

Eluding Soot for Better Environment Using Machine Learning

Prasanna Patil¹, Varshini B², Vinay Kumar K N², Manju M², Manohar²

²Student, Department of Computer Science and Engineering, Maharaja Institute of Technology Mysore, Karnataka, India.

¹Assistant Professor, Department of Computer Science and Engineering, Maharaja Institute of Technology Mysore, Karnataka, India.

Corresponding Author: varsha1nakshathra@gmail.com

Abstract: - Environment is getting polluted from the harmful gases released by the vehicles which leads to many lung disorders in human beings and also depletes ozone layer which surrounds the earth. This paper explains avoiding those problems by following instructions and information technology. Road transport is one of biggest sources of pollution in the world, out of the 80 million vehicles on our road, 59% are diesel vehicles. Diesel vehicles emit higher levels of NOx and much higher emission of particulate matter, to control the emission of toxic pollutants from the diesel vehicles, when a vehicle arrives at the gas station and the license plate of vehicle scan using OCR technology, and verifies the emission test update by comparing vehicle data in centralized hub (Core FTP lite server). And RC card value input to verify emission test too. Buzzer triggering based on decision tree to ensure the result of emission test, negative result failed to get gas, if positive procedure should be followed. And two-way authentication using RFID technology, Result shows that the proposed system is superior in performance with 95% accuracy and is highly effective, robust and reliable in delivering to our environment can be identified and thereby controlling air pollution.

Key Words: — CNN, OCR, SVM, RFID, Machine Learning.

I. INTRODUCTION

Importance for environment awareness was instigated in the beginning of 21st century. One of the main worries regarding the environment is air pollution. Green houses gases contributed by air pollution, which causes the greenhouse effect, whose side effect are now well known to all of us after the findings about the hole in the ozone layer. Air pollution that are inhaled have serious impact on human health affecting the lungs and the respiratory system, these pollutants are also deposited on soil, plants, and in the water, further contributing to human contact and also disturbing the sea life. Vehicles are the one of major contributors to air pollution apart from industries. The vehicle emits menace gases like CO which are very harmful to the environment which directly affects the human being and it leads to chronic obstructive pulmonary disease and increases the risk of cancer and also contributes a large amount of contamination to earth. The growth rate of global vehicles is staggering, and the petrochemical fuel consumed and the exhaust emissions caused by it cannot be underestimated. Vehicles exhaust emissions, mainly containing pollutants including hydrocarbons (HC), carbon monoxide (CO), nitrogen (NOx), etc. The emergence of hybrid electric vehicle (HEVs) can aid solve fuel ingesting and emissions problems of vehicles and further alleviate global energy catastrophe and ecological pollution.

The rest of paper is organized as follows. Section II gives the background information and brief note about the various research activities, on history of emission test, control the

emission from vehicles, and the HEVs advance vehicles. Section III discusses about the various blocks of the offered system.

II. RELATED WORK

Over the years [1], there have been several regulations made by the Government to control the emission from vehicles, most of them being unsuccessful in period. The standards and the timeline for implementation are set by the Central Pollution Control Board under the Ministry of Environment and Forests. Bharat stage emission standards are emission standards instituted by the Government if India to govern the production of air pollutants from internal combustion engine equipment, including motor vehicles.

The first emission standards were introduced in India in 1991 for petrol and 1992 for diesel vehicles. These were followed by building the catalytic converter compulsory for petrol vehicles and the introduction of unleaded petrol in market. On April 29, 1999 the Supreme Court of India ruled that all vehicles in India have to meet Euro 1 or India 2000 norms by June 1, 1999 and Euro II will be compulsory in the NCR by April 2000. Car makers were not prepared for this transition and in a subsequent judgment the implementation date for Euro II was not compulsory. The standards, grounded on European guidelines were first introduced in 2000. Gradually stringent standards have been rolled out since then. All new vehicles productions after the implementation of the norms have to be compliant with guidelines. Since October 2010, Bharat stage III norms have been obligatory across the

country. In 13 major cities, Bharat stage IV emission standards are in place since April 2010.

