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Theft Detection and Location Tracking in Electronic Toll Collection System Using RFID and AES Algorithm

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ABSTRACT

Typical methods for collecting tolls are manual collection, automatic toll collection via coin machines and Electronic Toll collection System. The existing toll collection system all over India is operated manually. A toll system is the place where toll is paid for passage of a vehicle from the toll plaza. In the existing toll collection system there are limitations like mismanagement of time, long queue for the payment. The aim of the project is to implement toll collection system using RFID technology to overcome demerits of existing toll system. This paper mainly focused on how the electronic toll collection system reduces manual work load using RFID technology. Ultimately, this system reduces environment pollution due to the burning of fuel as well as reduces the waiting time of users in toll queue. User can access the toll collection system webpage and may perform their money transaction from any location. Their transaction will reflect in the centralized database. Due to the use of online transaction, users do not need to carry cash with them and this leads to reduction of human error occurring at the toll booths. Also the police admin can add the theft car details and this tollgate system will block the vehicles which are added by police admin. The cloud data will gets encrypted and decrypted using AES algorithm.

Keywords : Theft Detection, Electronic Toll Collection System, AES Algorithm, RFID, M-Toll, ETC

I. INTRODUCTION

All over the India there is only manual toll collection system. The proposed work is to make the toll collection system totally electronic with the use of Wi-Fi and IoT technology. The automatic toll collection system is a technology enabling the automatic toll collection of toll payments through online and also to identify the vehicle. The technology has been studied by researchers and applied in various highways, bridges, and tunnels and there is a requirement of such process

This system has a capabilities of determining whether the vehicle is registered or not, and then informing the authorities of toll payment violations, debits, and participating accounts. The most obvious advantage of this Technology is the opportunity to eliminate congestion at tollbooths, especially during festive seasons when traffic tends to be heavier than normal. It is also a method by which we can prevent complaints from vehicle owners regarding the inconveniences involved in manually making payments at the tollbooths. So to overcome this, authorities are applying automatic toll collection system to make benefit for toll operators.

1.1 Manual Toll Collection

The manual toll collection system is a process of paying money in toll booth to toll operator by

waiting for a while in a toll booth. The toll payments will be differ by the each type of vehicle and the toll collector determines the amount to be paid by each vehicle.

1.2 M-Toll

Automatic Vehicle Identification is a technology will identify the type of vehicles at highway speeds and thereby enabling the automatic toll collection applications. When a vehicle passing through a toll collection booth there will be a RFID device reader, after which the toll system is deducted from the customer's pre-existing account or the customer is sent an invoice. The driver pays the toll without stopping and tollbooths are not required. The automatic toll collection system also determines whether the vehicles passing are registered over the online webservers, and retrieves the information of the vehicle for further collection or to block the vehicle.

This paper gives the simplified procedure to passengers to pay the tolls by making them automated and also provides intimation about vehicle. These activities are carried out using RFID tag thus reducing the efforts of carrying the money and records manually. The RFID Readers mounted at toll booth will read the prepaid RFID tags fixed on vehicles windshield and automatically respective amount will be detected. Since every vehicle registration ID is linked to user account, toll can be deducted from the account bank directly.

II. LITERATURE REVIEW

This section provides the basic significance of workflow scheduling in cloud. It also provides the numerous methodology. This development has resulted in huge usage of many applications. Toll Collection Technology and Best Practices-. In the research, toll collection technologies and practices are discussed with less benefits for both vehicle owners and toll collection systems. The developments and enhancements are reviewed. The research will have recommendations to develop the vehicle identification/registration systems with the potential to go beyond the tolling function to include other desirable transportation system management functions.

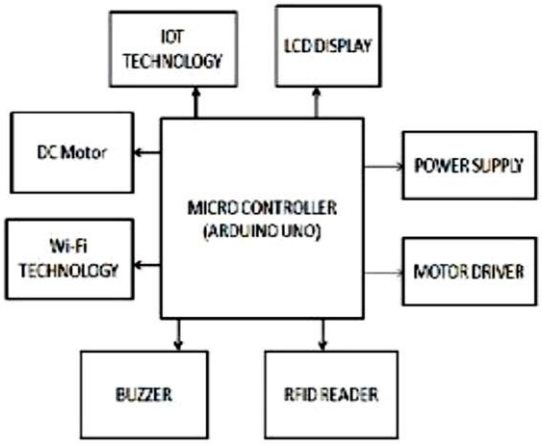
M-Toll Using Wi-Fi Technology-.The aim of the project is to implement toll collection system using Wi-Fi technology to overcome demerits of existing toll system. A Mobile Wallet has a proposed work where users do not need to carry hard cash while travelling. Wi-Fi toll collection stations allow the traffic to flow continuously, and vehicle being stopping and starting again. Thus it reduces fuel consumption and has non pollution effect on environment. M-toll payment system will leads to automatic and easy toll payment in toll collection booth. The user need to be register the vehicle details by vehicle owner and it will be stored in the database of toll tax system. Wi-Fi technology will help the toll collection system to make the payments in quick manner.

