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E-VAAHAN - Smart Transport Monitoring System

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Abstract: Public transport monitoring is one of the major and crucial facilities which is very much necessary to maintain records of vehicles running on the road nowadays. A public transport monitoring is very much required as a purpose of interstate border safety as well as intrastate safety. It is necessary that a vehicle should have proper documentation before it is brought on the road. The proper documentation of a vehicle is also necessary for its validation and verification so that frauds can be kept on check. For giving an edge to these monitoring facilities we are going to develop a system named as E-Vaahan which will be able to fetch the vehicle number through a number plate on the rear side of the vehicle using an online smartcam and will generate all the details regarding that vehicle. These records generation will be very much helpful in finding majorly three things. First, this system will be able to detect whether the vehicle on the road has proper documentation or not regarding insurance, pollution, etc. which is a default feature of a monitoring system. Secondly, the system will be able to detect whether the vehicle number is valid for the vehicle type or is it a fraud. And third, the system will be able to keep on checking interstate movement of the vehicle and its pass validity. Hence E-Vaahan will definitely provide a user friendly approach to keep eye on vehicles on the road which can be easily handled by the traffic police officers and reduce the maximum of their efforts that they give to manage traffic.

Keywords: Detection, Monitoring System, Smart cam, User-Friendly, Verification

I. INTRODUCTION

In today's world of industrialisation, mode of transport is the most important medium to take this technological advancement to the next level each and every day. So, to take count of these modes of transport has become the most essential part for the aspect of security as well as proper document validation of vehicles.

A number plate is the most common recognizable proof of a vehicle. Constant number plate acknowledgement assumes an essential part in keeping up law requirements and keeping up movement rules. It has wide applications such as, number plate validation, interstate pass validation, pollution pass validation, fraud detection, Insurance validity check. Automatic number plate recognition has three noteworthy parts: vehicle number plate extraction, character division, and Optical Character Recognition(OCR).

Before real-time recognition of the number plate, we are performing the text extraction on some sample images. For that we are using Python and some libraries such as CV2, matplotlib, numpy, imutils, easyocr, etc. First of all we are reading the image in grayscale. Then we are applying some filters and applying the Canny algorithm to find edges for localisation. After these steps we are finding approximate contours and applying a mask to the most appropriate contour and finally we are rendering the result.

II. RELATED WORK

In paper[1], M. Naveen kumar and Ayyasamy Vadivel proposed the aim of image processing. The Library used is a python library known as OpenCV. The library provides a wide number of APIs regarding computer vision applications. The paper gives information about some of the image processing techniques such as Image Filtering, Image Transformation, Object tracking, Feature Detection, etc. The paper also described some of the sample image processing applications using OpenCV. The mentioned applications are: Intruder alarm System using motion detection, Authentication System using Face Detection, Edge Detection System and Video Processing using Android Phone. So these applications helped us to gain some of the unknown techniques that we have used in our project.

In paper[2], Amit Kochale et al. discuss the importance of traffic control and vehicles' owner identification during the motion of a vehicle on road. And to design the system EasyOCR and tensorflow models have been used. The system is designed in different stages such as Image Normalization & Binarization, Character Region Extraction, Character Segmentation, Optical Character Recognition and finally Identify

License Plate Number. The authors have also explained about various methods and algorithms which are Canny algorithm for edge detection, Laplacian of Gaussian for Blob Detection and Connected Component Analysis. The information provided by the author is worth reading and applying these methods and techniques to make some progress in our project. The number plate detection proposed by this system has good accuracy.

Chirag Patel et al. have proposed about different stages that have been followed in developing the License Plate Recognition (LPR) system in paper[3]. The technique of Image Binarization, Hough Transform, Blob detection, Connected Component Analysis and Mathematical morphology are used to design this system. Image size specification and its success rate are also mentioned in the tabular form to get some idea for keeping an ideal image size. Many other methods of character recognition such Artificial Neural Network (ANN), Template matching, etc. have also been explained in this paper along with their success rate to detect the character imprinted on a number plate.

