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Theft Detection using Internet of Things in Automated Toll Plaza

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ABSTRACT

Time is the most precious thing in this world, automation of toll plaza could be one of the best possible ways to save it. Automated toll plaza system using Radio Frequency Identification emerges as a converging technology where time and efficiency are matters of priority in toll collection systems of present day. Whenever the vehicle moves through the toll gate on any road, it is indicated on the RFID reader that the vehicle has crossed the clearing. The reader reads the information available in the RFID tag attached to the vehicle. Based on this information the controller first checks the criminal database for any sorts of complaints filed on the particular vehicle. If the data in the criminal database matches with the vehicle ID obtained over RFID then both the gates of the toll booth will be locked and a message regarding the identification of the stolen vehicle would be sent to the nearby police station. If there is no complaint on the particular vehicle ID then the transaction takes place through a centralized database and the payment receipt of the successful transaction is intimated to the user's mobile through Way to SMS. The need for manual toll based systems can be completely eradicated using this method. By implementing this system there would be a high possibility to reduce the number of vehicle thefts. Also, this would help to curtail the thieves from escaping to other places with the stolen vehicle. It would greatly help the cops to catch the thieves as the area to look for them would be minimized.

Keywords: *IoT, Stolen, Centralized Database, Raspberry-Pi, SQL, and Java Script.*

1. INTRODUCTION

Our life is changing very fast and the role of automation. In our day to day life is increasing at a very faster rate Men have no time to spare. The collection of tolls on toll plaza is a time-consuming process due to public too. Traffic Thus we congestion have thought and it causes automatic inconvenience toll collection to the system. Here the priority is for time and efficiency. The need for the manual toll-based system is completely reduced in this method and the tolling system works through RFID technology and the stolen vehicle can be easily identified by checking through the database coded through SQL and Java Script. Here the vehicle need not be stop on the toll gate, the amount is collected from the user's account from a tag in the vehicle using RFID technology and the transaction details will be sent to the user's mobile through 'Way 2 SMS' and if the data in the criminal database matches with the vehicle ID obtained over RFID then both the gates of the toll booth will be locked and a message regarding the identification of the stolen vehicle would be sent to the nearby police station. The picture of the vehicle is also captured and is sent over email.

A. Related Work

In [2], the author mentioned that the micro simulation model for the automated toll plaza system using RFID technology. The 8051 microcontroller is used for the control system. The signal is sent to the PC via RS-232 cable from PIC. In this system, the microcontroller is the main part of the system because of the signal is sent to PC and the output results showed on the LCD display. And then, the microcontroller sent the signal to the motor driver for opening the traffic gate.

In [3], the author explained that the RFID based automatic toll gated system. The frequency 928 MHz is used for the communication between RFID system and the control system. The microcontroller was programmed using the C programming language and Visual Basic was used in the serial communication between the computer and the RFID as well as with the PIC. The database was developed using Microsoft Access because it can contain up to 32768 records of objects.

2. METHOD FOR IMPLEMENTATION

A. Software Design

To accomplish the system, the choosing of software is very important. For the frontend coding software such as HTML, CSS, Java Script is used. For the backend, the software such as PHP is used and for the data base creation, MySQL is used. The Raspberry Pi microcontroller is programmed with the IDLE python tool.

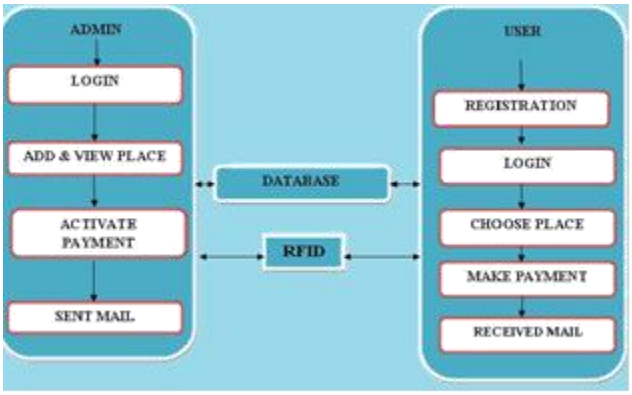

Figure1. Software Architecture

1) Frontend Software's

- **HTML**

Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web. Web browsers receive HTML documents from a web server or from local storage and render them into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document. HTML elements are the building blocks of HTML pages.

Some of the reasons for using HTML in frontend creations are, i) it is widely used, ii) Every browser supports HTML language, iii) Easy to learn and use, iv) It is by default in every window so you don't need to purchase extra software, v) HTML is the most search engine friendly.