Electronic Toll Collection Systems-an system has ability of electronically charging a toll to an established customer account. The system will determine and identify whether the vehicle passing the toll booth is registered, if registered automatically charging those vehicles and if not, alert the local highway patrol about users that are not registered. The ETC method allows vehicles to pass through a toll facility without requiring any action or stopping by the driver.

The proposed work gives the simplified procedure to passengers to pay the tolls by making them automated and also provides intimation about vehicle. The activities are carried out by using RFID tag thus saving the efforts of carrying money and records. The RFID Readers mounted at toll booth will read the

prepaid RFID tags fixed on vehicles windshield and automatically respective amount will be detected. Since every vehicle registration ID is linked to user account, toll can be deducted from the account bank directly. When vehicle is stolen the owner registers complaint on the website with its registration ID and unique RFID tag number.

Now when stolen vehicle passes by the toll plaza, the tag fixed on it is matched with the stolen Vehicles tag in the database at the tollbooth. The vehicle ignoring the traffic signal will be detected by the RFID readers which is fixed at signal crossing and it will be notified to the traffic police. This can be done efficiently and great Accuracy. Vehicle travelling above speed limit can be tracked with 100% accuracy.



The main objective of this paper is to provide automatic toll paying system and also eliminate delay on road side. When the vehicles enter the toll booth, the RFID reader reads the RFID tag that is placed on the vehicle. The microcontroller checks if is valid or not. If it is valid microcontroller checks it has sufficient amount or not.

If it has sufficient balance the microcontroller senses the signal to DC motor to open the toll gate. And then the dc motor allows the vehicle to pass through the toll gate and also at a time the required amount has deducted from the owner prepaid account. If otherwise is does not allow the vehicles to pass through it. IoT is used to inform the current account details to user. The account will be rechargeable.

III. METHODS AND MATERIAL

3.1 AUTOMATIC TOLL COLLECTION

When the vehicle is going to enter into the toll plaza, the first aim is to detect the type and no. of the vehicle. Then we have here the RFID system. In this system the tag which is stickled at the front glass of the vehicle is detected by the RFID reader and the data is matched with the data base provided at every tollbooth. Since every vehicle ID is linked to users account (toll account), automatically respective amount will be deducted.

3.2 THEFT DETECTION

The database will maintains the whole list of vehicle owners as the vehicle registration could only become successful after fixing the RFID tag on the vehicles according our proposed scenario. Thus when an unauthorized vehicle The vehicle owner could report the vehicle theft to the person who handover the particular vehicles tag id to the toll booth user. The person who is authorized to view the vehicle details on the monitor and could prevent the vehicle from getting passed through the toll gate and catch the theft red-handed.

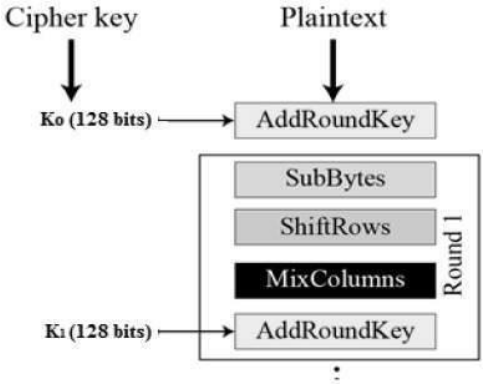
3.3 LOCATION TRACKING

The proposed work will consist of GPS system in every Toll collection plazas. The GPS system is connected to IoT devices which will make the toll system to automatic collection of toll payments and also helps to detect the blocked vehicles. The toll collection system is connected to Wi-Fi module and so the system will intimate the user about the bill payments and the location where the bill paid.

