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Effective Expressway Assistance System and Depassment Detection

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ABSTRACT: Improving transportation will have an immediate impact on productivity and the economy . Among them toll systems are having a wide impact in people's life. Typically, tollbooths are provided in a ratio of three or four for every lane of through travel, which requires considerable right-of-way. Today, due to the increase in the vehicles, there is a lot of gathering of the vehicles at the toll booths. Each vehicle on an average needs to wait at the tollbooth for about a minute for the payment of the toll tax. In order to decrease this traffic, this project has been developed to reduce the manual work and hence increases the vehicle speed passing by the toll booth. There are multiple technologies are available in foreign countries to reduce the toll gate issue. This project is mainly concentrated on the persons taking two way ticket. We will keep track of input vehicle and details of the vehicle will be stored in the database. While returning this system will be automatically recognizing the number plate and compare it with the data acquired in the database which leads to the traffic reduction and reduce time consuming operations of checking with the vehicle individually.

KEYWORDS: Deep learning algorithm, Convolutional Neural Network, Optical Character Recognition

I.INTRODUCTION

Our life is changing very rapidly and the role of automation in our day to day life is increasing at a fast rate. This is the main motive behind our project that is "Automation". As the population increases the number of vehicles passing over the road is increasing due to which the road condition is decaying rapidly. Our Indian government sponsors the price of road construction and maintenance. The government has some amount of money to build and maintain these roads & this source is the Toll Station.

In today's era of technology, where automation are being extensively used in all the fields this project is trying to emulate concept, which will be of great use in public transport systems. Today a person has to travel long distances to unknown territories for job, business, or even for tourism. As the vehicles are increasing and roads are falling short, now a days we see heavy traffic jams or long queues at the toll stations waiting for paying the toll. Paying the toll every-time through cash or checking the pass takes a lot of time as today time is more precious than money. With entry and exit tolls, vehicles collect a ticket when entering the highway. Upon exit, the driver will pay the amount allocated for the given exit of the toll gate.

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Figure a):Toll plaza

This system is mainly based upon the two foremost technologies used in image processing. They are Deep learning algorithm and convolutional neural network.A deep neural network provides state-of-the-art accuracy in various tasks, from object detection to speech recognition. They can learn automatically without any predefined knowledge explicitly. CNN is a multi-layered neural network networkwhich are a special kind of neural networks which are designed to recognize visual patterns directly from pixel images with minimal preprocessing.

SihamBouchelaghem and Mawloud Omar,"Reliable and secure distributed smart road pricing system for smart cities"published on August 2018 proposed mainly to detect any fraudulent drivers trying to cheat on their toll payment.They proposed a secure and reliable approach for smart road pricing systems that prevents toll violation which works under a completed distributed threshold-based control system.
HaiyunGuo,MingTang,KuanZhu,"Two-Level Attention Network with Multi grain Ranking loss for vehicle Re-Identifiaction",published on April 2019 in which they proposed a novel Two-level Attention network supervised by a Multi-grain Ranking loss (TAMR) to learn an very efficient feature embedding for the vehicle re-ID task that can be very adaptively extract discriminative features from the visual appearance of vehicles. This paper gives us an very additive attention refinement at pixel level to focus on the different characteristics within each part.
Another common existing system that can be seen is the Fastag process which uses the RFID tag. During the entry of the vehicle the scanner scans the RFID tag which will be placed in the windscreen of the rear window. The amount will be automatically deducted from the account of the RFID tag holder. The main drawback of this existing system is that the tag can be lost or being theft and the network in that area should be clear so that the scanner can able to scan efficiently.if there is loss of accuracy on even one percentage the tag holder will face consequences like that there is possibility of paying double the amount of usual toll payment.
So from the above existing systems we proposed an idea of reducing the traffic and waiting time in the toll region effectively with fifty percentage of manual work and fifty percentage of automated work as there is no system that can be completely work automatically without even some percentage of manual help.

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II. PROPOSED SYSTEM

In this paper we proposed a construction of a project which reduces the manual work and hence increases the vehicle speed passing by the toll booth. But in India it is difficult to implement because not everyone has the credit card. To solve the toll gate issue by 50 percentage we are going to develop a system with an application. We will keep track of input vehicle number and whether they are taking return ticket or not and everything will be stored in database. If return ticket is taken then when they return back to toll, we will automatically recognize the number plate and compare it with the database and will automatically open the gate if match occurred which leads to the traffic reduction and time consuming operations of checking with the vehicle individually.