The paper [4] proposed by M. Geetha et al. gives an insight about how manual text extraction was an error prone task. Thus applying deep learning techniques are very much useful for text detection and extraction. The text extraction and detection have been performed here using the EAST algorithm to convert the text into machine recognizable form and then OpenCV with RNN has been used to recognize the extracted text and finally feed it into the database. In OCR stage Image text extraction, SVM for classification of zones, Connected components to connect every pixel and then Gamma correction method have been used. The OpenCV package of python helps in image preprocessing, grayscale manipulation, noise removal, Segmentation process, etc. To perform accuracy on a higher level in recognition of the text Nanonet OCR is used. So this paper brings out a handsome amount of information which is implemented in our project.

In paper [5] Pratiksha el at. described a method of implementing automatic license plate recognition using Python language and the Open Computer Vision Library. It is a technology to abstract text from the number plate of the vehicle. License plate extraction is divided into two different parts which are license plate detection through Haar-like features and through edge detection. The paper also describes the advantages of using OpenCV over MATLAB which includes high speed, resources needed, effective cost, high portability and the specific nature. This system is tested with different number plates from different parts of the world and works satisfactorily well.

In paper [6] Ayush Srivastava et al. describes the use of automatic number plate detection in toll tax collection, shopping malls and traffic challans . It is a real embedded system which aims at automatically recognizing the number plate. Implementation of automatic number plate detection is divided into various steps which includes steps such as grayscaling, bilateral filtering, sobelling, canny edge detection and finally contouring the result. Bilateral filtering helps to reduce outside noise and smoothening the image. OpenCV library is used to extract text from the license plate. This system is tested with different number plates and gives results with high accuracy.

In pape r[7] Priyal Jawale el at. implements object detection in real-time using deep learning and CNN (convolutional neural network) architecture concepts. Tensorflow is an open source and a universal library used to detect objects in real-time with maximum accuracy. Three types of layers are present in CNN layer which are convolutional layer, fully connected layer and pooling layer. The paper describes how advancements of convolutional neural network architecture based schemes helped images become most suitable. Multiple algorithms can be implemented for a wide range of data sets within the tensorflow environment. The paper is tested in different conditions to achieve object detection in real time and it gives significant results.

In paper [8] Ponvizhi. U el at. aims to use deep learning using OCR(Optical Character Recognition) to extract text from an image. It uses three algorithms which are convolutional neural networks(CNN),Recurrent Neural Networks(RNN) and Long Short Term Memory Networks(LSTMs).The paper aims at providing an efficient and enhanced software which performs image analysis and document processing which can be used in many academic, business and governmental organizations that have large pool of images.

In Paper [9] Christos Nikolaos E. Anagnostopoulos proposed a replacement algorithm for vehicle registration code identification. This algorithm was tested with 1334 natural-scene gray-level vehicle images of ambient illumination and different backgrounds. The camera focused within the plate, in this way that while the angle of view and also the distance from the vehicle varied in line with the experimental setup. The PNN is employed to spot alphanumeric characters from car license plates supported data obtained from algorithmic image. A review within the related experiment presented during this paper tells that better performance (90% up to 95%) has been reported.

In Paper [10] Matei O proposed a novel process to optical character recognition (OCR) used in real environments, such as gas-meters and electricity-meters, where the quantity of noise is sometimes as large as the quantity of good signal. This method combines two algorithms an artificial neural network and the k-nearest neighbor as the confirmation algorithm. The experiment results says that this method with moderate level of training epochs can produce a high accuracy of 99.3 % in recognizing the digits, proves that it is working well.

In Paper [11] Prathamesh Kulkarni implements algorithms like: 'feature-based number plate localization' for locating the quantity plate, 'image scissoring' for character segmentation and statistical feature extraction for character recognition; which are specifically designed for Indian number plates. Automatic number plate recognition (ANPR) could be a real time embedded system which automatically recognizes the identification number of vehicles. During this paper, the task of recognizing number plates for Indian conditions is taken into account, where number plate standards are rarely followed.. The system can recognize single and double line number plates under widely varying illumination conditions with a hit rate of about 82%.