- **CSS**

Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language. Along with HTML and JavaScript, CSS is a cornerstone technology used by most websites to create visually engaging webpages, user interfaces for web applications, and user interfaces for many mobile applications. CSS frameworks are pre-prepared libraries that are meant to allow for easier, more standards-compliant styling of web pages using the Cascading Style Sheets language. CSS frameworks include Foundation, Blueprint, Bootstrap, Cascade Framework and Materialize.

Some of the reasons for using CSS in frontend creations are, i) Separation of content from the presentation is easy, ii) site-wide consistency, iii) Easy to learn and use, iv) Page formatting can be easily done, v) Accessibility.

- **Java Script**

JavaScript often abbreviated as JS, is a high-level, interpreted programming language. It is a language which is also characterized as dynamic, weakly typed, prototype-based and multi-paradigm. Alongside HTML and CSS, JavaScript is one of the three core technologies of World Wide Web content engineering. It is used to make web pages interactive and provide online programs, including video games.

2) Backend Software

- **PHP**

PHP is a server-side scripting language designed for web development but also used as a general-purpose programming language. PHP code may be embedded into HTML code, or it can be used in combination with various web template systems, web content management systems, and web frameworks.

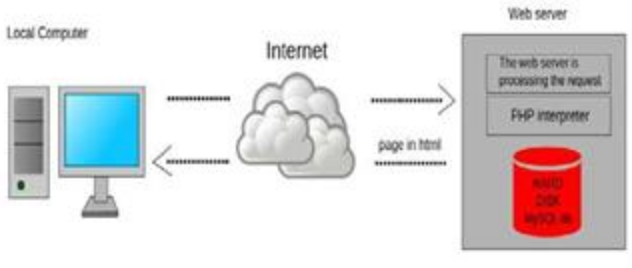

Figure2. Software Processing

3) Database Creation

- **MySQL:**

Structured **Q**uery **L**anguage is a third generation language for working with relational databases. Being a 3G language it is closer to human language than machine language and therefore easier to understand and work with. One of the main reasons for using this is due to cloud deployment. All the user information is to be stored in the cloud for verification purposes and this can be done by using this software.

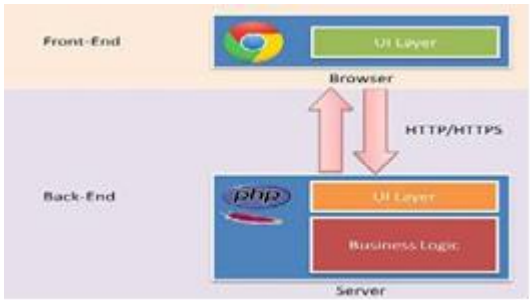

Figure3. Frontend and Backend format

4) Internet of Things

Internet of things (IoT) is the network of devices, vehicles, home appliances, and other items embedded with electronics, software, sensor, actuators and connectivity which enables these objects to connect and exchange data. Each thing are uniquely identifiable through its embedded computing system but is able to inter-operate within the existing internet infrastructure.

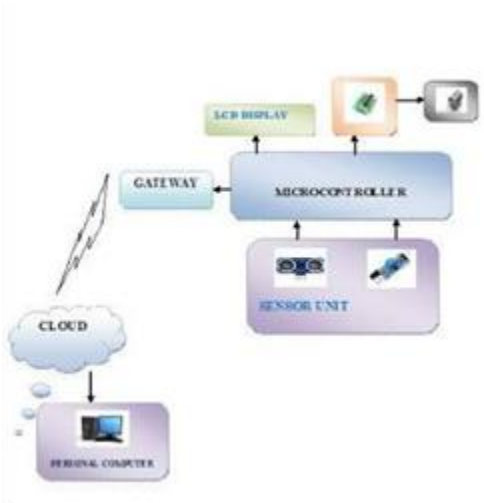

Figure4. Cloud processing

In this system, cloud plays a major role in saving the user's database online used for verification purposes. At the first stage, the information from the input devices can be given to the microcontroller and then it verifies the input with the database. Then based on the result obtained the output devices will work. This is the main reason for using IOT in this project.

B. Hardware Design

The hardware system gets the input from the user and it will be sending it to the raspberry pi microcontroller for data analytical purposes. The hardware system mainly consists of components like RFID, IR Sensors, Raspberry Pi microcontroller, power supply, motor drive, light indicator, and camera. The automated system using RFID technology can be classified into two modules. They are vehicle module and base module. The vehicle module consists of passive RFID tag. The RFID reader, host computer system and gate control system are composed of the base module. The block diagram of automated toll collection system is described in figure 5.