3.4 ENCRYPTION AND DECRYPTION

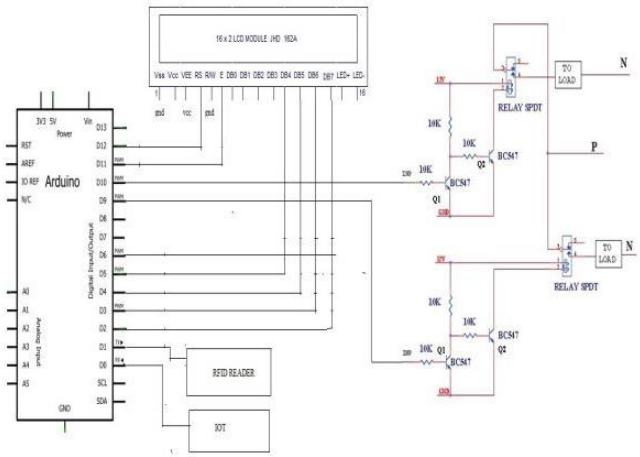
The data transferred through wire will always happen to data loss or any data corruption and it is always a vulnerable to security. It is always recommended to encrypt such information and transmit those confidential data. Java provides multiple encryption algorithm for this. In this project, we use AES (Advanced Encryption Standard) symmetric encryption algorithm in java with CBC mode which is faster and more secure than 3DES. AES stands for Advanced Encryption System and it's a symmetric encryption algorithm. The AES algorithm will request a engine where it requires a plain-text and a secret key for encryption of data and same secret key is required to decrypt the data. AES algorithm will be used with CBC mode to encrypt a message as ECB mode and is not semantically secure. The IV mode should also be randomized for CBC mode.

The same key is used to encrypt all the plain text and if attacker finds the key then all the cipher can be decrypted in the similar way. The usage of salt and iterations will improve the encryption process further. In the following example we are using 128 bit encryption key.




```
Initialization
password, key, time, salt : string
time ← get_time
input ← (password)
key ← salt + time
Encryption
chipertext ← AES encrypt (password, key)
output(chipertext)
Decryption
key ← salt - time
for as much tolerance given time
    if key = get_time
        key ← salt + time
        plaintext ← AES decrypt (chipertext, key)
    end if
end for
output(plaintext)
```

3.5 CIRCUIT DIAGRAM



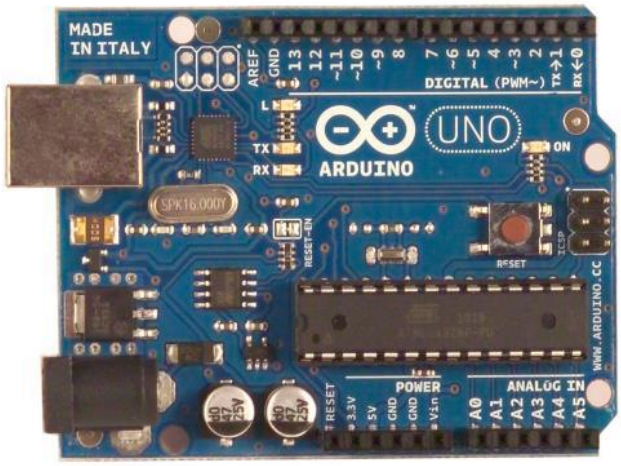
IV. HARDWARE REQUIREMENTS

1. ARDUINO
2. RFID Reader and Tags
3. Wi-Fi technology
4. DC motor
5. Keypad
6. Relay

4.1ARDUINO

The Arduino is a microcontroller board which is based on the ATmega328. It consists of 14 digital Input/output pins where 6 can be used as PWM

outputs and as 6 analog inputs.It as a 16 MHz crystal oscillator, a USB connection, has a power jack, and an ICSP header, and also has a reset button. It contains everything that are needed to Support the microcontroller and it is simply connected it to a computer by a USB cable or power with an AC-to-DC adapter or battery to get started. The Arduino devices differs from all preceding boards where it does not use the FTDI USB-to-serial driver chip. The Uno and version 1.0will be the reference versions of Arduino in moving forward for updated version. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform and it comparison with previous versions.



4.2RFID READER AND TAGS:

RFID reader is used to read information which is stored in RFID tag. The reader operated on 125 KHz which contain on-chip antenna which can be powered with 5V power supply. The Reader is attached to computer or any microcontroller but in the proposed system is connects it to the computer and through which it communicate with Arduino board. Communication range of reader is 2-10 cm. RFID tags will contains the information stored in the tag and the data is readed when it is tap on to the reader.