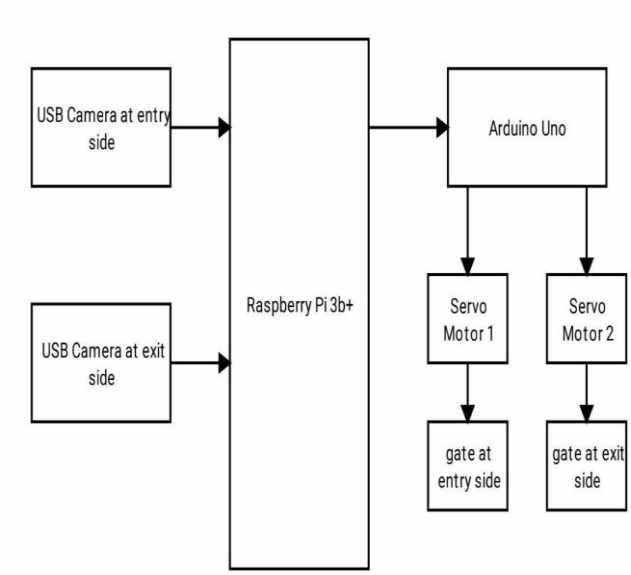

Figure b) : Hardware Methodology description.

The camera captures the image of the input vehicle then process the image of the vehicle. Then Optical Character recognition algorithm is used in the image to extract the number of the vehicle and stores in the database. Then the image of the vehicle is being captured in the exit gate and that image details are matched with the details already stored in the database. If there is a match between two data the gate automatically opens. This is the working principle behind the project.

Initially the first step in this model generation will be collection of data set. The system will be collecting different types of data set from the internet and various resources of different vehicles and its number plate such that it can be trained by which our system can analysis the different vehicles and its number plate then the data set will separated into two parts, training as well as testing. Training data set will be used for training the model completely whereas the testing data set will be kept separately which will be used for testing in the last when the model is completely generated. Now these data set will undergo data argumentation process which is the conversion of one particular image to many images so that we can increase the data set amount predict the model or to train the model. Then the data set will undergo a process called preprocessing which will align the dimension of image to one particular size. Then the module will be trained with the algorithm and after that OCR will be applied to the number plate which will extract numbers from the images. These number plate images will be then converted to text which will be analysis by system to predict whether the vehicle booked have return ticket or not. Now the model is ready for prediction. It may have

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some noise, in order to remove those noises, we will be performing optimization and loss minimization which will optimize as well as minimize losses generated during training process. Now the model will be validated and tested by giving real time images.

The image processing part consists of whole part like converting the original image of the number plate to the grayscale and applying filters and contour detection etc.., As the RGB image cannot be processed for further steps efficiently so in the first step we convert the original image into the grayscale image.

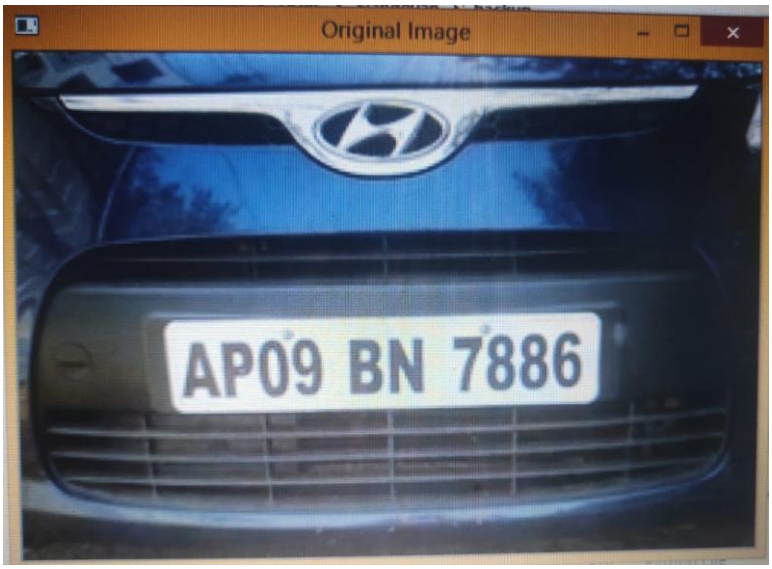

Figure c):Original image

Figure d):Grayscale image

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After converting the original image into the grayscale image application of filter is done in the very next stage. This filter has been applied for the efficient extraction of the number plate. When applying the OCR to extract only the number of the vehicle the image of the number plate should be very clear so that the process can be done easily. The filter used here is bilateral filter as it is one of the efficient filters used to apply for the particular area.

```
gray = cv2.bilateralFilter(gray, 11, 17, 17)
cv2.imshow("2 - Bilateral Filter", gray)
```

Figure e): Bilateral filter image.

Once the filter is applied then the image is subjected into Canny edge detection. This edge detection helps us to extract the area of the number plate which will be in the particular meters of area. This edge detection will efficiently gives us the area of the number plate so that the next process of the image preprocessing will be very easy. Among all other detection the Canny edge detection as been used here because it has the ability to detect the edges perfectly and the process of applying this detection to the images is also an easy process.

