A CLOUD-BASED INTELLIGENT TOLL COLLECTION FOR SMART CITIES

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ABSTRACT - Our project Electronic toll collection (ETC) systems is adopted by city managers to beat the problems of long vehicular queues, fuel wastage, high accident risks, smooth travel and environmental pollution that include the utilization manual toll collection systems. during this project, an intelligent system is developed to eliminate long vehicular queues, fuel wastage, high accident risks, and environmental pollution in an exceedingly smart city supported mobile applications. Android platform is used to deploy mobile application. The payment is finished automatically using Android Application and car number plate number is recognised by Automatic Number Plate Recognition (ANPR).

Keywords: Electronic Toll Collection; Automatic Number Plate Recognition; license plate recognition; RFID tag.

1. Introduction

Transportation has emerged as a prevailing a component of India. the foremost common transportation mode is through roads. during this mode toll plazas play a major role in maintaining the road transportation. At present, manual toll collection is most generally used collection method in India. because of manual intervention, the interval at toll plazas is highest. impediment at Toll plazas leads to huge economical loss in terms of fuel wastage, holdup and causes pollution. Online Toll Payment System which is an android application, is developed for lessening the over congestion in toll plazas and has become part of the metropolitan cities nowadays. When this application is used1-2 km before the parcel, a notification are sent to the movable of the approaching user with Toll Name and applicable Toll Fee. The notification process is finished by using GPS. Payment are going to be facilitated through any mobile wallets and even through most typically using Google pay, Phone pe. The transportation has become unavoidable in

everyone's life, but it also has its own problem when it comes at implementation level. one in every of them is collection of payments at parcel of land. because of automation, minimum human power is required, and this provides the facility so as that the

time and energy is save and efficiency are often improved. With the communication revolution and embedded systems Electronic Toll Collection (ETC), the new era of intelligent transportation systems (ITS)has been started.

The proposed ANPR system will provide the higher solutions to the toll collection and can cater to the issues arising thanks to traditional toll collection methods. It also sends notification to the registered user via SMS and E-mail, when vehicle passes through toll automatically, which provides best security. ANPR or registration code recognition (LPR) has been one in all the useful approaches for vehicle surveillance. it's may be applied at number of public places for fulfilling a number of the needs like traffic safety enforcement, automatic toll text collection, parking area system and Automatic vehicle parking system. ANPR algorithms are generally divided in four steps:
(1) Number plate detection
(2) Character segmentation and
(3) Character recognition.

OBJECTIVES

• This technique wont to reduce the manual presence near toll gate similarly because the time required to pay toll and avoids the scope of presenting fake documents at the time of document verification.
• A vehicle owner needn't carry any documents with him often, instead use a tag which consists of unique therein specifies the RC details, insurance validity, emission status etc.
• This information is stored in registration database and as per the registration their vehicle details also are stored in an exceedingly separate database named vehicle registration.

• On the completion of all necessary details, an account are created for that user or vehicle owner to recharge and make necessary transaction of toll tax.

• All the vehicle documents are going to be verified when working with this technique initially so required amount of toll tax are deducted from his/her account.

• And if there's any violation reported against the vehicle then authorities are notified. This helps the police to stay track of blacklisted vehicle.

2. Existing System

FASTag is a toll collection system in India, operated by the National Highway Authority of India. It employs Radio. Frequency Identification technology for making toll payments directly from the prepaid or savings account linked to it. A radio-frequency identification system uses tags, or labels attached to the objects to be identified. The tag can be purchased from official Tag issuers or participating Banks. RFID tags can be either passive or active or battery-assisted passive.

RFID tags contain at least two parts: an integrated circuit for storing and processing information. It also includes either fixed or programmable logic for processing the data. In this system sensors were placed above roads and vehicles get charged, a sensor identifies the vehicle number and the details were sent to server, which is processed, and toll is collected. But this technology has some risks.

