

Congestion Free Toll Collection, Stolen Vehicle Detection and Tracking System for Authorised Person

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Abstract - Now a days traffic is one of the major problems being face by people especially at every toll plaza in the city which can be reduced by automatic toll collection system. Proposed system based upon radio frequency identification (RFID) technology in which toll deducted after detection of vehicle according to type of vehicle which is stored in RFID tag at the time of registration of that particular vehicle in Regional Transport Office (RTO). In this way one can deduct toll without stopping vehicle. In case of complaint registered with RTO by the owner, regarding theft of the vehicle, an entry will be added to the database. When a vehicle approaches at toll plaza, an ID registered in stolen vehicle category can be easily detected at next toll plaza and short message service (SMS) is sent informing of detection to RTO as well as owner of that vehicle. Detected vehicle can be blocked at toll plaza. Also stolen vehicle can be tracked by using global positioning system (GPS) in case of very large distance between two consecutive toll plazas or areas with no toll plaza. Smart card also used in the proposed system for traffic control to ensure the authority to drive vehicle, where person is having license or not is verified using fingerprint identification system.

Index Terms- Automatic toll collection system, fingerprint identification system, GPS, RFID tag, smart card.

I. INTRODUCTION

Day by day number of vehicles on road is increasing with increasing purchasing power of people. But roads are not developed in proportion. It causes high traffic density and accidents due to driving of unauthorized or unlicensed person. Here, need to construct and maintain roads for which public private partnership mode was launched [1]. But still problem of traffic and accident not solved. So here comes need of automatic toll collection system. Automatic Toll Collection system is more convenient way of collecting the toll and traffic management leads to eliminate delay on toll roads. One of the new methods for collecting toll and detection of stolen vehicle is by radio frequency identification (RFID) technology [2].

Electronic Toll is a real time system which is an element of intelligent traffic system which allows continuous monitoring of traffic as well as nonstop toll collection. It is a technology for smooth flow of traffic in efficient and intended to help the RTO, police Department and Public Transport. When any person buys a vehicle, he registers vehicle at RTO office where RTO office will give RFID enabled tag with unique ID along with the registration number of vehicle which is to be fixed on vehicle. Vehicle owner must have to deposit minimum amount to the account linked with this RFID tag. After registration, data will be available in the database with details and transaction history [3]. Whenever vehicle approach to toll plaza, tag fixed on vehicle is activated by signals from RFID reader and sends required information to the reader. System then accesses the data corresponding to the information received and transaction begins, depending on the vehicle type, toll will deduct directly from the linked account if balance is available. In case of insufficient balance, vehicles need to pay extra toll manually at the end of the tollgate lane or move to the special cash only lane. Details are then updated in the database and status of transaction is sent to user as a text message [4].

On the other side, if any vehicle owner registers a complaint to RTO office regarding theft of the vehicle, that vehicle's ID is flagged in the stolen vehicle database. When a vehicle with same ID approaches at toll plaza, system identifies the stolen vehicle and informs the authorities. With additional feature of GPS with GSM module, the system is capable of obtaining the vehicle's GPS coordinate and transmit it using the GSM modem to the user's phone[5][6].

It is always observed in majority of accident cases that the driver did not own a driving licence. Those drivers who has not undergone appropriate training are probable to have many deficiencies in knowledge and skills required for driving safely and efficiently. If Drivers do not hold a valid license then they may ignore the threat of license cancellation or other fines in case of mishaps [7] [8] [9].

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II. PROPOSED SYSTEM

At the time of registration of new vehicles in RTO office, RTO office gives the registration card which contain registration number. RFID enabled tag with all information in it about owner and vehicle like name of owner, mobile number of owner, and type of vehicle also model of the vehicle and creates a prepaid account. on the others side perfect driving ,smart card in the form of government issued driving license which can store data such as name, age, license number, Date and Place of birth, Date of issue, Date of Expiry, Photograph, fingerprints, type of license.

