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FFICIENT IOT BASED AUTOMATED TOLL COLLECTION SYSTEM

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Abstract - *The major problem faced today is the traffic congestion. Due to the increase in the growth of vehicles, the toll booth becomes bottleneck while vehicles pass through the toll gate due to their manual operations. Since the manual operations can be slow, the automated toll collection system is very successful right now. Every vehicle is tagged with RFID tag. Since each RFID tag is unique, it represents the unique identification number for the vehicle. RFID reader can detect or sense the RFID tags and send the information to the IOT controller (Raspberry Pi). Sensed information can be looked into the database for getting the balance in the owner's prepaid account, and then the toll tax can be automatically deducted. For user interface, a mobile app will be developed with which the client can track the details of vehicle and payment logs. The purpose of this paper is to overcome the drawback of manual toll collection system.*

Key Words*:* Raspberry Pi, Toll Plaza, RFID(Radio Frequency Identification), Automated Toll Collection.

1. INTRODUCTION

The increase in the number of vehicles on the road give rise to traffic congestion. Most of the major roads have manual toll collection system, where every vehicle should stop and pay the toll tax and then leave the toll booth. Traditional toll system become worst at times on the popular routes, where the waiting time for the vehicles will be significantly high. So the objective is to develop an efficient and cost effective system for gathering toll.

This system assumes that every vehicle is equipped with RFID tag which represents 16 bit unique identification number of the vehicle. The RFID reader is used to read the tags and the sensed information is stored in the database. A program running on the minicomputer retrieves vehicle details from its database[1]. When the vehicle pass by toll zone, the sensors fitted on the road, sense and send the signal to the toll booth. The microcontroller based device activates the number plate sensor, which receives the vehicle number and sends it to the computer. The computer scans the database, and displays the details of the vehicle such as registration number, owner name, current status-clear etc[2]. Based on this information toll tax is automatically deducted and the cost information will be sent through GSM modem to a mobile phone of owner's account and if the balance is low the toll gate remains closed. This system can be used by the RTO, police department, public transport and cargo companies to track the vehicles. The entire system is connected to the internet and mobile app which provides user interface for owner to track the details of vehicle.

There are many other benefits of automated toll collections, the service time is reduced in comparision with manual collection. This in turn reduces congestion at toll plazas, fuel consumption, less air pollution.

2. EXISTING SYSTEM

There are two existing methods of toll collection, first is the traditional manual method which requires toll collector or attendant who collects the amount and issues the receipt. The other one is the smart card method where the person needs to show the smart card to the system at the toll booth. Both the mentioned methods are tedious and there are chances of escaping the payment of tax. The Existing methods are not an efficient and also based on centralized approach and the details about vehicles and other messages are not exchanged between toll plaza and toll authorities, hence it reduces the security and tracking capability

The existing system has following disadvantages:

- The traffic congestion at tollbooths.
- Requires man power.
- Time consuming.
- Fuel loss

3. PROPOSED SYSTEM

The main objective behind this proposal is to create automatic toll collection system. The term suitable here means minimal changes in the current infrastructure with maximum increase in efficiency. This system eradicates all the problems related to manual toll collection thereby achieving higher efficiency. IR sensor detects the arrival of vehicles at the toll plaza and RFID reader scans the tags of the vehicle and verifies it with the information in the database. If the vehicle status is clear, the gate opens and the appropriate toll tax is deducted and the cost information will be sent through GSM modem to a mobile of the owner. The status of the vehicle will be displayed on the LCD.

The advantages of proposed system are:

- Shorter queues at toll plazas by reducing the service

time at toll plaza.

- Pollution is reduced.
- There is no chance of escaping the payment of tax.
- Automatic toll collection: The toll tax is automatically deducted when the vehicle pass by the toll plaza.
- Vehicle theft detection: When the vehicle is stolen the owner of the vehicle can file complaint against the registration number, unique RFID tag number and when the vehicle passes by the toll plaza, it can be blocked by police.

4. DESIGN COMPONENTS

A. *Power Supply:*

This unit supplies power to the circuit, which is applied from the regulated power source. It consists of transformer, rectifier, filter and regulator.

B. *Raspberry Pi:*

Raspberry Pi is the microprocessor used in the toll gate block. The software program running on it retrieves vehicle details from its vehicle database.

C. *IOT modem:*

In this work, IOT gives flexible front end for all toll gate authorities to have a complete update of the vehicle such as toll collected, detection, how many vehicles passed, how many times vehicle passed, account details. These data can be exchanged through IOT to concerned authority and people. These data will be stored in the server; it can be accessed in real time.

D. *RFID Tag:*

RFID tag is an object, that is attached to the vehicle. Since RFID tag is unique, it represents unique identification number for each vehicle.

E. *RFID Reader:*

RFID Reader is used to scan or read RFID tagged items so that the tags can be made available to any tracking application. In this system, RFID reader is used to detect the RFID tag attached to the vehicle.

F. *IR sensor:*

IR sensor is a device that emits infrared light outside the visible spectrum. It detects or receives the IR light. In this work, the IR sensor is used to detect arriving vehicles.IR LED's are uised as IR transmitter and it continuously emits the IR rays towards the IR receiver.

