

SMART TRAFFIC ENFORCEMENT: RFID-GSM AUTOMATED E-CHALLAN SYSTEM WITH REAL-TIME ALERTS TO RTA

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ABSTRACT

Motor vehicle accidents are a major global cause of death, with a particularly high rate in developing countries. Approximately 3,000 accidents occur worldwide due to poor traffic management, and in India, nighttime accidents are prevalent due to the absence of traffic police. The current solution involves CCTV cameras to capture traffic violations, but these require manual monitoring, and vehicle numbers may sometimes be obscured. To address this, an RFID-based system integrated with traffic signals is proposed. Each vehicle is fitted with an RFID tag storing its details in a database, while an RFID reader is installed at zebra crossings and connected to NodeMCU. When a vehicle crosses during a red signal, the RFID reader captures the tag information and sends it to NodeMCU, which automatically generates an e-challan. The microcontroller verifies this data against the stored database and sends the challan via GSM to the registered mobile number of the vehicle owner and the Regional Transport Office (RTO). The owner can pay the challan at the RTO or online if linked to a digital payment system. Additionally, the system enables tracking of vehicles driven by unauthorized drivers, as traffic signal databases are linked to the RTO for security purposes. By leveraging RFID technology, which uses wireless data transmission between tags and readers, this solution automates traffic rule enforcement, reduces manual dependency, and enhances road safety by ensuring compliance with traffic regulations through real-time monitoring and automated penalty processing..

Keywords: RFID-GSM, Signal Jump, E-Challan System, Auto Alert, RTA (Regional Transport Authority), Motor Vehicle Accidents, Traffic Management System, RFID Device, Zebra Crossing, Traffic Signal Break

INTRODUCTION

Governance in a diverse, vast, and rapidly developing country like India presents significant challenges. To drive large-scale transformation and effectively implement government initiatives, India requires cutting-edge technology. As one of the fastest-growing economies, ensuring equitable growth remains a crucial priority. This project aims to contribute to e-governance, addressing the needs of India's large and densely populated society. By leveraging advanced digital solutions, it enables real-time access to essential services, bringing governance to citizens' fingertips for a more efficient and inclusive future. Create your profile with your vehicles to get notified on New Challans Raised against your vehicles. So never miss a payment on your challans Who wants to buys someone else's challans along with their vehicle or keep track of how obedient their dear ones are obeying traffic rules So now you can search for all pending challans on your vehicles and pay right then and there through the App or to list all the violation history of a particular vehicle. We offer a lot of FAQ's and Driver education is definitely our Forte for betterment of road safety on our roads. Firstly, the number plate of the vehicle will be scanned and the number will be recognized using the text recognizing API, then through the number of the vehicle all the data of the owner will be fetched using the vehicle RC details API. After that the Cops can easily file a challan against the offender

and all the details regarding the challan will be recorded and will be saved in the database for later uses. Secondly, through the app Cops will be able to save the faces of the offenders and can be easily saved in the database, all this can be done using the face recognition API, also for client end that is for normal people especially for women, this app packs a feature for women safety which includes a feature of emergency button that triggers a function that executes as soon as it has been called which will send the current location of the victim to the nearby Police Station Through the app the Police can be able to fine someone for various reasons such as over-speeding, red Light jumping etc. Fetching data from the app will make it convenient for the Police and to store all the fines for later inspection. We can further extend the project by implementing the facility for normal people to use the app and can communicate to the nearby Police station in case of an emergency like in case of stolen vehicles, so that they can complain the Police immediately. We are developing this application because in this today's lifestyle the workflow of Government servants like the Police has become very hazy and tough due to the current increasing population, which increases their work pressure, so this application can act as a companion for them as this will reduce their work, along with the women safety which is an additional and very key feature of the application. support needed for managing and monitoring traffic penalties. It is also a type of decentralized information system which allows all the stakeholders to access the needed information anytime anywhere. In the following sections a detailed Smart cop can make the process of challan very easy and less time consuming as it follows a very simple way of generating a challan .