After the period of time [2], The HEV uses at least mechanical energy from an internal combustion engine (ICE) and an electric motor (EM) and is an advance vehicle. The emergence of hybrid electric vehicle can help solve fuel consumption and emission problems of vehicles, and also helps worldwide energy crisis and environment pollution. In order to properly issue the power of the vehicles, the HEV can execute and manage its energy components through a control strategy. Therefore, we can reduce the vehicle's fuel consumption and toxic emission by designing appropriate control strategies while maintaining the performance of road driving vehicles.

III. METHODOLOGY

System architecture is defining the construction, behavior and more views of a system. Design details as follows:

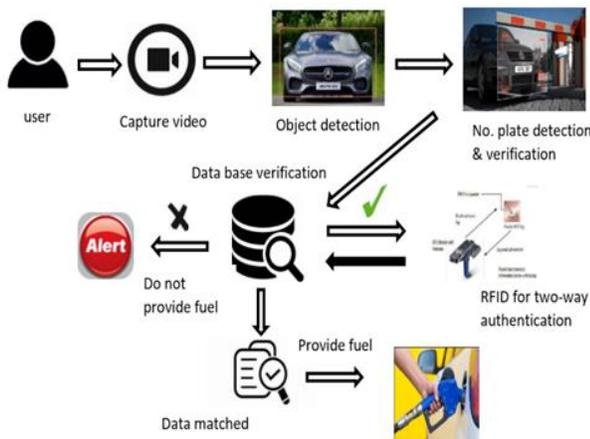


Fig.1. Concept design

Whenever vehicles arrive at the petrol bunk, vehicle is recognized using objects detection method and then license plate data is extracted using OCR technique. Then it'll check with the emission test database whether that vehicle has undergone emission test or not. If the vehicle has undergone emission test, then vehicle will be provided with the fuel otherwise fuel will not be provided. Making a centralized hub to store emission test details of every vehicle is also an objective. It can be made more computerized with greater efficiency by 2-way authentication using RFID during fueling the vehicle by matching vehicle's unique Electronic Product Code (EPC) i.e., electronically stored information generated and provided during emission test, is compared with license plate number identified using OCR technique for the same vehicle.

To avoid any kind of misconduct it re-verifies that the fuel is providing to the same vehicle which is detected in the first step this re-verification is done using SVM technique. Fuel will be provided for those who want fuel in other external container but they must provide their vehicle registration certificate and

then by entering registration number mentioned in vehicle registration certificate the same process is carried out by checking the emission outcomes in the database for that mentioned registered number. If emission test status is pass, then fuel is provided by limiting the quantity of fuel for that particular registration certificate otherwise the fuel is not provided. This system can also be implemented during insurance renewal by checking the vehicles emission test details in the database and then adding penalty if emission tests duration has expired.

IV. FUNCTIONAL REQUIREMENTS

In software engineering, a functional requirement defines a function of a structure or its component. A function is described as a set of inputs, the performance, and outputs. It includes the explanation of data to be entered into the system, operations performed by each system, work-flows performed by the system and also how the system meets applicable regulatory necessities.

Administrator:

The administrator has following functionalities:

Login Module Here, admin can login by giving username and password and can make use of the application services.
Manage Vehicle Emission Test Results Admin can add or remove vehicle emission details.

Petrol Bunk:

The Petrol Bunk has following functionalities:

Provide Fuel If the vehicle has undertaken emission test.

Does Not Provide Fuel If the vehicle hasn't passed the emission test.

End User:

The End User has following functionalities:

Receives Fuel End users obtain the required quantity of fuel.

View Notification End users can view a notice before a week of its vehicle emission test expiration.

V. TECHNIQUES

A. Convolutional Neural Network (CNN)

In deep learning, a convolutional neural network is a class of deep neural networks, most often beneficial to analyzing visual imagery. They have applications in image and video recognition, recommender systems, image organization, medical image investigation, natural language processing, and financial time series.