G. *16X2 LCD Display:*

LCD (Liquid crystal display) is an electronic display, mainly used to display the vehicle details like vehicle number, name and so on and the deducted toll amount at the toll booth.

H. *Driver circuit and gate models:*

Motor driver is used to drive the motor. DC motor is used for opening and closing of gate.

5. SYSTEM ARCHITECTURE

Working principle

Figure 1 shows the architecture of the proposed system. First job is to detect the arriving vehicle using IR sensors. For that purpose, it has to pass through the IR transmitter-Receiver gate. Then it enables system to read RFID tag attached to the vehicle and the data is matched with the information in the database provided during registration. We assume that the vehicles are already registered and the toll gate remains closed for the unregistered vehicle or if the balance in the owner's account is low, he will be directed to pay toll manually. So this system can be used by RTO and police department to identify stolen vehicles and to block that particular vehicle. The details will be updated in the database server. The status will be displayed on the LCD. It also triggers the mechanism to generate the bill and the cost information is sent to the mobile phone of the owner through GSM modem. The whole system is connected to the internet and web app via server having the database of vehicles and users can use the app for monitoring. Each user will have unique vehicle number as username and password. After logging into the account, the user can see the all the related details. In case of insufficient balance, user can recharge using e-mode of the app.

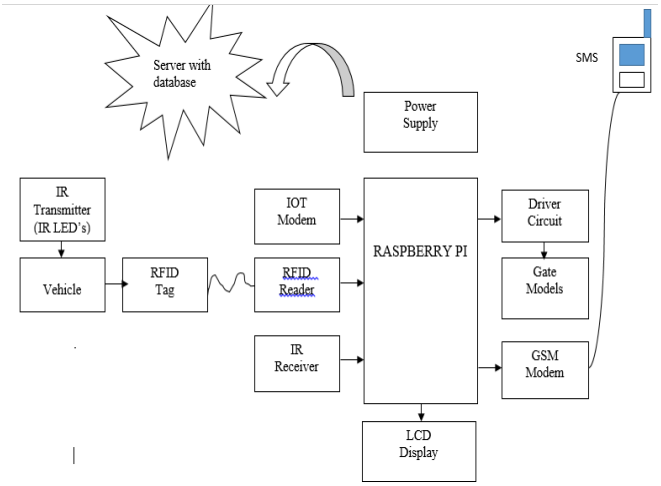

Fig 1. Automated Toll Block

6. FLOWCHART

Figure 2 shows the work flow of the toll booth when the vehicle arrives at the toll booth, RFID reader will validate the RFID tag that is attached to the vehicle. RFID reader scans the tag and if matches with the data stored in the database, the vehicle is allowed to pass. Otherwise, the toll gate remains closed and the system serves as an effective anti-theft system. When the stolen vehicle arrives at the toll plaza, RFID reader receives the RFID tag value and checks for theft registration. If the particular vehicle is stolen, then it is blocked and the information is sent to the concerned authority. Therefore, it is easy to trace the stolen vehicle.

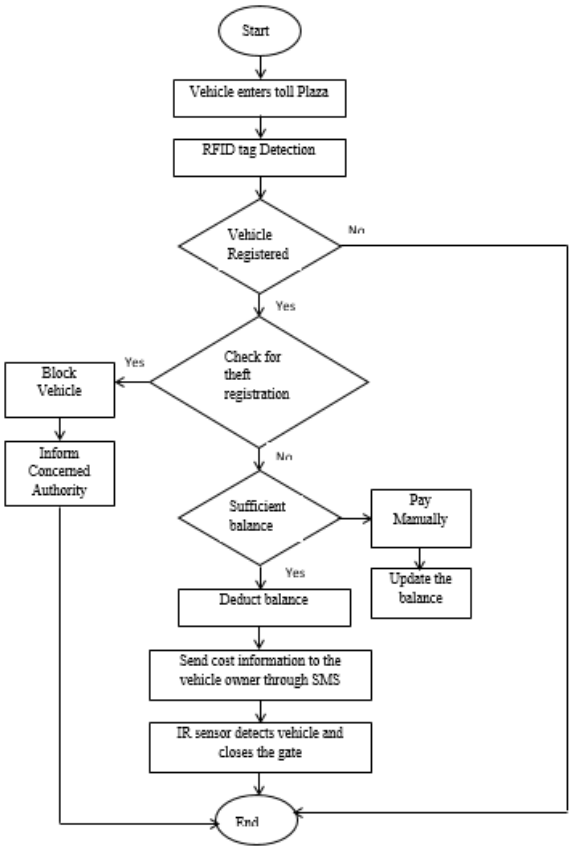

Fig 2. Flowchart for Automated Toll Block

7. RESULTS AND DISCUSSIONS

Figure 4 shows the automated toll block activity. The vehicle arrival will be sensed by the RFID reader that would read the tag number attached to the vehicle, the system verifies with information in the database, deducts the balance and updates the same on the database.