2.LITERATURE SURVEY

Priya amble [1] : The Project detects any signal break by the vehicle on the traffic signals and generates the E-challan through implementation of programming and hardware mechanism. Deploying the RFID technology which create tags storing data and transferring that data to readers over a wireless interface. Microcontroller compares this reader's information with previously stored information of that vehicle after correlate. It sends the texted message (challan) to GSM. It sends to registered mobile number of owners of that vehicle as well as RTO (Regional transport office) office. Owner has to pittance the challan amount to the RTO office or can pay online if linked to online payment system. This system also provides the tracking of vehicle driven by unidentified vehicle driver. Since vehicle would be among traffic signals and database are bond online to RTO office as protection purpose.

Abhinandan Jain [2]:This paper presents the development of a fully Automated Energy Meter which is having capabilities like remote monitoring and controlling of energy meter. Automatic Meter Reading system (AMR) continuously monitors the energy meter and sends data on request of service provider through SMS. It saves huge human labour. The data received from an energy meter has been stored in database server which was located at electricity Board station through SMS gate way for further processing by energy provider. Energy provider sends electricity bill either by e-mail, SMS or by post. This system allows to the customers to pay bill online either by credit card, debit card or by net banking. This system provides freedom to electricity companies to take action against lenient customers who have outstanding dues, otherwise companies can disconnect the power of customer .Companies can re-connect the power after deposition of dues. This system also gives the power cut information and tempering alert. So GSM based AMR system is more efficient apropos convention billing system.

H. G. Rodney Ta [3]:The development of a GSM automatic power meter reading (GAPMR) system is presented in this paper. The GAPMR system is consists of GSM digital power meters installed in

every consumer unit and an electricity ebilling system at the energy provider side. The GSM digital power meter (GPM) is a single phase IEC61036 standard compliance digital kWh power meter with embedded GSM modem which utilize the GSM network to send its power usage reading using short messaging system (SMS) back to the energy provider wirelessly. At the power provider side an ebilling system is used to manage all received SMS meter reading, compute the billing cost, update the database, and to publish billing notification to its respective consumer through SMS, email, Web portal and printed postage mailing. A working prototype of the GAPMR system was build to demonstrate the effectiveness and efficiency of automatic meter reading, billing and notification through the use of GSM network.

Sudhish N George [4]:The technology of e-metering (Electronic Metering) has gone through rapid technological advancements and there is increased demand for a reliable and efficient Automatic Meter Reading (AMR) system. This paper presents the design of a simple low cost wireless GSM energy meter and its associated web interface, for automating billing and managing the collected data globally. The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider. Also they can monitor the meter readings regularly without the person visiting each house. A GSM based wireless communication module is integrated with electronic energy meter of each entity to have remote access over the usage of electricity. A PC with a GSM receiver at the other end, which contains the database acts as the billing point. Live meter reading from the GSM enabled energy meter is sent back to this billing point periodically and these details are updated in a central database. A new interactive, user friendly graphical user interface is developed using Microsoft visual studio .NET framework and C#. With proper authentication, users can access the developed web page details from anywhere in the world. The complete monthly usage and due bill is messaged back to the customer after processing these data

G. Thavasi Raja [5]: In every aspect of life, electronics plays a vital role. Though many technological innovations are taking place in this world, existing electricity consumption billing process seems in India to be very obsolete and does not meet the latest technology available. In this paper, the above said process is totally automated and the communication is made possible entirely through the power line. This communication is bi-directional at a faster data rate through long distances. By digitizing, the currently used analog energy meter has been completely transformed to a digital one. Hence it is beneficial to the customers as the system is made very user friendly.

Guilin Zheng [6]: A novel intelligent wireless electric power management and control (IWEMC) system based on ZigBee technology is presented in this paper. It evolves from the traditional automatic meter reading (AMR) system. The IWEMC system includes intelligent electric meter, data collector, concentrator and specialized analysis software. Compared with AMR system, IWEMC system has three outstanding advantages: (1) ad-hoc communication network based on ZigBee technology; (2) synchronous acquisition of various power parameters; (3) distributed data storage. Transformer power supply area is the basic unit of IWEMC system. Power line loss and the characteristics of power grid and load can be achieved by monitoring the electric power consumption process of high voltage power line, low voltage power line and load of the transformer unit. IWEMC system proposes strategies of energy conservation by analyzing the relationship between electric power supply and consumption, on-line and real-time diagnosing the operation of power grid and equipment.