In Paper [12] Patel C shows introduction of Optical Character Recognition (OCR) method, History of Open Source OCR tool Tesseract, architecture of it and experiment results of OCR performed by Tesseract on different kinds images are discussed. Optical character recognition (OCR) method has been employed in converting printed text into editable text. OCR is an incredibly useful and popular method in various applications. Accuracy of OCR is often passionate about text preprocessing and segmentation algorithms. Sometimes it's difficult to retrieve text from the image thanks to different size, style, orientation, complex background of image etc. They conclude this paper by comparative study of this tool with other commercial OCR tool Transym OCR by considering vehicle number plates as input. From vehicle number plates they tried to extract vehicle numbers by using Tesseract and Transym and compared these tools supported various parameters.

III. METHODOLOGY

It has always been tried to keep the methodology and procedures simple to develop this prototype. So the system has been divided into three major parts, i. Frontend or the user interactive stage, ii. database management, iii. backend or the functional part of the system.

So to have a great interface different features of HTML and CSS have been used. The user will have a different experience as compared to other monitoring interfaces.

Some of the backend as well as database have been implemented using PHP and MySQL which are used to manipulate all the records of vehicles, customers, admin as well as traffic police officers. The Number Plate Detection phase is completed with the help of Tensorflow Object Detection model which has been used to detect the proper dimension of the plate as well as to train the model. For Image extraction and filtering EasyOCR has been used and finally to implement the Real time detection feature OpenCV module of Python has been implemented.

The communication and utilizing different features by different entities of the system has been shown using the Use Case Diagram and 3-levels of Data Flow Diagram.

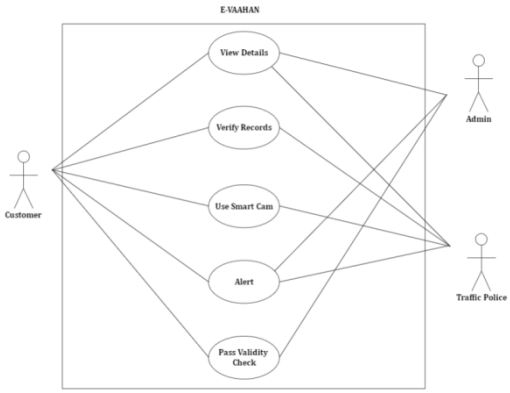

Fig. 1 Use Case Diagram of E-Vaahan

Data Flow Diagrams are showing all the processes, functions and features implemented in this system. The Level 0 Data Flow diagram shows the external behavior or the characteristics of the system.

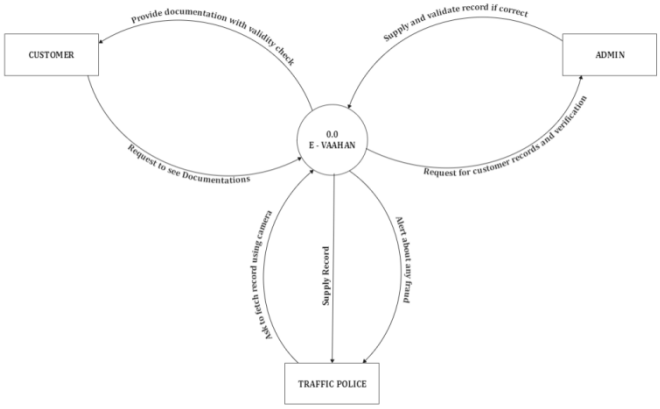

Fig. 2 Data Flow Diagram of E-Vaahan (Level 0)

The Level 1 Data Flow diagram summarizes the database management as well as the functionality of the design when a traffic police and a customer uses it.