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Figure f): Canny edge detection.

The next step of the preprocessing will be the application of contours.

(cnts, _) = cv2.findContours(edged.copy(), cv2.RETR_LIST, cv2.CHAIN_APPROX_SIMPLE)

Finally the Optical character recognition has been applied using tesseract engine. Tesseract is the most commonly used OCR engine now a days. It has been used widely because the accuracy in the tesseract OCR engine is fairly high out of the box and can be increased by a well designedTesseract image preprocessing pipeline. So at the end of the preprocessing techniques the text from the number plate are obtained clearly and it is stored in the database.

Figure g): Extracted text of the number plate.

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III. SIMULATION RESULTS

The simulation results are mainly based upon the selecting the type of the ticket and storing the data depend upon the ticket chosen.

When the person takes only one way ticket:

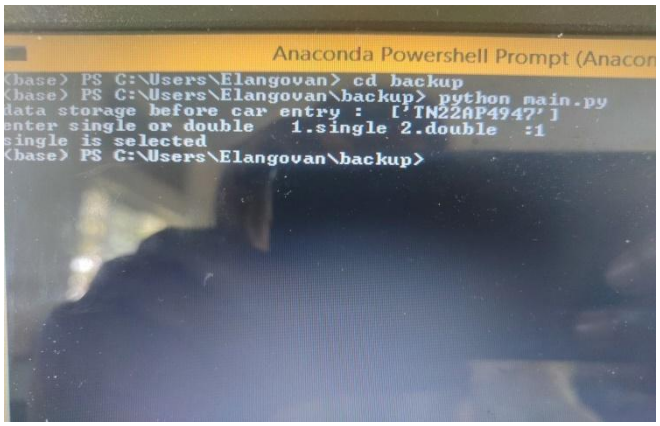

Figure h):Simulation output when one way ticket is chosen.

In this process only one way ticket is chosen hence the further processing of the conversion of image to extract only the number of the data is not implemented and not the number will not be stored

When the person takes two way ticket:

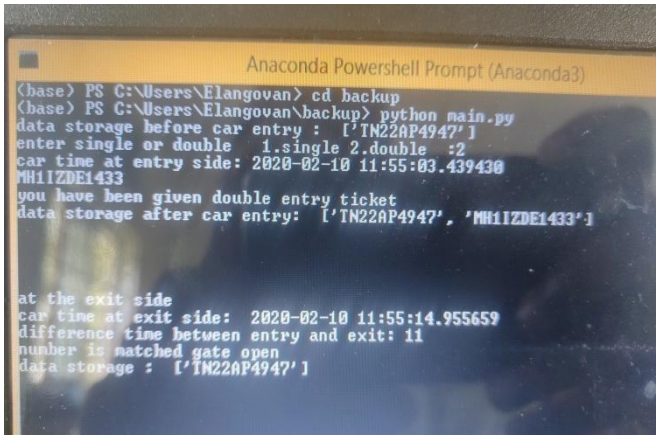

Figure i): Simulation output when two way ticket is chosen and the car entered within validity time.

In this process the person is taking the two way ticket then the image will undergo the image preprocessing and after the process of optical character recognition and the number has been extracted. At the exit side when the car with the same number occurs then the exit gate will be open.

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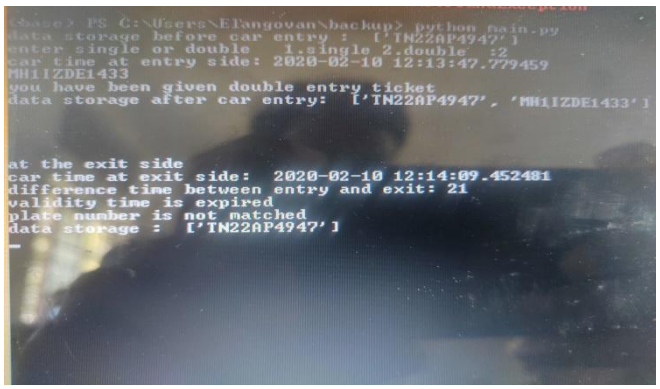

Figure J)Simulation output when two way ticket is chosen and the car entered after the validity time.

At the same time when the car enters after the validity time in the exit side the match will not be detected and the gate will not be opened.

IV. CONCLUSION

Thus, this project helps the traffic reduction and reduce the time consuming operations of checking with the vehicle individually. This paper proposes effective way to reduce the traffic in the toll region by using some of the image preprocessing techniques and using the Optical Character Recognition method. It also provides many advantages compared to the traditional methods. In the tollgate system there has more chance to develop or covert this project in many ways.

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