2.1.1 RFID TAG

RFID technology relies on image processing technique during which number plate is scanned as a picture, afterwards further processing on it image is completed and remaining task get finished regarding toll collection of vehicles. RFID tags contain a minimum of two parts: an microcircuit for storing and processing information. An RFID tag or a transponder, consists of a chip and an antenna. A chip can store a novel serial number or other information supported the tag's form of memory, which may be read-only, read-write, or write-once read-many (WORM). Figure 2.1 refers the tag and therefore the antenna, which is attached to the microchip, transmits information from the chip to the reader. Typically, a bigger antenna indicates a extended read range. The tag is attached to or embedded in an object to be identified, like a product, case, or pallet, and may be scanned by mobile or stationary readers using radio waves.
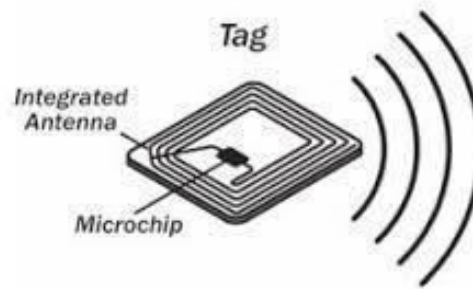

Figure 2.1 RFID Tag

2.1.2 RFID Reader

A reader is needed for an RFID system to function or a scanning device, that is capable of reading the tags reliably and communicating the results to the database.

Figure 2.2 shows the reader which uses its own antenna to speak with the tag. When a reader broadcasts radio waves, all tags designated to reply to it frequency and within range will respond. A reader also has the potential to speak with the tag without a right away line of sight, counting on the frequency and therefore the form of tag (active, passive, or semi passive) used. Readers can process multiple items without delay, with increased read processing times. Like handheld devices, It will be mobile, that scan objects like pallets and cases, or stationary, like point-of-sale devices utilized in supermarket.
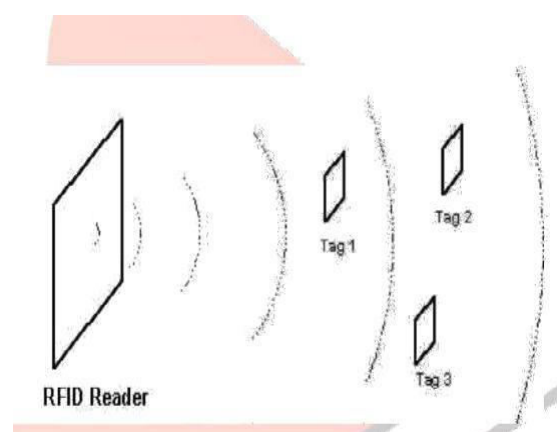

Figure 2.2 RFID READER

3. Proposed System

Android is an open source and Linux based package for mobile devices like smart phones and tablet computers. Android developed by the Open Handset Alliance, is led by Google and other companies. Toll payment has always been a cumbersome process leading to long queues. just in case if there's quite one occupant in a very vehicle with an app within the phone then all the riders will get indication to choose payment, whoever clicks first are going to be ready to pay the toll and just in case nobody clicks to pay then the toll amount are going to be deducted from the registered number.

By downloading a mobile application, users can use both mobile phones and tablets for such transactions on Android, iOS and BlackBerry platforms and to avail the app facility, users will need to download the applying to their phones or tablets and fill in their details. The servers at the parcel are going to be ready to detect the appliance from 200 meters of the toll gate and can deduct the toll from the account. Soon, commuters may have the choice
without stopping at tract. The owner receives an SMS message on their mobile about the main points of the payment and there's no need for him to prevent the vehicle. Vehicles passing through the toll gate are going to be stored within the database.

The servers at the tract are ready to detect the applying from 200 meters of the toll gate and can deduct the toll from the account. Soon, commuters may have the choice of paying toll from their movable accounts no end at piece of ground. The owner receives an SMS message on their mobile about the main points of the payment and there's no need for him to prevent the vehicle. Vehicles passing through the toll gate are stored within the database.