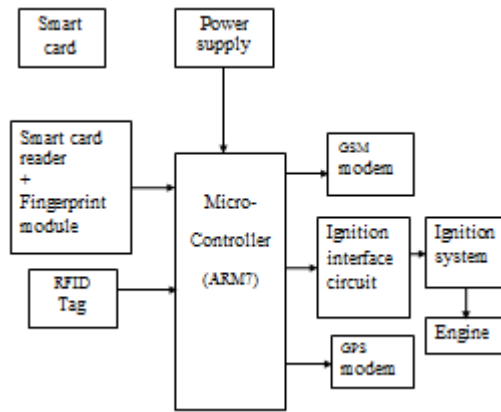


Fig 2.1 Block diagram of vehicle module

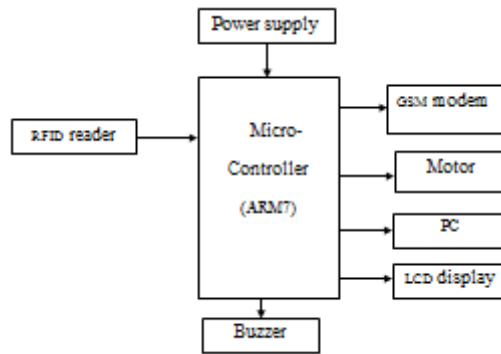


Fig 2.2 Block diagram of toll plaza module

Vehicle module

Smart card is read through slot of reader. The card reader integrates it with a fingerprint scanner. The analysis is done for its minutiae information whenever a fingerprint impression is read, and is compared with the template stored in the card. If fingerprint matches with the fingerprint which is stored in the license card then and then only ignition switch will activate.

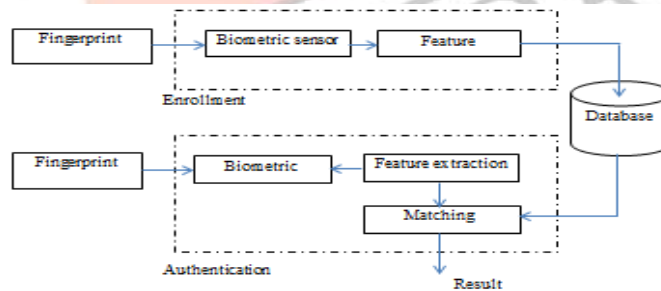


Fig 2.3 Generic architecture for biometric system

The bio-metric system is divided in two stages enrollment and authorization.

- *Enrollment:* It is the first process through which you have to go, where it will have to recognize each day by the system which learns about all the people. During enrollment, scanned fingerprint are analyzed, and that fingerprint image stored in the secure database which is in coded form. Typically less than a half second required to store person’s prints.
- *Authentication:* The scanner reads fingerprint, checks it against all the fingerprints which is stored in database during enrollment, and then decides operational access of person

A. Smart card:

A smart card is the license issued by the government which store the different types of information such as name, age ,license number, Date and Place of birth, Date of issue, Date of Expiry, Photograph, type of license also store the fingerprints templates of 10 fingers. These fingerprint templates are the derived form of the fingerprint scan by template generation process.

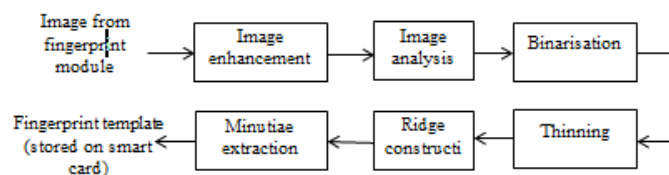


Fig 2.4. Fingerprint template generation

The type of scanner use here is optical scanner which scans the fingerprint image and converts it in to digital form. At the time of scanning it detects ridge and valleys that converts in to zeros and ones. This raw biometric scan analyze by complex algorithm to identify the characteristics of fingerprint knows as minutiae. Fingerprint template is made up of stored minutiae's.

Image Enhancement:

The structures of ridge and valleys in fingerprint image are not always well defined, and therefore, there is need to improve the clarity of ridge and valleys structures by using an enhancement algorithm. The main aim of fingerprint enhancement is to improve clarity of ridge structure of fingerprint image in recoverable region and remove unrecoverable regions.

