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Online Toll Payment System Using Image Processing

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Abstract: ***In this 21st century, India is developing country. To make India a developed country DIGITALIZATION can play vital role. India is currently going through the process of digitalization. Various fields are being digitalized by our Government. But at many places still traditional methods are being used. One such place is the Toll Plaza encountered on various highways. Traditional methods are very time consuming and also not secure. There is no platform till date to pay the toll fees digitally. And this causes very high rush on toll booths. This project will provide an Android App, which will help to pay toll fees through Mobile by using Credit/Debit card .This approach will go eco-friendly because of paperless transaction. Project uses the GPS technology to track the location of the vehicle. When the location of mobile enters in range of 2 km from toll booth, a notification will be sent on user mobile with details of toll and charges. The user pays tool charges without having to stop at the upcoming toll booth.***

Keywords: Image Processing, GPS coordinates, Digitization and Image Capture, Mobile wallet

1. Introduction

There is always a queue at various toll booths on highways across the country. Increased traffic and poor process of toll collection at toll booth delay the travel time. Furthermore payments are made by cash which increases transaction time. Travellers on the road are not aware of how many and when the toll booths will arrive during travelling.

To solve the problem of traffic congestion at Toll Plaza we are developing an Android Application for online toll payment. The major modification that we are planning is to provide voice notification to user. Also in the future we are looking to add feature that will allow the government cars to pass through without collecting their tax.

2. Related Work

We have studied many papers, researches about automation in toll collection system at highways. At many toll plazas there is manual toll payment system which creates lots of problems. But this manual toll collection system at toll plazas is unreliable, time consuming and it creates traffic congestion. Also it leads to wastage of fuel. Many researchers have used RFID for toll collection which reduces manual labor and also leads to secured transaction process.

Also at many places, image processing is used for toll collection. Number plate of vehicle is captured using camera and then amount of toll is collected from the account number which is linked to the vehicle owner of that number plate. We have seen RFID card punch system in hostels, medical centers and offices to restrict the entry of general people. We aimed to combine those ideas and introduce something new which can be implemented at the highways and bridges to ensure security.

In some cases, vehicles are equipped with GPS tracking device which helps to get the co-ordinates of vehicle. With help of these co-ordinates vehicle will be tracked and notification about nearest toll plaza will be send to owner. Then online payment will be done by owner.

For an effective and fast collection of toll, another system was developed using QR code. QR code id mounted on vehicle and that code will be read by QR code reader. Whenever vehicle arrives at toll plaza, camera captures image and send it to QR code reader for decoding process. It will retrieve vehicle database.

We are combining GPS and Image processing systems from above and trying to develop more efficient system for toll payment at highways.

3. Methodology

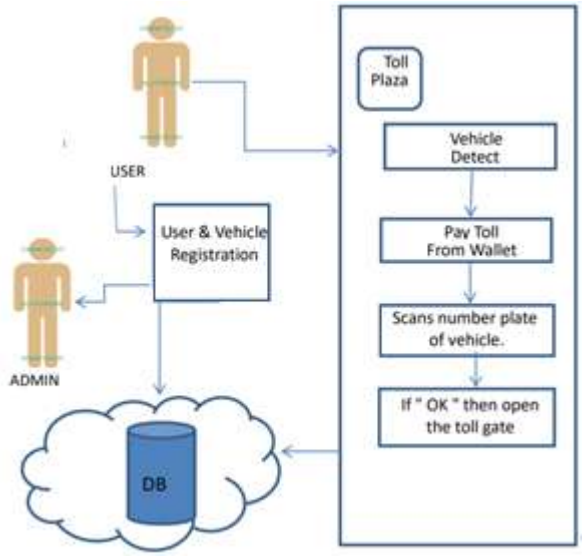

Figure 1: Block Diagram of System

4. Literature Survey

A. The Survey on Automated Toll System for Number Plate Detection and Collection.
Rama Takbhate, Prof. S. D. Chavan, Volume 1, Issue 3, IJIRCCE, July 2014
In the journal the technique is to collect the toll tax with the help RFID base system to collect the toll tax automatically

B. Number Plate Detection with Application to Electronic toll Collection System:
Kannan Subramanian, Volume 1, Issue 1, IJIRCCE, March 2013
The detection of the number plate is the part of the image processing domain, the detection of the number plate in the above journal is done with the help of the camera and then process by using the OCR image processing algorithm and the collection of the toll is with the help ofRFID system is done here.

C. Automated Toll Booths and Tracking System for theft Vehicle:
S. R. Jog, S. D. Chavan, Rama Takbhate, Volume 1, Issue 2, 2013
The major problem of the Country is the stolen vehicles. The journals make the tracking system like that it will capture the stolen or the theft vehicle easily and collect the toll tax.

D. Automated Toll System for Number Plate Detection and Collection:
AnkitaBhore, Bhawananimbhorkar, PunamPure, Priya Thombre, Volume 5, Issue 9, October 2016
The journal is to overcome the drawback of vehicle congestion, money corruption, time consumption and stolen vehicle. It uses the technique called image processing to detect the number plate and input the video and having the collection of number plates in the video.