To classify and location the objects in a video, an idea is to capture the frames from a video, thus many well-understood object detection methods can be applied on each frame. CNN have made countless process dealing with object detection tasks, principal methods like SSD, Faster Regions with CNN features (Faster-RCNN) and Object Detection via Region-based Fully Convolutional Networks (R-FCN) all work well. Objects should be detected timely while sailing, thus the rapidity of method matters a lot. To suit the application on environmental awareness system, SSD algorithm holds great promise. In this work, we use CNN based on a SSD architecture to decide objects in real-time.



Fig.2: Object detection

As understood in the above image, classification refers to classifying the object to a class and conveying it a class label.

- Here, the image contains of a single image and the main goal is to provide it a class name. In localization, an area of that object is found out.
- The object is being bounded by a box. Object detection is the mixture of both classification and localization.
- In real life, images consist of several different objects that fit to different classes. We cannot label them with a single class. Hence, object detection approaches are used.

Divide the input image in to separate regions. Now, each of these regions would be considered as separate images. Feed these images as the feedback to CNN and classify each image

to a class. Finally combine all these regions to get the original image with the identified regions.

B. Support vector machine (SVM)

In machine learning, support-vector machines are supervised learning models with allied learning algorithms that inspect data used for classification and regression analysis. Support vector machine or SVM algorithm is based on the concept of 'decision planes', where hyper planes are used to classify a set of particular objects.

If we have two sets of data. These datasets can be alienated easily with the help of a line, called a decision boundary. But there can be several decision boundaries that can divide the data points without any errors. All decision boundaries classify the datasets correctly. But to pick the best decision boundary. The best decision boundary is the one which has maximum distance from the nearest points of these two classes. Also remember that the nearest points from the optimal decision boundary that maximize the distance are called support vectors. The region that the closest points define around the decision boundary is known as the margin. That is why the decision boundary of a support vector machine model is known as the maximum margin classifier or the maximum margin hyper plane.

How a support vector machine algorithm model works linearly:

- First, it finds lines or boundaries that properly classify the training dataset.
- Then, from those lines or boundaries, it picks the one that has the maximum distance from the closest data points.

Now, the question, how do we classify non-linearly separable datasets.

Clearly, straight lines can't be used to classify the above dataset. That is where Kernel SVM comes into the picture. What does Kernel SVM do? How does it find the classifier? Well, the Kernel SVM projects the non-linearly separable datasets of lower dimensions to linearly.

C. Optical Character Recognition(OCR)

Number plate recognition is a procedure of automatic vehicle identification. A number plate is the sole identification of vehicle. Automatic number plate recognition has three main parts: vehicle number plate extraction, character segmentation and Optical Character Recognition (OCR).

1. Number Plate Extraction:

The captured image is in capital RGB format. It is transformed into gray scale image and into binary image.

2. Character Segmentation:

The character segmentation part further segments the character separately from the extracted number plate. From feedback image the first process will be to crop out the number plate characters from starting to the ending point leaving all the additional wide spaces from top to below and from right to left as it is. Characters are similarly fit in the plate region. For easy evaluation of the input character with the character in the data base the outcome is normalized into the character set as the size of the images in the database.

3. Optical Character Recognition:

The optical character recognition is a recognition technique in which the idea is an image and the production is string of character. OCR is a method which splits the dissimilar characters from each other taken from an image. Template matching is one of the methodologies of OCR. The cropped image is matched with the template data kept in database. OCR automatically identifies and recognizes the characters without any secondary input. The characters on the number plate have constant fonts then the OCR for number plate recognition is fewer complex as related to other methods.



Fig.3: Automatic number plate recognition using OCR

D. Radio Frequency Identification (RFID)

Radio-Frequency Identification (RFID) is the usage of radio waves to read and capture material stored on a tag attached to an object. A tag can be read from up to several feet away and does not essential to be within direct line-of-sight of the reader to be tracked. This is the benefit over Bar-code. A RFID reader is a device used to gather evidence from an RFID tag, which is used to track distinct objects. Radio waves are used to handover data from the tag to a reader. Radiofrequency identification (RFID) habits electromagnetic fields to automatically classify.