The vehicle and the web application both will hold relevance while connection with toll plaza. The vehicle upon being sensed will be verified from the data that is fetched from the database by the virtue of world wide web, the vehicle is then prompted into the toll booth and the amount is deducted from the application and the updated value is pushed back into the database again.

Fig 3. Automated Toll Block Activity

This system can reduce the real time problem of checking process at toll plaza and to reduce the waiting time and fuel consumption of every vehicle in the toll plaza because of automatic checking and automatic detection of amount. The stolen vehicle can be found when a complaint is filed and intimate the insufficient balance notification, while crossing of any toll plaza system. In addition to this, GSM module is combined with RFID system to send the confirmation text message to the mobile phone of the owner.

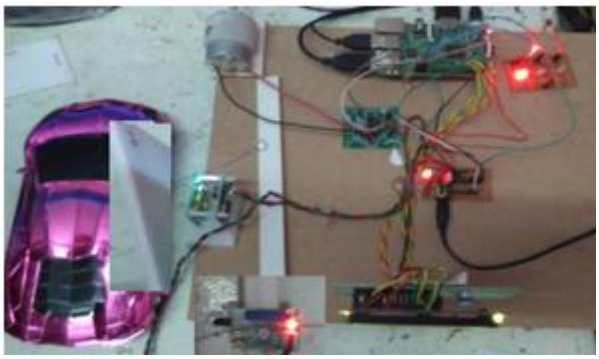

Fig 4. Hardware Setup of Automated Toll Block

Web Application

Fig 5. Screenshot of Login Page

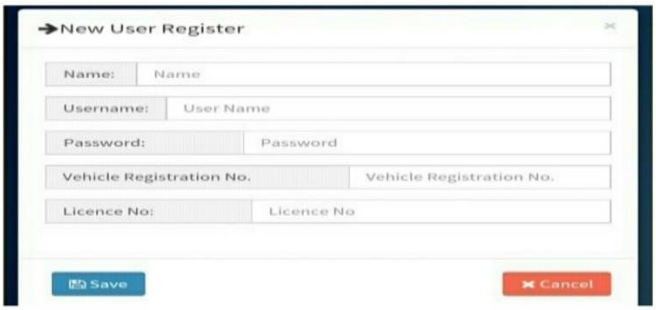

Fig 6. Screenshot of Registration Page

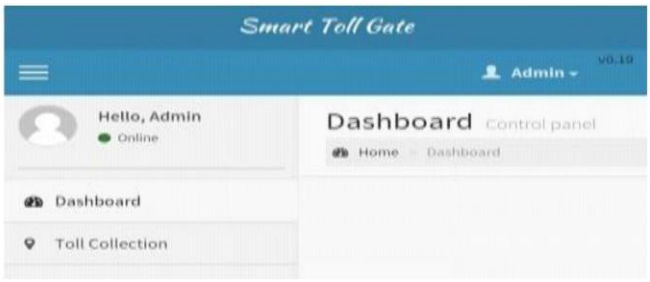

Fig 7. Admin Login

Fig 8. User Login

8. CONCLUSION AND FUTURE WORK

The automatic toll collection system is the best solution over traditional manual toll collection by reducing time consumption, manpower, traffic congestion at the toll plaza. By eliminating the human interaction in the entire collection process, we can create a better solution. In this paper, RFID system is used to the vehicle identity and in the design of the proposed system, toll collection and anti-theft solution have been developed. An anti-theft system which prevents passing of any vehicles is implemented, thus assuring security on the roadways. The system can be improved to implement vehicle type identification for more secure and valid payment.

REFERENCES

[1] Sana Said Al-Ghawi ; S. Asif Hussain ; Muna Abdullah Al Rahbi ; S. Zahid Hussain , *"Automatic toll e-ticketing system for transportation systems"*, IEEE 3rd MEC international conference on big data and smart city 2016.

[2] Janani Krishnamurthy; Nitin Mohan; Rajeshwari Hegde, *"Automation of toll gate and vehicle tracking"*, International Conference on Computer Science and Information Technology Technology 2008.

[3] Abdulkader, O., Bamhdi, A.M., Thayananthan, V., Jambi, K., & Alrasheedi, M, *"A novel and secure smart parking management system (SPMS) based on integration of WSN, RFID, and IOT"*,15th Learning and Technology Conference(L&T), 2018.

[4] Saarika, P.S., Sandhya, K., & Sudha, T, *"Smart transportationsystem usingIOT"*,International conference On Smart Technologies For Smart Nation(Smart Tech Con), 2017.

[5] Bahubali Akiwate, Manjunath Suryavanshi, Mallappa Gurav, *"Automated Toll Collection"*,International Journal of Advanced Research in Computer Science and Software Engineering, Vol 5, issue 10, oct-2015.

[6] V.Sridhar and M Nagendra, *"smart card based toll gate automated system"*, International journal of advanced research in computer engineering and technology, Vol1, issue 5, july 2012

[7] Colella, R., Catarinucci, L., & Tarricone, L, *"Evaluating the suitabilityof specific RFID tags for IOT applications through a new characterization platform"*, International Multidisciplinary Conference on Computer and Energy Science(SpliTech).