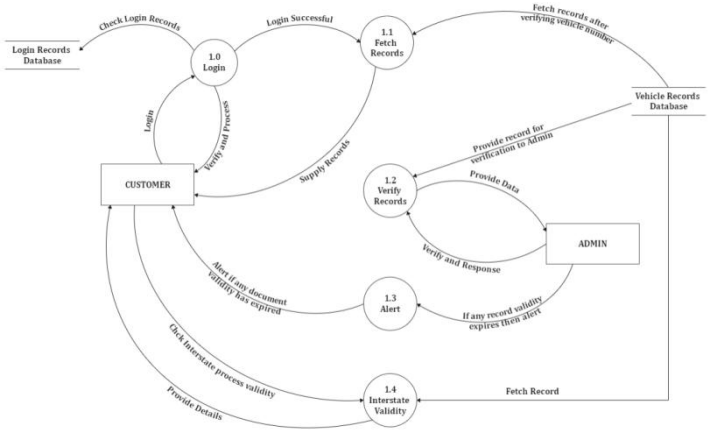

Fig. 3 Data Flow Diagram of E-Vaahan (Level 1)

The Level 2 Data Flow diagram represents all the interactions between all three entities i.e. Admin, Traffic Police and the Customer. This level of Data Flow Diagram shows how fraud detection is going to work in the system.

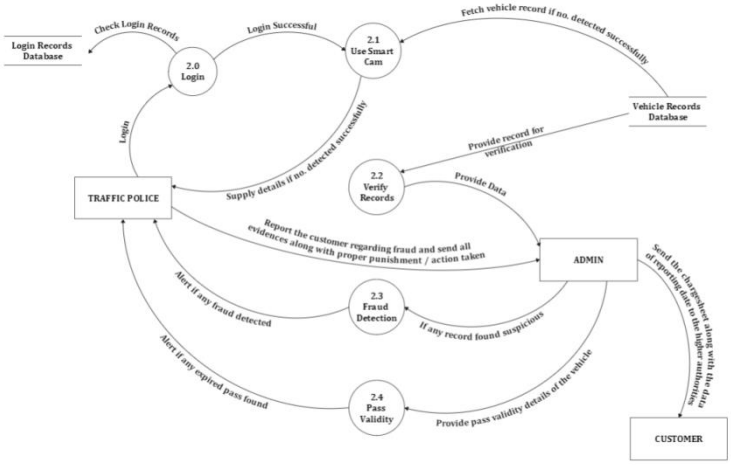

Fig. 4 Data Flow Diagram of E-Vaahan (Level 2)

IV. RESULT AND DISCUSSION

Thus we have developed a prototype which consists of two parts i.e. the frontend whose pictures have been shown below in which we can clearly identify the Admin Dashboard, Traffic Police Dashboard as well as Customer Dashboard. The Dashboards show different features provided to different entities of this system. The second part is the backend part where the number plate detection has been performed using image processing and text extraction. The backend part has the major use of Tensorflow model, OpenCV and EasyOCR.

