

SMART TOLL GATE SYSTEM USING IOT

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Abstract- Smart Toll Gate System, an advent of the common place global to the Automated worldwide. It reduces human intervention and the man-made mistakes. Bringing automation in Societies has a primary advantage that is: machine/hardware dependency is expanded (more dependable) and human dependency is decreased. This brings to an end that combining automation with daily life will make lifestyles less difficult and simpler. Nowadays almost all highways toll plazas are operated by hand, where an operator collects cash from the motive force and affords a receipt. Since this manner may be sluggish, we often come upon visitors jams on the toll plazas on busy highways. Toll collection in automated way can save money, energy, and man power. In this work suggest a low cost and efficient approach called Electronic Toll Collection. The use of RFID modules that mechanically collects the toll from shifting automobiles once they cross the toll plaza. This project addresses the problems confronted at toll plaza & also introduce identity gadget for vehicles towards which stolen and coincidence instances are registered the use of RFID.

I. INTRODUCTION

As we all know, transport is the backbone of any country's economy. Improving transport networks leads to a better environment wherein people gain exceptional freedom of travel, large trade in manufactured goods and services, higher job levels and social mobility. In addition, a nation's economic situation was tightly linked to productive modes of transport. Increasing number of road vehicles lead to numerous problems such as traffic jams, road accidents, environmental damage and more. Most sectors of the economy use different modes of transport for various tasks. Hence, increasing transportation must have an instantaneous influence on world and environmental performance. These are some of the main reasons for economic competitiveness is to reduce the costs of transporting items at manufacturing sites and to deliver finished goods to the buyer. The smart toll gate system is a technology that can determine whether or not an automobile is authorized and afterwards notify the

control unit of the violation receipt, debits and accounts involved. The biggest advantage of this

smart toll gate system is its ability to eliminate traffic in toll booth, particularly during all those seasons where travel seems to be higher than expected and when traffic is more frequent.

II. LITERATURE SURVEY

The survey taken is [1] highway toll susceptibility and the maintenance of those data to examine the road infrastructure threat depends entirely on the simulations using an established traffic model. [2] notifies the shortest route for the destination and also re-routes the route if there is any traffic , so that it provide users with accurate route details and also reduce the journey time and cost.[3] follows the e-payment for toll payments using prepaid card and also incorporates the card recharge stations. It collects feedback from passengers and then evaluated by the utilization of rundown facts and figures using Mann Whitney test, to improve it.[4] survey is carried out on toll payments made using the RFID tag and its improvement. This also holds the data concerning the vehicle and its user.[5] the sharing economy makes it simpler by linking vehicles to a registry over the internet. The vehicle records its movement by submitting routine data to the controller. The emphasis is on gathering empirical traffic updates to ensure free traffic. [6] monitors passenger travel by comparing the vehicle's location with toll plaza using GPS and collects tax from the vehicle owner for the account.[7] Here RFID sensing fitted in the toll capture passing vehicle information and make digital transaction trouble-free on the basis of the unique pattern.[8] Eliminates manual labour and thus allowing automobile travel much rapid than traditional tariffs and RFID information is stored in the cloud to facilitate payment.[9] Approach the toll outline to render the toll more effective in terms of contact less fare charging and state-of-the-art control. Here the variable resistance test section is used to calculate the vehicle's capacity, so that the sum can be recouped on a vehicular basis.[10] Designed to automatically sign vehicles on or off the interstate or tram, shortening the time necessary to pay toll in long queues. The comprehensive monthly bills are sent to the recipient by the end of the month. This offers user-specific vehicle-related relevant information, including reference number, vehicle number and charging address data about the driver. [11] Recommends toll payment via mobile

application, in order to minimize the time spent looking in the queue and payment. Avoids congestion too. This is applied to detect the position of the vehicle and toll employing sensing devices and the distance payment is automatically assessed and paid in the mobile application. [12] To analyse the approach of specifying in toll plaza about a host of actions such as banning the vehicle, increasing the casement, presiding over the unique coinage for the user.[13] It imposes security measures to mitigate toll crimes. By using GSM module, it blocks a certain type of vehicle. Simple code text is sent to the system, and the vehicle is the blocked by not raising the barrier even if payment is done.[14] proposes e-payment by expressway toll using RFID tag installed and maintains the records of the vehicle using image processing and cloud.[15] This incorporates a method of calculating the distance of travel of the vehicle and the exact amount of the toll is paid on a distance basis so that additional taxes can be avoided.