Champ Prapasawad [7]:In this paper, we propose a development of an automatic meter reading system focusing on the design for an energy meter implemented with ZigBee wireless

communication protocol conforming to IEEE 802.15.4 standard. We use a microcontroller STM32L152VBT6 to manage energy data and ZigBee to enable communication between the energy meter and data centers.

N.S. Malik [8] :Mobile agent is a suitable paradigm to collect information from multiple sites in a distributed environment. As compare to other technologies, mobile agents can be used beneficially for Automatic Meter Reading (AMR) and to measure power quality information at each energy meter. Since meter contains embedded system, so the choice of agent platform for such an application is very important. This article investigates different methods from literature that use mobile agent paradigm for AMR process. It proposes a method that reduces the total security computation cost which is incurred in AMR process. In this method, energy meters are organized in the form of a group based upon the geographical location. In such one location energy meters perform their jobs under a security manager. In this method, the concept of local mobile agent is proposed to avoid the visit of external mobile agent to energy meters directly. Local mobile agent carries the acceptable queries from security manager and visits energy meters. This article uses mathematical modeling to represent the security computation cost incurred by each method from literature and compare it with the propose method. It is concluded that the proposed mechanism reduces the security computation cost considerably, compared to other methods.

Subhashis Maitra [9] :In this paper, a new concept of energy meter will be discussed, where maximum demand of energy of a consumer will be indicated in the meter used by the consumer. After exceeding the maximum demand, the meter and hence the connection will automatically be disconnected by an embedded system inserted in the meter itself. According to the maximum demand, the consumer will purchase a cash-card of amount depending on the consumption of energy and after the full consumption, the consumer again has to purchase another cash-card or recharge the same and thus the hassle related to go to the billing office, to stand in a long queue and to submit the bill, can be avoided. Also this system helps to eliminate the draw backs of billing management system, such as to take the reading from the meter, to create the bill, to print the bill, to send the bill to the proper address and to collect the amount for the bill. Hence this system can effectively reduce the man power required to a great extent. Also a new concept of a distributor has been dealt here which is used to disconnect a line if the energy consumption per day of a consumer greatly exceeds a pre-demand energy consumption per day. With the help of this system electric supply authority can detect a power hacker also.

Roger David Boyle [10]: proposed a vehicle detection model to control traffic. In the model, pixel comparison of foreground and background images is executed instead of edge detection. Thus, the effectiveness of the system is improved. After pre-processing of the image, the daytime images and nighttime images undergo different processing methods. For daytime, execution of the conversion of RGB images to greyscale images takes place. Then, a mask created with specific coordinates for a particular road uncovers the road portion of the background image from the foreground image. For nighttime, extraction of the road portion of the foreground image takes place by utilizing a mask generated for a particular road with distinct coordinates. The average accuracy of day and night time for the proposed model is 95%.

3. PROPOSED SYSTEM

The main objective of the system is to develop a RFID-GSM based signal jump to collect the traffic violation in the form of image, text. It uses a ESP32 as a processor. ESP32 is equipped with a Portable

Projector/LCD display. We can display messages and can be easily set or changed from anywhere in the world. In addition, mobile application is used to convert voice into text. Here the voice is pass through the voice reorganization system and converted into text.

The system will send this message to cloud. Then it passes to the which is connected to internet by Wi-Fi. The processor, process it and displayed on the screen. We can send the message to all the screens or desired screen.

The proposed system consists of two main units.

1. Controller unit

2. GSM unit

In this proposed system, the message sent from an authorized user to the GSM module we open the app and give some message, the GSM module takes that message and sends it to the Arduino which has a code written in it in Embedded C, for the message to go from the GSM to the LED. Arduino converts the message and sends it to the ESP32 which has a code written in python for text to speech conversion. The message gets stored in the buffer and if it's valid, the message gets displayed on the LED and also comes out through the speaker.

