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Swift Toll Plaza – A Computerized Toll Plaza System

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Abstract: *Swift Toll Plaza is an automatic toll collection system. The objective is to make the toll collection system entirely computerized. The developed system initially captures the vehicle image, then the vehicle's number plate is recognized by the image segmentation method. Optical Character Recognition method is used for character recognition. The resulting data is then used to compare with the data in the database to extract information like vehicle details, user details, toll plaza location with toll amount, etc. It is observed that the developed system makes the toll collection activity easier and secure.*

Index Terms: *Number Plate Recognition, Optical Character Recognition, Image Processing, Automatic Number Plate Recognition.*

I. INTRODUCTION

The major reason for increase in traffic at toll plazas is the increase in number of vehicles. There are long queues on busy highways. Nowadays people prefer to use their personal vehicles instead of public transports which results in an increase in traffic. The increasing number of vehicles on the roads, resulting in many problems such as congestion, air pollution and fuel wastage etc. The Swift Toll Plaza System helps to reduce traffic. It helps to make the toll collection system entirely computerized with the minimum number of labour. The user needs to login to the application via a unique number provided by RTO. The user then links the application to the bank account for transactions. The application helps the user to obtain the toll plaza locations, their live location and the toll amount of the toll plaza. This system helps to make the money exchange activity secure. The users also get a verification message of the toll amount deducted.

II. A BRIEF THEORY AND PREVIOUS WORKS

Nowadays people prefer to use their personal vehicles instead of public transports which results in an increase in traffic. Due to the increasing number of vehicles, the traffic is increasing at the toll plazas. There are long queues on busy highways. The major objective of this system is to make the toll collection system entirely computerized and hence being more easier and secured. The currently existing system also provides direct toll amount transactions but require some kinds of tags or scanners or QR-code tags that require the vehicles to stop at the toll plaza for a few seconds or so. The Swift Toll Plaza System minimizes this problem and makes the system completely computerize.

III. SYSTEM MODEL

The overall Swift Toll Plaza System is subdivided into the Software model and Hardware model.

A. Software Model

The main and the most important part of the system model is the software model. The software model uses a series of image processing techniques which is implemented using Matlab. The software model is broadly divided into four categories :

- 1) Capture image
- 2) Extract number plate from the image
- 3) Recognize the alpha-numeric values from the number plate
- 4) Compare obtained data with the database and proceed for transactions.

The first step is to capture the video of the vehicles using ANPR Road Wolf Infrared Video Cameras and extract the number plate from it. The Automated Number Plate Recognition (ANPR) system is used for obtaining a clear image from the video. The Automated Number Plate Recognition (ANPR) system uses Optical Character Recognition on images to read the vehicle registration plates and it works by tracking vehicles travel time between two fixed points and calculates the average speed. The system would typically scan and compare many images, with 5 being considered the minimum for high accuracy. With the help of retro-reflective characteristics of number plate, the illumination from the illuminator will be reflected directly back to the camera. Hence only infrared light will be seen without any visible light or other reflections or refractions. The picture will be black with no details except for the number plate. The OCR software then converts the image to usable code.



Fig. 1 Hardware components of ANPR



Fig.2 Image capturing using ANPR User agent (UA)

B. Vehicle Classification

Classification of vehicles is also the major function of the system. The motion segmentation is a technique used for extracting moving vehicles. Image Segmentation can be done using split merge approach. The splitting method takes the entire image as initial segment. Then the method successively splits the image into quarters. A merging method starts with an initial segmentation and successfully merges regions that are similar enough. Split Merge method is a very popular approach in image segmentation because of its simplicity and computation efficiency.



(a) (b) (c)

Fig.3-1 The series frames of the moving vehicle



(a) (b)

Fig.3-2: The result after motion segmentation



Fig.3-3: The Final Result

C. User's End

The user needs to register to an application "Swift Toll Plaza" via a unique verification number provided by RTO while registering the new vehicle. The user needs to fill in the journey details like source, destination, single journey or round trip or monthly pass. The user also needs to link the application with the bank account for transactions. As the vehicle pass from the toll plaza, the user will receive a confirmation message to the registered number. Using the application the user will also be able to locate the toll plaza's and its own location. The application provides detailed information about every toll plaza's – from their location to toll amount.

IV. CONCLUSION

In this paper, a completely computerized toll plaza system is presented. The system uses a series of image processing to obtain a clear image of the number plate and verifying it with the data stored in the database in the PC. The system is implemented in MATLAB. ANPR Road Wolf Infrared Video Cameras ensure the images taken in low light conditions are clear. The system robustness and speed is increased by using high-resolution cameras.



Fig.4 ANPR Road Wolf Infrared Video Camera

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