III. EXISTING SYSTEM

In existing method, there is automatic unit collecting money but not efficient as the proposed system, as well as there is no automatic barrier that is open at the time. There is no technology, even in toll collection, to identify vehicle fraud, recognize the vehicle. But the existing system consists of technology that notifies the shortest route to reduce the journey time. It has the system of using pre-paid card for toll payments. Also, the system consists of sharing economy which makes it simpler by linking vehicles to registry over internet. It also consists of RFID sensing fitted in the toll. The system of transaction of toll via mobile application also exists.

These methods for the toll collection are a very time-consuming method. Also, there are some chances of escaping from the payment of toll tax exists. It leads to queuing up of following vehicles for very long time.

Considering the average time taken by a vehicle, every year 72,000 vehicles simply wait for 5.0 hours by the engine on condition, thereby aiding

pollution and wasting fuel and money. Now, considering 50 toll plazas, a drastic amount of fuel and money will be wasted leading to heavy traffic.

Other than government vehicles, there are also vehicles exists which has number plates in Tamil. There is no special methodology for recognising the vehicle number plates which is in Tamil. Even though, the existing system has automatic toll collection system, the system uses only template matching which is an out dated technology. This system uses image processing technique for maintaining the records of the vehicle but not for finding the theft vehicles.

IV. PROPOSED SYSTEM

In proposed system, image processing is used to monitor every vehicle. Theft vehicle can be easily identified using pressure sensor and image processing. Vehicle database is stored in the cloud via an IoT module. Automatic payment is made, and vehicle number plate breaches are also detected using pressure sensors.

The main work is the front-end components i.e. the RFID tags, RFID scanner and pressure sensor. Here the RFID tags have a unique Id which is used to detect the authorized user and those authorized users are detected by the receiver. If it authorizes the user then with the help of the Arduino IDE the control is transferred to the motor. The IDE consists of the embedded C programming which takes control of what component should be used and when? This system uses Optical Character Recognition instead of template matching which makes the system much more efficient. The numbers and text in the number plate are recognised using a process called edge segmentation. It also recognises the vehicle's number plates which is in Tamil. For that, it uses the technique of trained datasets. Using image processing technique, it can verify the driver with the RFID user account details. If it does not match, then the vehicle is taken for verification. This application works as an automatic alternative for the manual system. It also consists of a display panel that displays the user's detail and also displays if the user is not authorized to use it. If the user is unauthorized, the control is transferred to the buzzer that rings and the security is established here. It saves waiting time, fuel and reduces traffic

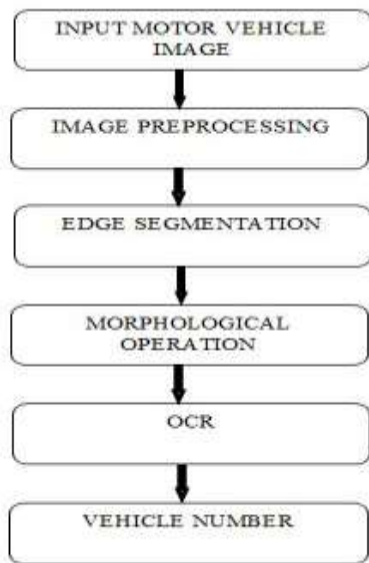


Fig. 1 Block Diagram for Image Processing

V. METHODOLOGY

In this system, which acts as the brain of the system, we use ARDUINO UNO (ATmegA328P) microcontroller because the entire system program instruction has been stored inside it. The image processing unit is used to identify the vehicle number by acknowledging the vehicle's number plate using OCR and using the pressure sensor to identify the weight of each vehicle and categorize the vehicles.