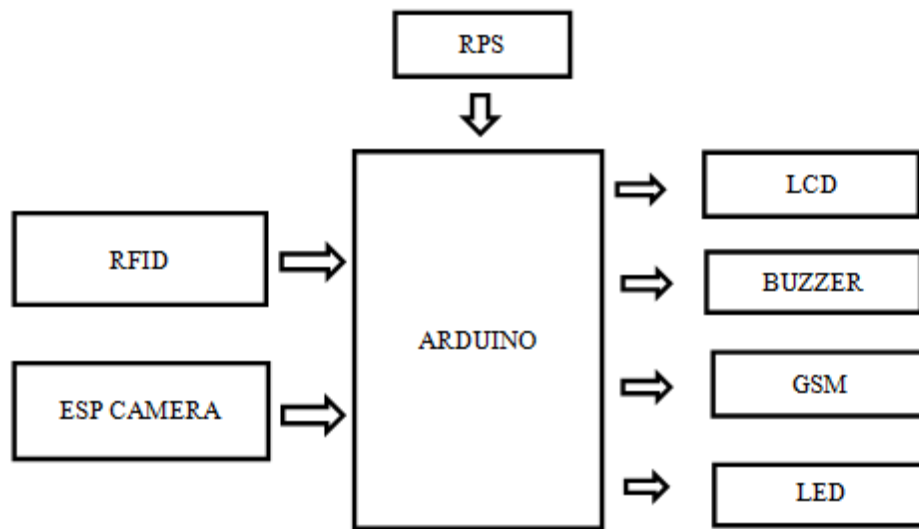


Fig: Block Diagram of the Proposed System

The proposed system integrates RFID and GSM technologies to create an efficient signal jump E-challan system with automatic alerts to the Road Transport Authority (RTA). Utilizing Radio-Frequency Identification (RFID) tags installed at traffic signals and corresponding receivers in vehicles, the system can detect instances of signal jumping accurately. Upon detection, the system triggers an alert mechanism via Global System for Mobile Communications (GSM) to notify both the violator and the RTA simultaneously. This real-time alert ensures immediate action can be taken against the offender while providing valuable data to the RTA for monitoring and analysis purposes. By leveraging these advanced technologies, the proposed system aims to enhance traffic management, promote road safety, and streamline enforcement processes, contributing to a more

efficient and accountable transportation ecosystem.

The system integrates RFID (Radio Frequency Identification) technology with GSM (Global System for Mobile Communications) capabilities to create an efficient Signal Jump E-Challan system with automatic alert functionality to the Road Transport Authority (RTA). This innovative system aims to address the issue of signal jumping violations by motor vehicles. RFID tags will be installed in vehicles, and RFID readers will be placed at traffic signals. When a vehicle equipped with an RFID tag jumps a signal, the RFID reader will detect the violation and trigger an automatic alert to the designated authorities via GSM. This alert will include relevant information such as the vehicle's registration number, date, time, and location of the violation. Upon receiving the alert, the RTA can generate an e-challan and send it directly to the vehicle owner's registered mobile number or email address. This not only streamlines the process of issuing fines but also acts as a deterrent to signal jumping behavior, thereby promoting safer road practices. Additionally, the system can maintain a centralized database of violations, enabling authorities to analyze traffic patterns, identify hotspots, and implement targeted enforcement strategies for improved traffic management and safety. Overall, the RFID-GSM based Signal Jump E-Challan system offers a technologically advanced and efficient solution to enhance traffic discipline and road safety.

