on human beings, other living creatures and environment. Exposing to HCs, beyond certain limits can damage our respiratory system and CO is harmful for human vascular system. Emissions of NOx are responsible for the acid rain, greenhouse effect, and visible impairment. NO and CO are identified as precursors of photochemical smog and other secondary pollutants. These consequences of the pollutants have historically lead toward implementation of more and more stringent vehicular emission control regulations. To overcome with these regulations, one of the most widely used options by vehicle manufacturers today is catalytic converter. Diesel engine, like other internal combustion engines, converts chemical energy contained in the fuel into mechanical power. Diesel fuel is a mixture of hydrocarbons which during an ideal combustion process would produce only carbon dioxide (CO_2) and water vapour (H_2O). Indeed diesel exhaust gases are primarily composed of CO_2, H_2O and the unused portion of engines charge air. Most of the pollutants originate from variant non-ideal processes during combustions, such as incomplete combustion of fuel, reactions between mixture components under high temperature and pressure, combustion of engine lubricating oil and oil additives as well as combustion of non-hydrocarbons components of diesel fuel. There are other sources that can contribute to pollutant emissions from internal combustion engines-usually in small concentrations, but in some cases containing material of high toxicity. These additional emissions can include metals and other components from engine wear or components emitted from emission control catalysts.

DIESEL PARTICULATE FILTER (DPF)

It is an exhaust after treatment device that traps particulate matter such as soot and ash. A DPF typically uses a subtracted made of a ceramic material that is formed into a honeycomb structure. When the particulate matter (or) soot which is exhausted through outlet value of the engine it passes to the DPF cylinder, were the soot is collected on the side walls of the honeycomb structure and the exhaust sir is released to atmosphere which leads to less emission of particulate matter (PM). In this cylinder oxidation of particles doesn't takes place, so the carbon monoxide (CO) doesn't react with the ceramic materials and they release (CO), But the hydro carbon (HC) and other particles are captured and controlled in cylinder.

Particulate emission control technologies				
		Removal efficiency	Example uses	Considerations
Cyclones	Centrifugal force	>90%	Fluid catalytic crackers (refineries)	Collection efficiency falls off for smaller particle sizes
Filters	Impaction	>99.9%	Coal-fired boilers	High back pressures, making this technique impractical for many operations
Electrostatic precipitators	Electrostatic force	>99.9%	Power generation, petroleum refinery, waste incinerators	Electricity consumption for operation
Wet gas scrubbers	Nucleation/impaction	>90%	Petroleum refineries, pulverized coal combustors	Waste solvent is contaminated with wet dust; requires disposal

DIESEL OXIDATION CATALYST (DOC)

It is specifically designed to reduce the emission rate of carbon monoxide (CO) before releasing it to atmosphere. The oxidation takes place in the catalytic converter by the material coated in ceramic honey comb structure. When materials like hydro carbons (HC), particulate matter (PM), Carbon monoxide (CO) and Soluble organic fraction (SOF) gets reacts to the material and converted into carbon dioxide (CO_2) and water (H_2O). Basically the diesel engines works normally using more air than fuel, so therefore they operates as an oxidation catalyst cutting CO and HC emissions by more than 90%.

1. $CO + \frac{1}{2} O_2 \rightarrow CO_2$
2. $[HC] + O_2 \rightarrow CO_2 + H_2O$

The ceramic honey comb structure use material coated with metals such as platinum (or) palladium.