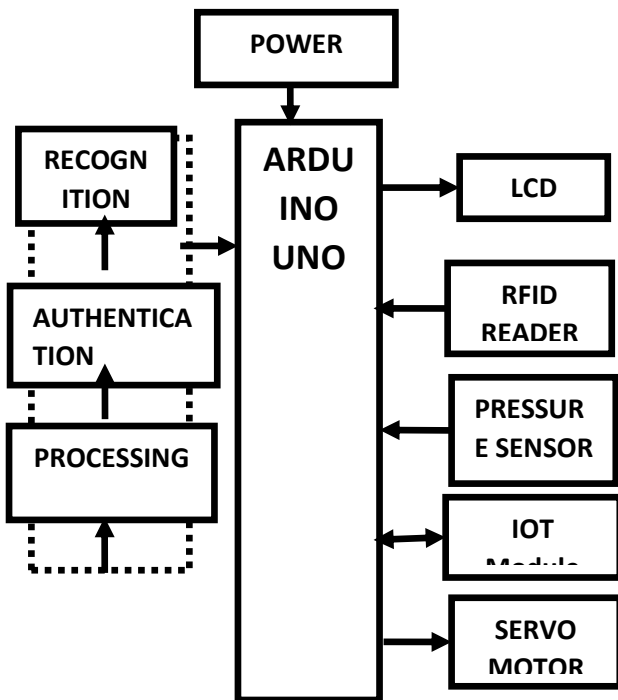


Fig. 2 Architecture Diagram

The money is collected based on the vehicle classification. RFID card tracks the money in the RFID card from the vehicle owner's account and vehicle database. If the car is a theft then the barricade does not open as if the barricade was operated using SERVO motor. The theft vehicle and other violated vehicles are detected by matching their vehicle number with the numbers given in the police notification. The theft vehicle is also detected using a pressure sensor as it monitors the vehicle weight and classifies the vehicle. If the vehicle does not have a relevant number plate based on its classification, the police are alerted. The toll payment and the toll process are displayed in the LCD screen.

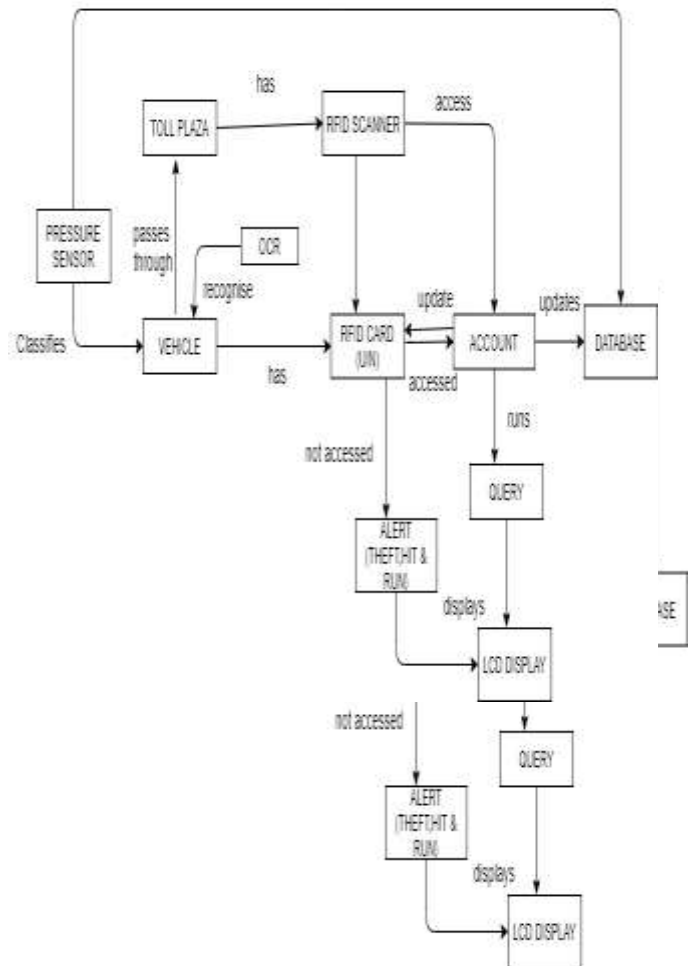


Fig. 3 Dataflow Diagram

VI. MODULE DESCRIPTION

a) Vehicle categorising using pressure sensor



When the vehicle is passed to the toll gate the pressure sensor in the gate detects the weight of the vehicle. By detecting the weight, the vehicle is categorised.

b) Vehicle number recognition

The vehicle number is recognised using optical character recognition. The OCR algorithm segments the number and texts using edge segmentation. It compares the segmented numbers and text with the database and when both matches it retrieves the data. It also recognises the characters in Tamil by using trained datasets.

c) Arduino interfacing with RFID reader

When the RFID card is scanned in RFID scanner, the antenna of the tag receives signals from an RFID reader or scanner and it returns the signal, usually with a few additional data. It compares the RFID card number with user details in the database and then the payment is done. If the number doesn't match with the database, then the illegal vehicle can be identified. And If the user does not have sufficient balance, an alert will be notified.