Binarization Method:

The binarization is the process which converts a gray scale image into a binary image. An adaptive thresholding used for binarization process. According to the intensity mean in local neighborhood pixel is assigned a new value (zero or one).

Thinning:

In thinned binary image a true ridge lines contains noise as false fridge line and gaps. The false ridgeline connections and local ridge direction are almost perpendicular to each other. Therefore, lines with similar features are automatically removed by the post-processing and binary filtering. Typically thinning is the final image enhancement step which performed by prior to minutiae extraction. Thinning is a morphological operation that successively erodes away the foreground pixels until they are one pixel wide

Minutiae extraction:

Most minutiae extraction algorithms operate on binary images. There are only two levels of interest: the black pixels that represent ridges, and the white pixels that represent valleys. Skeleton image is the basic algorithm performs minutiae. The approach involves using a 3 x3 window to examine the local neighborhood of each ridge pixel in the image.

B. Smart card reader:

Smart card is read by putting into slot of smart card reader which along with fingerprint module. When any person wants to drive vehicle then first he should insert his license card in to smart card reader and also put his finger on fingerprint module. Now whenever the impress fingerprint image matched with fingerprint which stored in license card then only ignition of engine start.

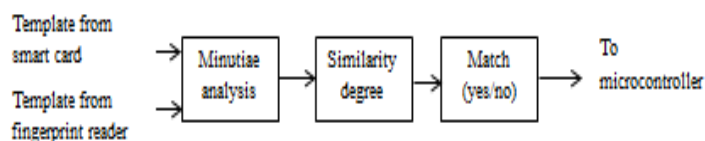


Fig 2.5 Fingerprint Reader Block Diagram.

C. Ignition system along with engine:

The ignition system is a system which provides timely supply and burning of the fuel in the engine. Engines are switched on/off with a lock switch operated either by a key or electronically. A wire from the battery in the vehicle starter is connected with wire from battery and other wires connecting the starter to the ignition system. When key of the ignition system is start once, two wires coming from the starter to the key system are bridged. After this process, the engine is in a READY or ON state. Turning the key again makes temporarily join the already ridged wires by third wire causing current to flow from the battery to the necessary regions of the vehicle so as to enable the engine run. The ignition system is controlled by placing a relay between the battery and ignition unit of the vehicle. Its control is managed by a signal from the microcontroller. Microcontroller activates the engine only when impress fingerprint of driver matches with fingerprint stored in his smart card. Tracking system for tracking system, GSM module sends the longitude and latitude to the owner of vehicle after vehicle is stolen.

D. Tracking system:

For tracking system, GSM module sends the longitude and latitude to the owner of vehicle after vehicle is stolen. Tracking is the easy way for searching stolen vehicle. If owner of the stolen vehicle send SMS “ Status. ” to GSM module which in the vehicle then Longitude and latitude data of that vehicle is captured by GPS module and send back to owner.

Toll plaza module

A RFID tag is placed at the front glass window of vehicle with unique ID. This ID is invisible on tag. RFID reader fixed at toll lane. RFID reader will continuously radiate the RF signal, whenever vehicle reach at toll plaza in the range of RFID reader, signal radiated by reader incident on tag attach to vehicle at that time tag will activate and reflect the signal to reader through RF frequency where reflected signal from tag contains tag ID number, registration number, vehicle number, type of vehicle, model of vehicle. Reader then decodes that signal and gives it to ARM7 controller. The controller accesses the registered data corresponding to that tag number at toll booth. The controller will then display the vehicle and status of transaction on LCD. Microcontroller is interfaced with computer host through serial port to collect the vehicle data for monitoring. It shows all the vehicle details such as tag ID, name of owner, mobile number of owner, and type of vehicle, also model of the vehicle, vehicle number, date, time etc. Microcontroller check the balance of account which connected to RFID tag, if sufficient balance is available then it deducts toll from linked account and update the balance, message is sent to owner of the vehicle by using GSM modem. Gate will open for few seconds after deducting the toll.