This system provides benefits to the clients yet on the Toll Collection Company. Here the payment is finished automatically using Android Application and car vehicle plate number is recognized by Automatic Number Plate Recognition. The system also contains some additional facilities where one can edit the small print if necessary. Mobile phones became the well-liked mode of transaction for the younger generation, and younger people use digital wallets over traditional banking. It also helps to seek out out a vehicle number of times it passes through the toll gate in a very day. Through this process of toll collection, it'll save time, effort and man power.

3.1 Automated Number Plate Recognition

The Automated Number Plate Recognition system uses Optical Character Recognition on image stored the vehicle registration plates, and it works by

tracking vehicles time period between two fixed points and calculates the typical speed. Unique ID is issued for each vehicle which is that the car number itself. All users would be registered to the Toll Collection Company.

ANPR is fixed at the automated gate which is connected to database. Figure 2.4 shows the diagram of ANPR. As a vehicle approaches the camera the software takes a series of 'snapshots' and stores them in an exceedingly file. The frame is scanned, when the amount plate is of sufficient size for the OCR software the frame is scanned and also the number is converted to ASCII code and held in a very long list. This continues for a series of images in line with the speed and position of the vehicle. The list is scanned for similarities in number and a 'favourite' selected to retain. The system would typically scan and compare 10-15 images, with 5 being considered the minimum for top accuracy. this can be the principle at which the software is functioning, some systems only take one image at a specific position.
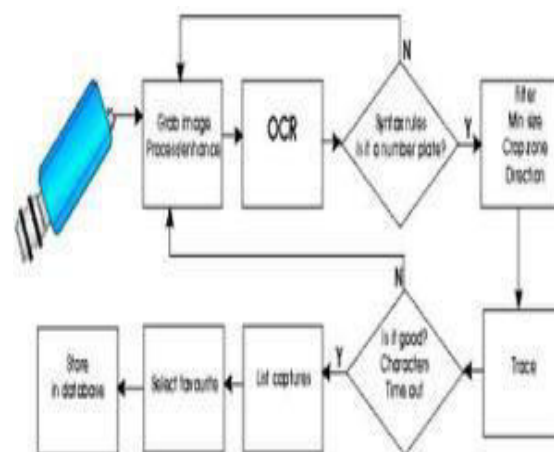

Figure 3.1 Block Diagram for ANPR

4. System Requirements

4.1 Hardware Requirements
• Mac OS Catalina.
• RAM 16GB
• Smartphone

4.2 Software Requirements
• Android Studio.
• PostgreSQL / Firebase

5. Software

Description 5.1 Android Studio

Android Studio is that the official Integrated Development Environment (IDE) for Android app

development, supported IntelliJ IDEA. Android Studio offers even more features that enhance your productivity when building Android apps on top of IntelliJ's powerful code editor and developer tools.

5.2 Android

Android is an open source software package; it is Linux based operating system. It is developed for mobile device such as tablets and smartphones. It is initially developed by Google and then further advanced by OHA (Open Handset Alliance). The android code is mostly written using Java language. The development and advancement for the Android may be done through Windows, Mac or Linux. The ultimate aim of android is to develop successful real-world object that improves the mobile experience for clients. The android version is Lollipop, KitKat, Jellybean, Ice cream Sandwich, Froyo, Eclairs, and Donut etc.
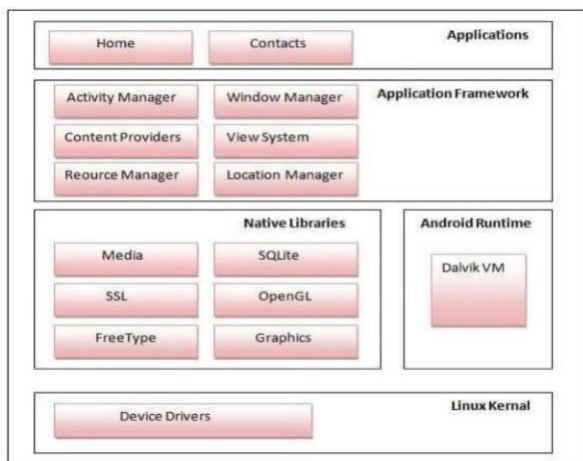

Fig: 5.1 Android

5.3 Languages:

JAVA and XML are the pre-requisite to function on Android Studio; the official language for Android development is Java. Large parts of Android and therefore the API are developed using Java.