Emission Legislation	PM Limit	DOC Application
Light-Duty Vehicles		
Euro (1996)	PM = 0.08 g/km	DOCs introduced on larger size diesel cars.
Euro 3-4 (2000-2005)	PM = 0.05-0.025 g/km	The main after treatment strategy, used on most diesel passenger cars and light trucks. Many cars could meet Euro 5a using a DOC, but DPFs became adopted in some markets (e.g., Germany) for political reasons.
Euro 5a (2009.09)	PM = 0.005 g/km	Many cars could meet Euro 5a using a DOC, but DPFs became adopted in some markets (e.g., Germany) for political reasons.
Heavy-Duty Engines		

US 1994	PM = 0.10 g/bhp-hr	DOC introduced on many light and medium heavy-duty engine models, most with mechanical fuel injection systems. DOCs widely used on urban bus engines due to a more stringent PM limit of 0.07-0.05 g/bhp-hr.
US 1998	PM = 0.10 g/bhp-hr	DOC remained common in many light and medium heavy-duty engine models. In some cases, a DOC was no longer required as in-cylinder control was enabled by the replacement of remaining mechanical fuel injection systems with electronically controlled systems required for the lower NOx limits. Urban bus engines continued to rely heavily on DOCs.
US 2004	PM = 0.10 g/bhp-hr	The DOC continued to remain popular for light and medium heavy-duty engine models using EGR to comply with NOx limits. Used for all on-highway engines that did not use external EGR (e.g. Caterpillar ACERT engines). Continued to be used on urban bus engines.
Euro IV/V (2005/2008)	PM = 0.02 g/kWh	DOC technology used on some truck engines with EGR (without urea-SCR).
Nonroad Tier 4i/Stage IIIB (2011-2012)	PM = 0.02 g/kWh	DOC technology introduced on selected nonroad engine models (mostly those using EGR for NOx control).

CATALYTIC CONVERTER

Catalyst is simply a chemical that makes a chemical reaction go faster without itself changing in the process. Normally catalyst consists of two-way pipes of opposite direction, one is input pipe where they allow the emission gas from engine outlet to ceramic structure. Other pipe leads the gas from catalytic cylinder to the atmosphere with less harmful gas emission. Ceramic structure inside the cylinder normally uses palladium, platinum and rhodium by varying the usage ratio of these metals the emission of gas is controlled. By through various researches the catalytic converter uses various ratios of metals inside. Normally when carbon monoxide released to atmosphere it gets into carbon dioxide, so using the catalytic converter to reduce the carbon monoxide (CO) make the process easier for atmosphere and makes less harmful than compare to No catalytic converter.

II.   PROPOSED WORK

Combination of after treatment devices makes the emission control very effective having the value of emission lesser than compare to every catalytic converter like DPF, DOC and SCR. When the emission of exhaust gas passes through every catalyst the gas passing from one catalytic to another makes the chemical reaction between the gas and ceramic honey comb structure easier, emission level is decreased. The catalysts are connected in the order Diesel particulate filter (DPF) next Diesel oxidation catalyst (DOC) and finally new catalytic converter so that the emission of exhaust gas is decreased at maximum level and released to the atmosphere.

III.   CONCLUSION

This paper shows that the emission can be reduced by the implementation of combination of after treatment devices into existing diesel engine. Considering a catalytic converter as the study point and investigation on combination of DPF,

DOC and catalytic converter to the diesel engine. By using the filter method in DPF catalyst we can reduce the emission up to 99%. According to the research the emission level in DOC get reduced in euro from 0.08 to 0.005 g/km and in US reduced from 0.10 to 0.02 g/kWh, so we took the advanced researches and made a cost and eco-friendly catalyst to reduce the emission level

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Dry Sliding-Friction and Wear Behavior of Hot-Extruded Al6061/Si$_3$N$_4$/C$_f$ Hybrid Metal Matrix Composite

C.S. Ramesh, Saleem Khan, and Zulfiqar A. Khan

The effects of reinforcement addition and hot extrusion on the microstructures, micro hardness, friction, and wear behavior of aluminum (Al) hybrid composite were investigated. Al6061 dispersed with electroless nickel-coated Si$_3$N$_4$ (6 wt.%) and copper-coated carbon fiber (C$_f$) (1 wt.%) hybrid composites was developed through stir casting followed by hot extrusion. Optical micro-structural studies confirmed that the size of reinforcements decreased, and their orientations were in the extrusion direction. The decrease in the grain size (29%) of hybrid composites was larger than that in the grain size of matrix alloys under hot-extruded conditions. The synthesized hot-extruded Al6061 hybrid composite exhibited a lower coefficient of friction (51%) and high wear resistance (39%) compared with the hot-extruded Al6061 base alloy.