If the vehicle is stolen, the vehicle owner registers complaint to police station where only authorized person will update flag the vehicle’s details on database with RFID tag number. When vehicle passed from toll plaza, every vehicle tag number is compared with stolen vehicle tag number present in stolen vehicle directory database at toll plaza. If it is matched, buzzer is on and message will be sent to nearest police station and vehicle owner because it is not possible to provide security at every toll plaza.

A. RFID tag:

RFID enabled tag with all information in it about owner and vehicle like name of owner, mobile number of owner, and type of vehicle also model of the vehicle and connect with a prepaid account.

B. RFID reader:

RFID reader fixed at toll lane. RFID reader will continuously radiate the RF signal, whenever vehicle reach at toll plaza in the range of RFID reader, signal radiated by reader incident on tag attach to vehicle at that time tag will activate and reflect the signal to reader through RF frequency where reflected signal from tag contains tag ID number. Reader then decodes that signal and gives it to ARM7 controller.

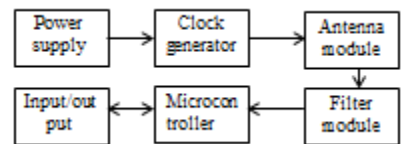


Fig 2.6 block diagram of RFID reader

III. DESIGN OF SYSTEM

Hardware:

Microcontroller (LPC2148):

RFID reader (EM-18):

GSM module (SIM 900):

GPS module (SIM28):

Fingerprint module:

Software

Keil software

Proteus

Flash magic

III. RESULTS

By inquiring location of stolen vehicle with a SMS, GPS+GSM Module replies with current longitude and latitude of the vehicle as shown in Fig.3.1(a). These co-ordinates can be incorporated with various MAP providers like latlong.net or googlemaps to locate the vehicle in real time Fig. 3.1(b).

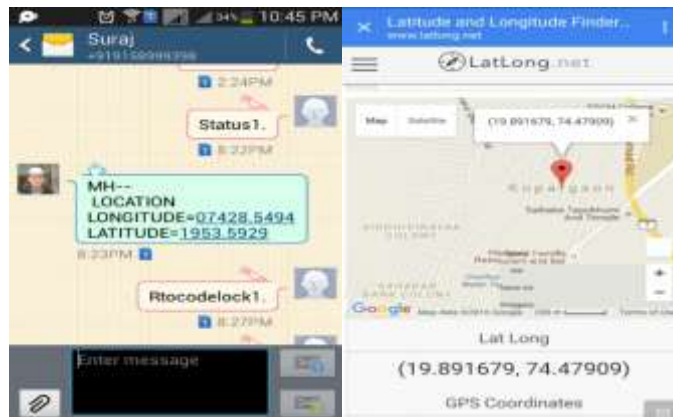


Fig 3.1 Tracking by using GPS

If any stolen vehicle pass through ETC plaza, its detected and SMS notification as depicted in Fig. 3.2 is sent to both Owner and RTO/Police Authorities.



Fig 3.2 Stolen vehicle detection

The display at toll plaza shows vehicle number, type of vehicle and amount of toll collected and total toll collection. One such display of small scale model is shown in Fig. 3.3

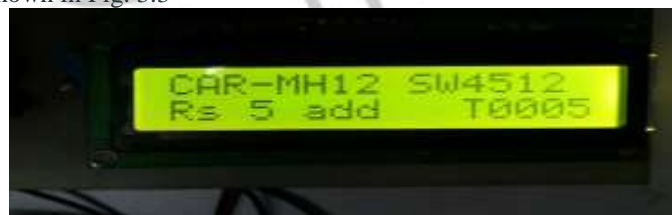


Fig 3.3 Toll collection by toll plaza

V. CONCLUSION

We can reduce traffic, waiting time, burning of fuel by automatic deduction of toll from account of vehicle owner by using RFID technology. This system also enhances the security of the vehicle due to GSM interfacing. This system will ensure safe and easy journey for the passengers. RFID technology can provide new capabilities as well as an efficient method to manage information. It also eliminates manual data entry, system improves the better management. Combining these benefits with GPS with GSM module and fingerprint with license module creates an efficient, secure, hassle free and safe transportation system for the daily increasing number of new vehicles entering on the roads.

VI. REFERENCES

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