5.4 Cloud:

Cloud computing may be a model which is used to construct a mutual pool of capacity assets which will tend ton number of clients within the meantime with least management effort. Cloud is employed as a storage element for developer and enterprises. the data on the cloud is accessed through a web connection without much network traffic. All the plate number and also the irrespective details are

initially kept in cloud storage that may be further retrieved using the uses smart phone via mobile application.

5.5 Connecting to the cloud Firebase:

Fig 5.2 describe the applying to be integrated to a hosted backend service to firebase. The way of integrating the mobile application to the cloud Firebase. Firebase provides a true time database and backend as a service. It provides services like cloud messaging, real time database authentication and hosting.

5.6 Smartphone

A Smartphone is a device that has advanced characteristics such as touch screen display of high-resolution, internet connection, Web browsing capabilities, and the ability to work mobile and web application, gathering current location. A Smartphone has more powerful processors than the personal computer, more storage and RAM, higher connectivity capability with internet, GPS, Bluetooth, etc.And larger screen display than that of a normal mobile phone. Develop a mobile application that uses the GPS, internet connectivity to be installed on the user's smart phone. The developed application is to be launched on Google Play Store from where the application API can be downloaded and installed on the Smartphone.
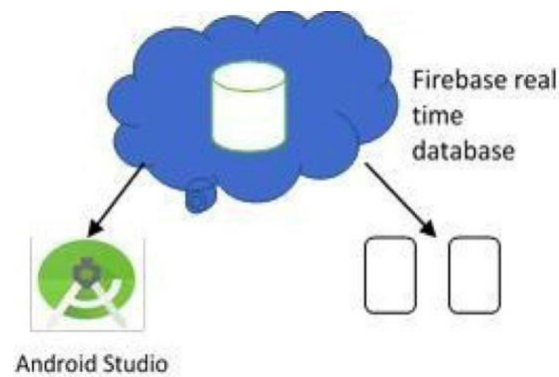

Fig 5.2 Firebase and cloud

6. RESULTS

The automatic number plate recognition system provides a better way to carry out very effectively and efficiently. Throughout the system it enables user to pay toll from their created account within second before reaching toll booth. This system gives many advantages, such as waiting time of the vehicles, no traffic congestion, assured and accurate collection of toll amount, free from cash, avoids waiting, minimum emissions which are harmful for living.

7. CONCLUSION AND FUTURE ENHANCEMENT

The project proposed a real time and efficient method for Vehicle Number recognition & implementation of that method for automatic toll tax collection. It helps in paying the toll amount through android application. This system makes the work easier at both sides and to pay the amount in very efficient way. The system has been tested on many images of various lighting conditions & system can be implemented on motorways & highways for automatic toll tax collection. Wastage of time and fuel because of the large traffic jams has been solved by implementing this android application which is user friendly to use and make payment.

The system works quite well however, there is still room for improvement. The camera used in the system for this project is sensitive to vibration and fast changing targets due to the long shutter time. The system speed can be increase with high resolution camera. The OCR method is sensitive to misalignment and to different sizes, so the affine transformation can be used to improve the OCR recognition from different size and angles. The statistical analysis can also be used to define the probability of detection and recognition of the vehicle number plate. At present there are certain limits on parameters like speed of the vehicle, script on the vehicle script on the vehicle number plate, skew in the image which can be removed by enhancing the algorithms further. Therefore, the by this system we achieve the followings: avoid fuel use, avoid financial loss, control the traffic.

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