1. Introduction

Aluminum (Al) alloy-based metal matrix composites (MMCs) dispersed with particles and fibers are widely applied in several fields such as aerospace, automotive, high precision military because of their excellent tribological properties. However, challenges faced during secondary forming processes, such as forging and extrusion, limit their applications. Among all of Al alloys, Al6061 is the most demanded matrix alloy used for fabricating MMCs because of its excellent formability (Ref 1, 2). By contrast, aluminum oxide (Al$_2$O$_3$), silicon carbide (SiC), silicon nitride (Si$_3$N$_4$), and carbon fibers (C$_f$) are the most preferred reinforcements in Al alloy-based MMCs (Ref 3-5).

Studies have reported adding Si$_3$N$_4$ in Al alloys improves their mechanical properties such as hardness and wear resistance (Ref 6-9).

Kumar et al. reported the tribological characteristics of Si$_3$N$_4$-reinforced Al6063 composites. An increased load and sliding distances caused a higher volume wear loss in both a base alloy and composite. However, Al6063/10wt% Si$_3$N$_4$ exhibited an excellent wear resistance compared with unreinforced alloys (Ref 10). Chenxu zhang et al. reported the mechanical and tribological behavior of Al-β Si$_3$N$_4$ whiskers developed through powder metallurgy. With an increase in the whisker content the wear rate of composite decreased, and the

formation of mechanical mixing layer (MML) was reported to cause reduction in both the coefficient of friction (COF) and wear rate of composites (Ref 11). Haq and Anand reported the friction and wear behavior of Si$_3$N$_4$/AA7075 composites. An improved wear resistance and a reduced COF, especially at a high load of 50 N, for developed composites were achieved (Ref 12).

C$_f$ has been widely used as reinforcement in Al alloys because of its high-specific modulus, high-specific strength, low expansion coefficient, excellent lubrication properties, wear resistance, and high thermal and electric conductivity (Ref 13-15).

Alten et al. fabricated nickel-coated carbon fibers reinforced with Al6063 composites by using squeeze casting. An increase in the coating thickness of nickel from 0.9 to 4.2 µm caused a decrease in the impact strength (Ref 16). Manu et al. (Ref 17) developed self-lubricating bi-directional C$_f$-reinforced Al composites by using squeeze infiltration. Cao et al. investigated the tribological behavior of AA5052-C$_f$ composites fabricated through friction stir welding. Adding C$_f$ in Al prevents the nucleation and propagation of micro-cracks, leading to an improvement of tribological properties. Additionally, MML formation is a factor contributing to the improvement of the wear resistance (Ref 18).

To obtain more satisfactory bonding and to minimize reaction at the matrix-reinforcement interface, some researchers have employed electroless nickel/copper coatings around reinforcements (Ref 19, 20). The toughness coupled with higher load-bearing capacity of copper-coated carbon fibers is higher than that of carbon fibers deposited with nickel. C$_f$ deposited with nickel exhibits low toughness because of the formation of brittle phases at the interface of a base alloy and fiber (Ref 13, 21). Thus, to overcome this problem, in this study, copper-coated C$_f$ was employed to synthesize hybrid MMCs. Metallic coatings on reinforcement will enhance the bond strength and reduce the interfacial reaction, which in turn substantially improves the yield strength leading to superior tribological properties.

Since last three decades, researchers have focused on MMCs preparation using a single reinforcement. However, these MMCs exhibit seizures at high speeds and some other drawbacks such as low load-bearing capacity, poor machin-

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