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Automated Toll Transaction Management

Mr. Jagadish P[1], Rishab R[2], Rahul Biswas[2], Nishanth V[2], Vinod[2]
[1]*Computer Science and Engineering ,Assistant Professor, BMSIT&M, Bengaluru*
[2]*Computer Science and Engineering , Student , BMSIT&M, Bengaluru*

Abstract: This paper aims to design and develop a new efficient toll collection system using QR Codes which will be a low-cost alternative among all other systems. The system is based on Computer Vision vehicle detection using OpenCV and Zbar library . In this system, a camera captures images of vehicles passing through toll booth thus a vehicle is detected through camera. On the other hand, user generates a QR code for his vehicle and paste it on the windscreen of his vehicle. Depending on the QR code of the vehicle, classification of vehicle is done as light and heavy. When server comes to know the type of vehicle, then it accesses the information and accordingly, appropriate toll is charged is deducted from the android application.
Keywords: Android, Smartphone, Camera, Vehicle Detection, QR Code

1. Introduction

Time is the more precious in today's world, everything has been automated. But still in India we wait in long queue in toll plazas to pay the toll fee. This is because of the complex toll system architecture. And still in India manual toll collection system is used. Manual toll collection is most widely used collection method in India. It requires a toll collector or attendant. Based on the classification of vehicle, cash toll is collected by the collector. The collector, who also dispenses change, may accept and sell scrip, tickets, coupons, making an entry of the vehicle in the system and issuing receipt to the patron. Due to manual intervention, the processing time is highest. The main idea behind implementing this paper is to automate the toll fee collection in toll plazas of Indian roads. System used here is QR (quick response) code tag system. As we know day by day peoples economic power is increased and also living standard is changed because of that they own many automobiles like bikes, cars, and many others which leads to traffic. So traffic issues will be a big challenge for controlling the traffic. During the rush hours, it is most difficult for drivers to drive from congested places. An embedded system based on the QR code, web cam and application program is developed for automatic toll collection in minimum time to overcome the traffic problem.

2. Objectives

2.1 Reduced vehicular conjunction

In their vehicles, need not stop longer in toll plazas for paying the toll fees, the toll fee is deduced from the vehicles linked prepaid account when the vehicles are in move. This makes the vehicles move faster in the toll area, no vehicular conjunction.

2.2 Time saving

Since there is no vehicular conjunction or traffic due to the proposed system, the vehicles need not wait in long queues to pay the toll fee and there is no traffic. This saves the precious time of many people who drive the vehicles.

2.3 Mobile first

By the term mobile first we mean that the user has total control of his account and is transparent on the transactions done. There is no back door for it which in turn reduces corruption and thus is a contribution of youths.

3. Related Work

Mr. V. B. Dharmadhikari has proposed a system Computer Vision Based Vehicle Detection for Toll Collection System Using Embedded Linux. System is based on Computer Vision vehicle detection using Open CV library in Embedded Linux platform. The system is designed using Embedded Linux development kit (Raspberry pi).In this system, a camera captures images of vehicles passing through toll booth thus a vehicle is detected through camera. Depending on the area occupied by the vehicle classification of vehicles as light and heavy is done. Further this information is passed to the Raspberry pi which is having web server set up on it. When raspberry pi comes to know the vehicle then it access the web server information and according to the type of the vehicle appropriate toll is charged. Linda John, Debyani Mitra has proposed a system automatic toll

collection using QR code scanning in this system capturing QR code by using web cam and recognize it. When web cam capturing QR code, and if the QR code is correct means that person's vehicle is authorized. Then the barrier is automatically opened and the car is allowed to pass Web cam is video camera, which is used to capture image. P. Mane has proposed a system RFID Based Automatic Toll Collection System Radio Frequency Identification (RFID) is an auto identification technology used for collecting toll automatically. This system can be classified by types of tag and RFID detector. RFID tag will be attached to vehicle. The tags contain information related to vehicle. RFID detector will be present at each toll plaza. RFID detector passes infra-red waves to detect presence of vehicle.

Yudhi Kristanto, Bagus Priambodo has proposed a system Application Design of Toll Payment using QR Code a Case Study of PT. Jasa Marga This paper describe Electronic transaction aims to improve the time efficiency at the toll gates using Android and QR code platform as the automatic media access so that the transaction does not need to be served manually.

4. System Architecture

Figure 1: System Architecture

In this system two types user are present, one is user with smart phone and other one is user without smart phone. User with smart phone can generate the QR code and show via phone he/she need not to paste it on the windscreen of his/her vehicle. And user without smart phone print QR code and paste it on vehicle windscreen or side screen. Also, they can manage their prepaid account, manage vehicle, recharge money, check deduction via admin panel or their android application user account. In QR code all information about vehicle and owner of this vehicle also required information about prepaid account is stored. User scan QR code on toll scanner. Toll booth equipped with QR code reader and CCTV camera. In this system, a camera captures images of vehicles passing through toll booth thus a vehicle is detected through camera. All gathered information is then transferred to toll booth central server, toll booth central server is responsible for manage multiple booth, deduct user toll, and generate payment report. Collections of toll booth records help analyze revenue generation possibilities for critical decisions of toll amount fixation.

5. Methodology

Let us take an example of a car entering a toll booth. So before the car enters the toll booth, the user should have a registered TollTM android prepaid account. When the user registers its vehicle with his vehicle number an unique QR code is generated for that vehicle.

5.1 QR Code Generation

Each vehicle has its own unique QR code generated by the user. The QR code carries the vehicle number as its data. In the above example the user when registers its vehicle with the account, a QR code is generated for that vehicle.

5.2 QR Code printing

Generated QR codes may be saved into system and printed when possible. This is beneficial for users without smart phone.

5.3 QR Code Paste/Show

Printed QR Codes can be pasted onto windscreen or side screen or Generated QR codes can be shown to readers. They will be scanned by the QR code readers and their data will be used for processing user request.

5.4 Recharge Money

This is an administration panel option that can be viewed over web. Here users will add money to their accounts that will be deducted when their vehicle passes through the toll.

5.5 Manage Vehicles

Multiple vehicles owned by the user can be added and managed here, thus having a centralized database of user vehicles. This would make it easy for owners to manage vehicles and accounts simultaneously.

5.6 Check Deductions

When toll is deducted from users' accounts, it would be stored into the system and users can see details regarding the deductions like time and place and vehicle that passed through the toll.

5.7 QR Code-Based Toll Payment System

QR Code Readers are used as Payment authenticators for this system. User options are considered for toll amount calculation.

5.8 Revenue Analysis

This paper concludes that by using Quick Response code scanning we can save more time. QR code provide easy recognition, storing of large amount data in small space, less cost for generation and scanning is easy to understand. Automatic Toll Collection Using QR Code Scanning provide flexibility, reliability and easy use that control the traffic and make collection of toll easy.

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