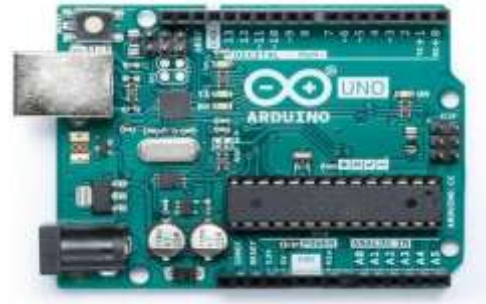
d) Theft detection and vehicle processing

When the vehicle is passed through the toll, the theft vehicle is detected using pressure sensor and number recognition by comparing the number with the vehicle that is categorised. Based on the vehicle category, the payment is done. If the comparison is mismatched, the theft vehicle is detected and the barricade does not open.

VII. COMPONENTS

a) ARDUINO UNO

The UNO is the best electronics and coding board to run. UNO is the most potent board on which the process can be actually processed. UNO is the most widely used and registered board within the entire Arduino elements. Arduino Uno is a platform based on an ATmega328P (datasheet) microcontroller. An ICSP header, a power jack and a reset key. Arduino is open source hardware. The reference hardware designs are authorized behind a creative common's attribution share-alike 2.5 permit and are available on the Arduino platform. "Uno" means one in Italian, and the label Arduino Software (IDE) release 1.0 was chosen. Version 1.0 of the Uno board and Arduino applications (IDE) is Arduino's reference models, now shifting to more recent releases. The UNO board is the first in a set of Arduino USB boards, and the Arduino platform reference model.



b) POWER SUPPLY

The Arduino Uno board can be powered by an external energy source or via a USB connection. Power system is automatically selected. External (non-USB) power may come from either an AC – to – DC converter, or a battery. You can connect the converter to the power jack on the board by plugging a centrally-positive 2.1 mm plug.

c) RFID READER

The reader has a radio antenna which emits waves; The tag replies by sending its data back.



d) RFID CARD

RFID tag is a microchip enclosed in a small packet with an antenna. The packet is designed to allow the RFID tag to be connected to an object to be monitored. The antenna of the tag receives signal via an RFID reader or scanner and then returns the signal with some detailed information, normally. RFID tags may be battery-supported inactive,



active, or passive. An active tag has an onboard battery and periodically transmits its ID signal. A passive tag is inexpensive and lighter, because it does not have a battery.

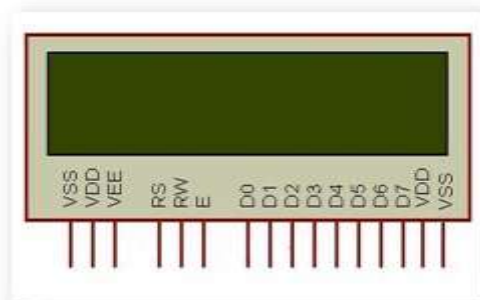
e) PRESSURE SENSOR

Pressure is measured by a pressure sensor, typically gas or liquid. Usually a pressure sensor act as a piezoelectric material, it produces a signal according to the pressure being imposed. Pressure sensors are used to regulate thousands of everyday applications and to track them. Pressure sensors can adjust significantly in terms of technology, design, performance, application suitability, and cost.



f) LIQUID CRYSTAL DISPLAY(LCD)

The LCD display is an electronic display monitor, and many applications are available. A 16x2 LCD monitor is a versatile screen that is extensively used in various applications and loops. These modules belong to seven segments and to other LEDs with multiple parts. The reasons are: LCDs are affordable, they are easy to implement; they have no limitations on showing unique and even special characters.



g) IOT

ESP-12E BASED NODEMCU:

This module comes with a USB connector built in, and a rich pin-out set. You can connect Node MCU devkit with a micro USB cable to your laptop, and just like Arduino you can flash it easily. Soon, it's breadboard friendly too.



h) OPTICAL CHARACTER RECOGNITION (OCR)

The Optical character recognition detects the data from a vehicle plate in this device and presents the results on the display when recording it into a text file, when node extracts the optical image and storage number in a text file from which it is moved to the system and is used for verification purposes.