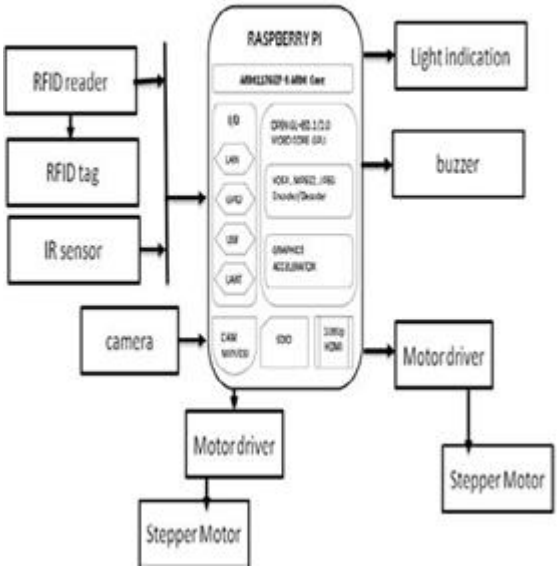

Figure5. Block Diagram

1) Raspberry Pi Microcontroller

The input from the camera, RFID and IR Sensor can be given to Raspberry Pi microcontroller for the analytical purposes. One of the main advantages of using Raspberry Pi over Arduino is, it is simple to interface with other hardware parts like camera, display, etc., It is a low-cost credit-card sized single-board computer. The Raspberry Pi was created in the UK by the Raspberry Pi Foundation. The Raspberry Pi Foundation's goal is to "advance the education of adults and children, particularly in the field of computers, computer science, and related subjects".

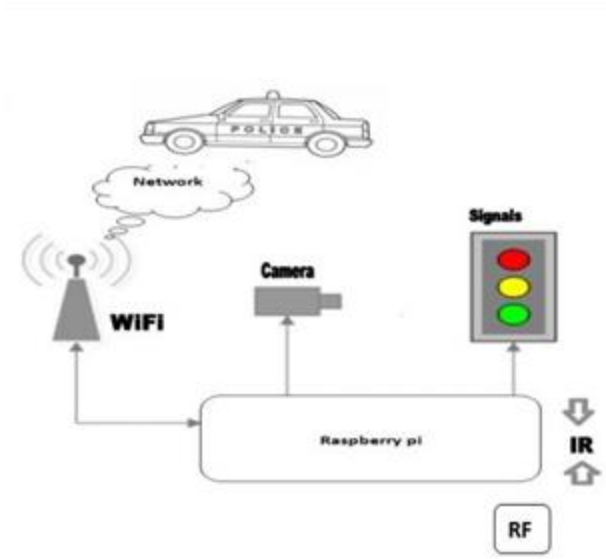

Figure6. Raspberry Pi interfacing with cloud

3. PROPOSED SYSTEM

The proposed method is to provide a fast and safe environment for toll collection and to automatically control the vehicle movements at the toll stations. IR sensor is used to detect the vehicle and the Gate models are used here to open and close while the vehicle is entering or exit in the Toll Tax unit. The RFID reader is used to read the tag of the vehicles. The Vehicle information is stored in the microcontroller based on the TAG number. Based on the number tax amount for that vehicle will be automatically deducted from the user's account and then payment receipt will be sent over message service to the registered mobile number of the user.

If the vehicle is free from any complaints, the information about the user such as date and time of crossing etc., will be logged into the database and then the amount would be deducted and confirmation mail and the message will be sent. If the vehicle number matches with the one in the complaint database then the toll doesn't open and buzzer alarms and also a message will be sent to the nearby police station.

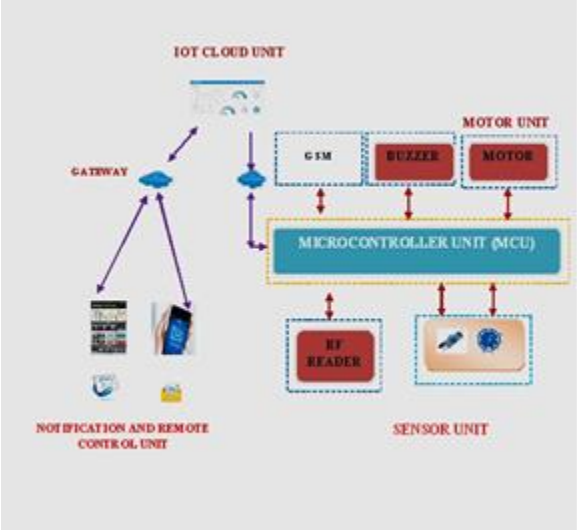

Figure7. Proposed System

The system can be seen clearly by showing the flow chart of the program. The overall flow chart of the toll collection system is illustrated as follow. Whenever the vehicle moves through the toll gate on any road, it is indicated on the RFID reader that the vehicle has crossed the clearing. The reader reads the information available in the RFID tag attached to the vehicle. Based on this information the controller first checks the criminal database for any sorts of complaints filed on the particular vehicle. If the data in the criminal database matches with the vehicle ID obtained over RFID then both the gates of the toll booth will be locked and a message regarding the identification of the stolen vehicle would be sent to the nearby police station.