E. Automated Toll Gate System Using Advanced RFID and GSM Technology:
S. Nandini, P. Premkumar, IJAREEIE
The system is implemented for the toll tax collection automatically and eliminates the possible humane efforts and sends the sms to the owner of vehicle by the GSM modem.

5. System Overview

The process starts when a sensor detects the presence of a vehicle and signals the system camera to record an image of the passing vehicle. The image is passed on to a computer where software running, on the computer extracts the license plate number from the image.

LPN (License plate number) can then be verified in a central database. If number is valid for this system then LPN recorded in a database with other information such as vehicle number, time, balance, personal details. License plate numbers can also be further processed and used to control other systems such as raising a gate. These toll systems are generally composed of four main components: Sensor used for vehicle identification, LPR Camera for capturing images, Computer with TOLL, Image processing software and Gate controlled system.

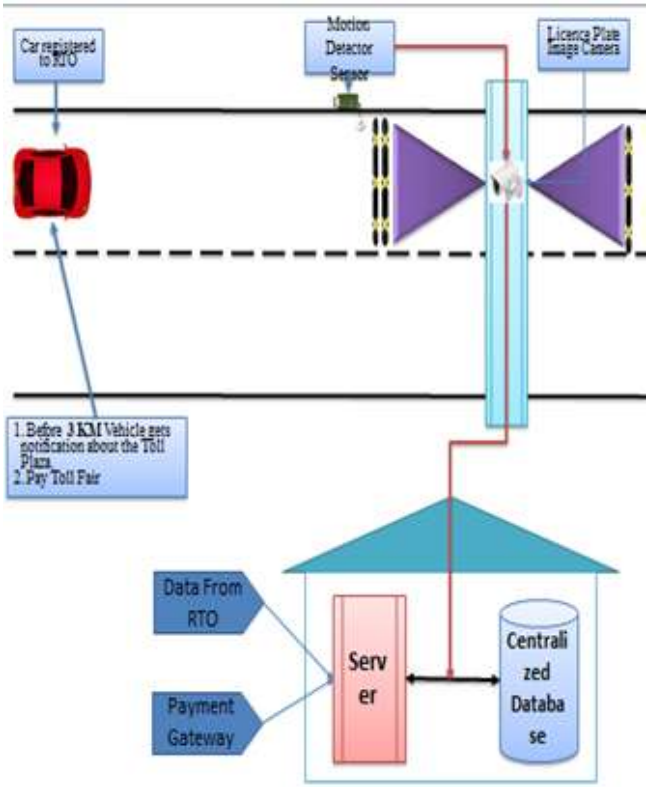

Figure 2: System Architecture

6. Design Components

1) **User Registration**
Initially, user have to register himself in our app. Information will be stored in User Database.

2) **Vehicle Detection**
Location of the vehicle will be detected by GPS System. Here, we will be using ***Haversine Algorithm.***

3) **Image Processing**
Number plate of vehicle will be scanned by a wall mounted camera at Toll Plaza.

7. OCR Technology

OCR stands for optical character recognition i.e. it is a method to help computers recognize different textures or Characters.OCR are sometimes used in signature recognition which is used in bank and other high security buildings. In addition, texture recognition could be used in fingerprint recognition. OCR's are known to be used in radar systems for reading speeders license plates and lot other things. The goal of Optical Character Recognition (OCR) is to classify optical patterns (often contained a digital image) corresponding to alphanumeric or other characters. The process of OCR involves several steps including segmentation, feature extraction, and classification. Each of these steps is a field unto itself, and is described briefly here implementation of OCR. One example of OCR is shown below. A portion of a scanned image of text, borrowed from the web, is shown along with the corresponding (human recognized) characters from that text. An OCR algorithm will be use in the system to detect the number plates of the vehicle using gray scale image representation

Figure 3: Number Plate Recognition

8. Haversine Algorithm

The **haversine formula** determines the great-circle distance between two points on a sphere given their longitudes and latitudes. Important in navigation, it is a special case of a more general formula in spherical trigonometry, the **law of haversines**, that relates the sides and angles of spherical triangles.

For any two points on a sphere, the haversine of the central angle between them is given by

$$\operatorname{hav}\left(\frac{d}{r}\right) = \operatorname{hav}(\varphi_2 - \varphi_1) + \cos(\varphi_1)$$

Where,

- *hav* is the haversine function:
  d is the distance between the two points (along a great circle of the sphere; see spherical distance),
- *r* is the radius of the sphere,
- φ_1, φ_2: latitude of point 1 and latitude of point 2, in radians
- λ_1, λ_2: longitude of point 1 and longitude of point 2, in radians

9. Conclusion

Thus a system used as an Automated Toll collection booth, based on image processing saves the time at toll booth, minimizes the fuel consumption of vehicle. In turn we can save the environment from emission of extra carbon monoxide (co2). Hence we can save our country. Also it serves in providing the tracking system for theft vehicle which is secured and highly reliable can be obtained. It can be used to remove all drawbacks with the current system such as time and human effort and it also doesn't require any tag only required best quality camera and fixed font number plate on each vehicle

References

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[4] https://en.m.wikipedia.org/wiki/Electronic_Toll_Collection