The module uses SPI (Serial Peripheral Interface) to connect with microcontrollers. The open-hardware community already has a lot of projects exploiting the RC522 – RFID Communication, using Adriano.

There are two types: *Passive tags* are powered by energy from the RFID reader's interrogating radio waves, does not comprise a battery. *Active tags* are powered by a battery and thus can be read at a better range from the RFID reader, up to hundreds of meters. RFID uses electromagnetic fields to robotically organize and track tags committed to objects. An RFID tag comprises of a tiny radio transponder, a radio receiver and transmitter. When activated by an electromagnetic interrogation pulse from a close RFID reader device, the tag communicates digital data, usually an identifying inventory number, back to the reader.

RC522 – RFID Reader / Writer 13.56MHz with Cards Kit includes a 13.56MHz RF reader with writer module that uses an RC522 IC and two S50 RFID cards. The MF RC522 is a extremely integrated transmission module for contact-less communication at 13.56 MHz. RC522 provisions ISO 14443A/MIFARE mode.

RC522 – RFID Reader features an outstanding modulation and demodulation algorithm to serve unproblematic RF communication at 13.56 MHz. The S50 RFID Cards will ease up the process serving to study and enhance the 13.56 MHz RF transition to our project.

E. Centralized Database Using MySQL

This data model shelters all the needed logical and physical strategy selections and physical storage constraints necessary to produce a design in a data definition language, which can then be used to form a database.

The figure described the numerous attributes that is going to be kept for each actor and module. Admin Table has Three fields namely, Admin Id, Password, Email ID. Admin ID is the Primary Key. Vehicle Test Details Table has three fields Vehicle NO (Primary key), Status, Test Date and Expiry Date of that specific vehicle emission test outcomes.

Core FTP Lite:

Core FTP is a safe FTP client for Windows. Features include FTP, SSL/TLS, and SFTP via SSH, and HTTP/HTTPS support. Secure FTP clients encrypt account information and data relocated across the internet, protecting data from being seen or sniffed across networks. Core FTP Lite is free for personal, educational, non-profit, and business use.

FTP- File Transfer Protocol, HTTP – Hyper-text transfer protocol, SSL – Secure sockets layer, SSH – Secure Shell, SFTP – SSH File transfer protocol (Secure)

GoDaddy:

GoDaddy is an American openly operated Internet domain registrar and web hosting company (to create domain, build a website and to get it on the web).

VI. CONCLUSION AND FUTURE SCOPE

In future, this tactic can be successfully replaced by the development of electric vehicles. An electric vehicle is a vehicle that uses one or more electric motors or traction motors for force. An electric vehicle may be motorized over a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels or an electric generator to convert fuel to electricity. Because electric cars are usually created by replacing the fuel tank and gasoline engine of a traditional car with electric motors, batteries, chargers, and controllers, the significance is a car that is weightier and less effective than a car solely running on electricity. Electric cars are extra expensive because the builder cannot fully improve the cost of the discarded parts and new parts and technology are expensive. Electric vehicles are not completely “emission-free.” If the electricity used is formed by a coal or oil-fired generator, this only allocations the emissions from the tailpipe to the power plant. Electric cars are partial as to the distance that they can be driven before complete battery letdown; average range is only about 100 miles. Electric cars cannot cruise, accelerate, or climb fast sufficient to compete with gasoline-powered cars and equipment, such as air conditioning and radios, drain the battery even further. They cannot tow a trailer or RV. No towing abilities.

Cars, trucks, and buses are all measured mobile sources of air pollution. To reduce air pollution from these noteworthy foundations, as required:

Provides technical, regulatory, and strategy support for vehicle emission control programs.

Implemented and maintains the vehicles Inspection and Maintenance (I/M) emissions testing program.

Developed databases and conducts analyses of OBD-based I/M data.

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