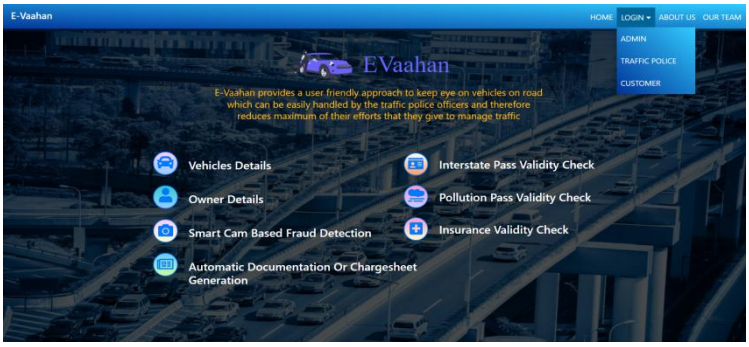

Fig. 5 E-Vaahan Homepage

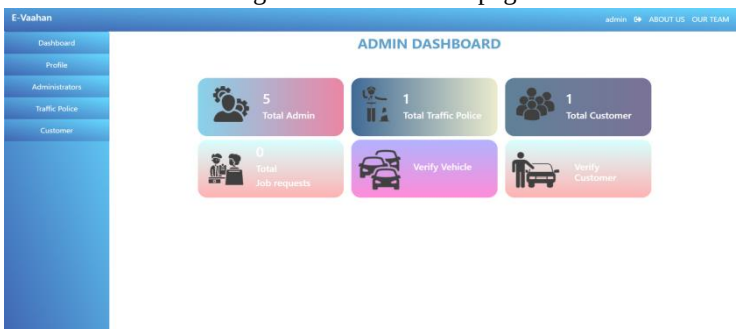

Fig. 6 Admin Dashboard

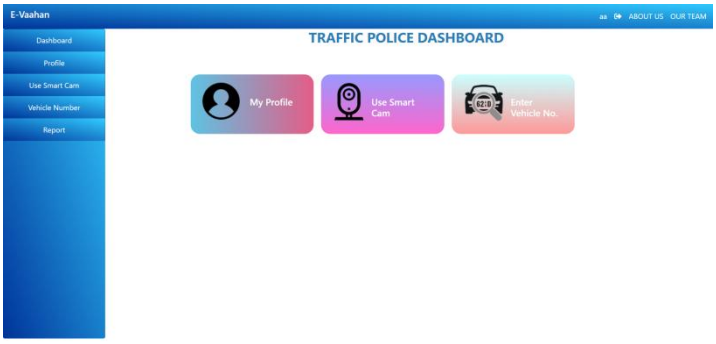

Fig. 7 Traffic Police Dashboard

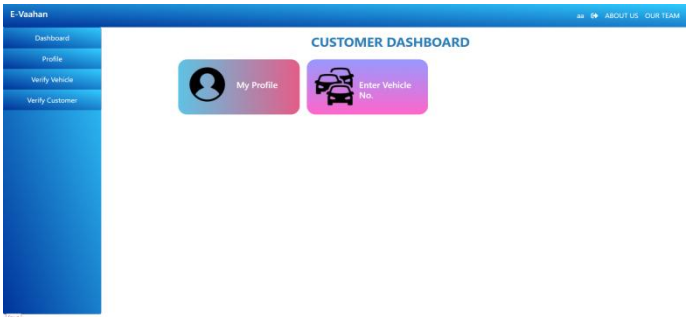

Fig. 8 Customer Dashboard

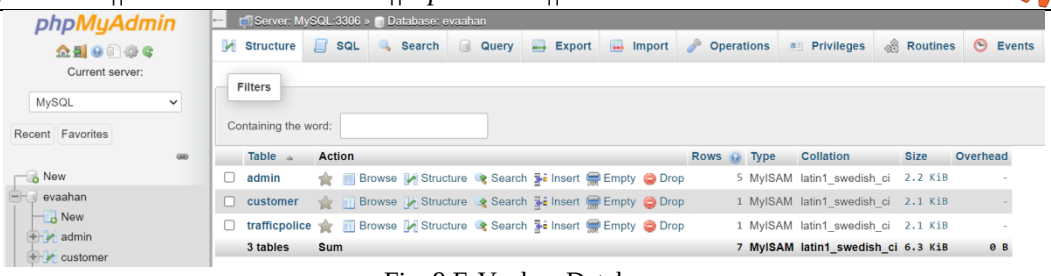

Fig. 9 E-Vaahan Database

Fig. 10 Real Time Image Detection With Accuracy Percentage

Fig. 11 Real Time Image Detection With Accuracy Percentage

Fig. 12 Text Extracted After Detection

V. CONCLUSION

Monitoring systems have always been a field of research in vehicle and traffic management as well as for road safety measures. This system has been developed keeping all the points in mind and every possible feature is tried to be included for giving service to the user accurately and efficiently to reduce their manual effort. After fetching the vehicle's number from the license plate comes the responsibility of database management. The database management module of a monitoring system must be a strong and reliable one as the system will be

storing a large amount of data in the form of images as well as text. For retrieving vehicle's details such as vehicle's owner's name, address, etc. authorized and secured data is needed. So to make a strong connection of data in our system which will be the most important part for vehicle verification and validation, we need an authorized database of vehicles which will be the part of the next stage of this project. The prototype can be moved to the next level by introducing more features as mentioned in the data flow diagram such as fraud detection, document verification, etc. These features are currently part of research for taking this project to the next stage. Finally the frontend and backend part is to be merged to develop a fully functional interface. So the future work should involve overcoming most of the limitations as mentioned above to make the system highly interactive in the market.

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