Product Features :

- ✓ Low-cost method for reading passive RFID EM4100 family transponder tags
- ✓ Reading Distance 10-15CM of the reader (Depend card shape)
- ✓ 125kHz read frequency
- ✓ 9600 baud RS232 serial interface
- ✓ Standard 2.54mm Pitch Bergstrip connector
- ✓ Bread Board compatible
- ✓ Low power Requirement 7-9V @ 100mA
- ✓ Small Size
- ✓ Built in Antenna
- ✓ No components at PCB bottom side (easy to stick to any surface like wood, glass etc.)
- ✓ Status LED for card detection
- ✓ On-Board Power LED

Key Specifications

- ✓ Power requirements : 7-9VDC
- ✓ Current Requirement : <110mA
- ✓ Communication : RS232 Serial at 9600 baud (8N1)
- ✓ Dimensions : 63mm x 98mm x 5 mm
- ✓ Operating temp range : -40 to +185 °F (-40 to +85°C)

4.3 Wi-fi TECHNOLOGY:

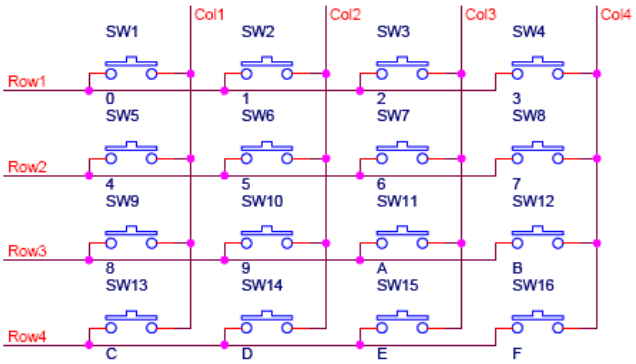
Wi-Fi is a local area wireless technology that allows an electronic device to participate in computer networking using 2.4 GHz UHF and 5 GHz SHF ISM radio bands. Many devices can use Wi-Fi such as computers, video-game devices, smartphone's, digital cameras, tablet computers and digital audio players. Wi-Fi is a radio frequency (RF) specification for long-range point to point and point to multipoint voice and data transfer. These can connect to a network resource such as the Internet via a wireless network access point. Such an access point (or hotspot) has a range of about 20 meters greater range outdoors.

4.4 DC MOTOR:

An electric motor is a machine which converts electrical energy into mechanical energy and so the toll gate will open and close the gate. DC motor works on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. The DC motor is connected to IoT devices, if vehicle is processed with toll payments then the toll gate will be opened, the motor starts to rotate the gate.

4.5 KEYPAD:

In a key pad it has a one or more then one keys are placed in a PCB. And all the keys are commonly grounded. This is the main difference to compared to matrix keypad. This key pads having maximum 8 numbers of keys. more then 8 keys are can not be connected because its not a efficient one. If we need more then 8 kays means, then only we can operate it a matrix keypad.



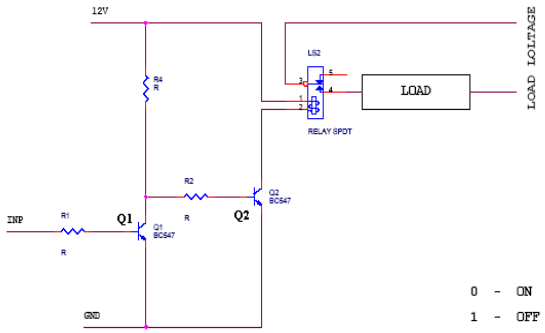
4.6 RELAY:

Relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one

circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil.

SCHEMATIC DIAGRAM



V. CONCLUSION

The proposed system will have the implementation of Wi-Fi technology in the application of toll tax system. Wi-Fi toll collection stations allow the traffic to flow continuously and vehicle having been avoided stopping and starting again. The combination will reduce fuel consumption and has positive effect on environment i.e. Pollution created will be minimum. Implementing the Wi-Fi technology is also not so costly. Manpower and cash risks are also reduced to minimum. Furthermore, only a minimum of traffic disruption is caused during installation.

The system will increases safety, as bottle necks and long queues are avoided. Society and business community also gain from the system as it results in faster transportation. The system is cost-effective, time saving and easy to install which benefits the operator as well as user. IoT based toll booth monitoring system is a Arduino based toll collection system. The results obtained from working have shown that the system performance is quite reliable. The system has successfully overcome the shortcomings of the existing system by reducing the man power at the toll booth. It provides easy way of toll collection and maintenance of the information.

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