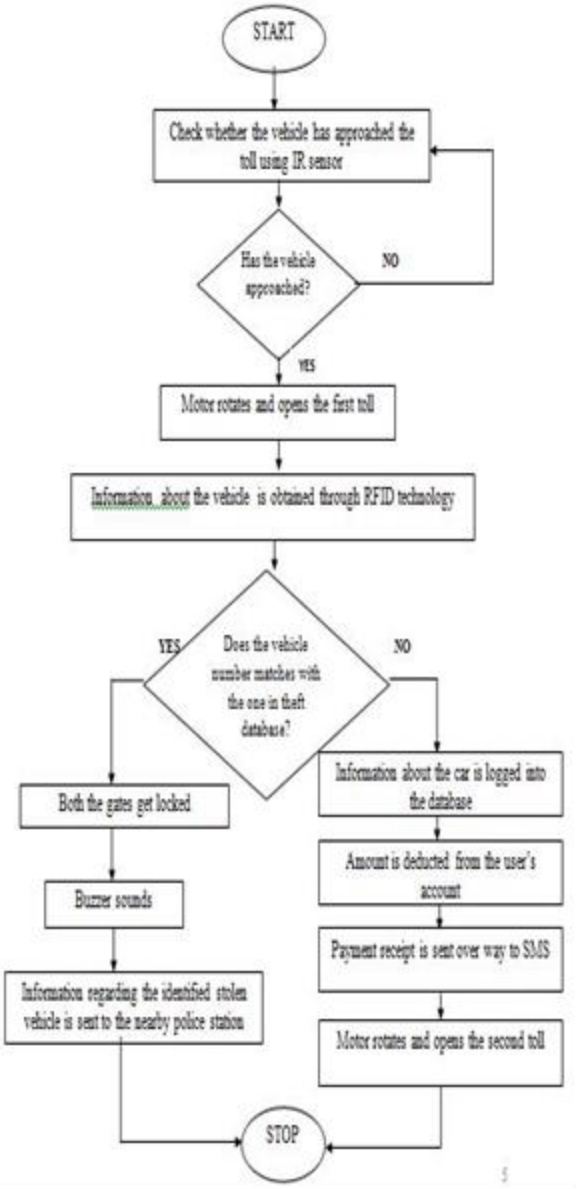

Figure8. Proposed Flow chart

The picture of the vehicle is also captured and is sent over email. If there is no complaint on the particular vehicle ID then the transaction takes place through a centralized database and the payment receipt of the successful transaction is intimated to the user's mobile through way to SMS. It is shown in flowchart 7.

4. WORKING SAMPLE

Whenever a vehicle approaches the toll booth, the unique code of vehicles identified using RFID technology is first compared with the data in the complaint database. If the vehicle is free from any complaints, it then logs the time, location and id of the vehicle in another database and then amounts is deducted and notification is sent to the user using GSM. If the id matches the one in the complaint database, the vehicle is restricted from passing through. Internet of things in toll plaza is done using programming languages such as Java and SQL and the information is logged in a cloud database.

Figure9. Sample Output for money deduction

5. CONCLUSION

This system mainly reviewed the research and development work for toll collection at the toll gate on the highway with the help of passive RFID technology and its use in stolen vehicle identification. RFID offers highly reliable data collection in harsh environments. RFID technology can provide new capabilities as well as an efficient method to collect, manage, disseminate, store, and analyze information It not only eliminates manual data entry but also inspires new automation solutions.

By developing this system, the knowledge of RFID system, Raspberry Pi microcontroller, the database constructions is realized. For this system, passive tags are better than the active tags because of low cost, low power consumption and also radio signals environmental factors. By using RFID based automated toll collection system, the vehicle can check for security with the passing time, save the time for toll collection and reduce traffic congestion at the toll plaza.

Therefore, the RFID based toll collection system is the best way for toll collection at the toll plaza. Also by implementing this system, there would be a high possibility to reduce the number of vehicle thefts and also to curtail the thieves from escaping to other places with the stolen vehicle. It would greatly help the police to catch the thieves as the area to look for them would be minimized.

6. ACKNOWLEDGMENT

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