VIII. RESULT

The labels that are as of now enrolled in the Arduino IDE might be authorised and given the entrance through the framework, even though the cars with tag however now not enlisted will be denied for the doorway and ringer will ring off and confirmed on the utility to inform the authority approximately the unapproved user. It also exams for the range plate in Tamil. Because, in TamilNadu there are numerous motors with the range plate in Tamil characters. The series of digital tolls increases person comfort and simplifies site visitors Stagnation. Under this system, safety at the toll booth will boom and identity of stolen vehicles becomes viable. A user needs to have a prepaid account devoted to it.





IX. CONCLUSION

The system helps in reducing the wait time at the toll plaza by using the technologies like RFID and Optical character recognition. Also, the theft vehicle and the hit and run vehicle can be detected easily by matching the vehicle number with the data stored in the cloud database. As the wait time is being reduced, it also helps in maintaining the heavy traffic. It also recognises the vehicle number which is in Tamil. Hence the Smart Toll Gate system can be considered as the best system when compared to the manual toll gate system. The system has been successfully implemented but still have enhancements to be done. The advancements include, sending the transaction details via SMS to the user's mobile. Also, instead of using edge segmentation for OCR, Google cloud vision API can be used where it also recognises user's face and also characters and numbers. Google API ensures high level security and also free to use their built-in functions.

X. REFERENCES

- [1] **Vulnerability Analysis of Highway Traffic Networks Using Origin-destination Tollgate Data**, Shi Fang, Kaigui Bian, 2016, IEEE.
- [2] **The shortest Path or Not? Analysing the Ambiguity of Path Selection in China's Toll Highway Networks**, Shi Fang, Kaigui Bian, 2016, IEEE.
- [3] **Analysis of E-toll card usage at pondok ranji tollgate** Andry M. Panjaitan, Jonathan Andrew,2018.
- [4] **A Survey on RFID based automatic toll gate management**, K. Gowrisubadra, Jeevitha, IEEE,2017.
- [5] **Transport Improved Intelligent System for Reliable Traffic Control Management by Adapting Internet of Things**, Ramkumar Eswaraprasad, Linesh Raja, IEEE,2017.
- [6] **Automated toll collection system using GPS and GPRS**, Sudheer Kumar Nagothu, IEEE,2016.
- [7] **A Unique Identity based Automated Toll Collection System using RFID and Image Processing**, Prakshaal Jain, Prashant Dhillon, Anand Vardhan Singh, IEEE,2018.
- [8] **Automated Toll Tax Collection System using CloudDatabase**, DipeshGarg; Rajeev Tiwari; ShuchiUpadhyay, IEEE,2018.
- [9] **Design and implementation of low-cost electronic toll collection system** Subhankar Chattoraj, SaptarshiBhowmik, Karan Vishwakarma, Parami Roy, IEEE,2017.
- [10] **Radio Frequency Identification (RFID) Based Toll Collection System**, Atif Ali Khan; AdnanI.ElberjaouiYakzan; Maruf Ali, IEEE,2011.
- [11] **Automated toll collection with security system**, P Kamala Kannan; M Balaji; A Avinash; S Keerthana; R. Mangayarkarasi, IEEE, 2010.
- [12] **A survey on automatic toll gate collection and management**, S. Aarthi; M. Indu; V. Sadhana, IEEE,2017.
- [13] **An Advanced Security system integrated with RFID based automated toll system**, Rafiya Hossain; Moonmoon Ahmed; Md. Mozadded Alfasani; Hasan U. Zaman, IEEE,2017.
- [14] **Design of Electronic Toll Collection System in Expressway Based on RFID**, Ren Zhengang; Gao Yingbo, IEEE,2017.
- [15] **Automated toll booth and theft detection**, P Arokianathan; V Dinesh; B Elamaran; M Veluchamy; S Sivakumar, IEEE,2017.