Project Working:

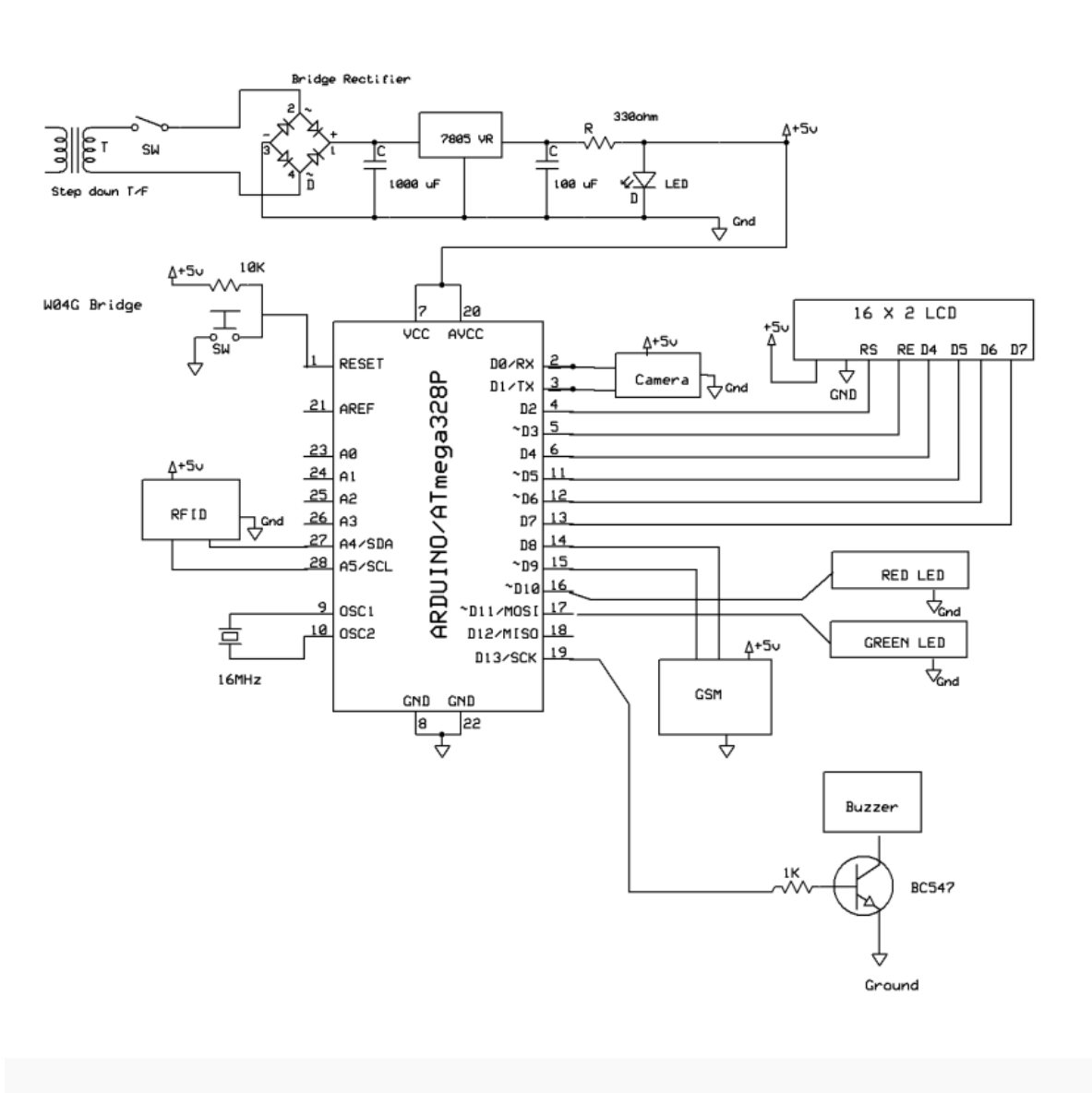
In this system there are totally five modules:

1. Regulated Power Supply
2. Input Section
 - RFID-Reader
 - ESP-Camera
3. Output Section
 - LCD
 - Buzzer
 - LED
 - GSM
4. Arduino Microcontroller
5. Embedded – C

The RFID-GSM E-Challan Signal Jump Auto Alert system operates through a seamless integration of RFID technology and GSM communication to efficiently address signal jumping violations and notify the Road Transport Authority (RTA). Beginning with the installation of RFID tags on vehicles, strategically positioned RFID readers at traffic signals detect instances of signal jumping by scanning for RFID signals emitted by passing vehicles. Upon detection, pertinent details such as the vehicle's unique identification, timestamp, and location of the violation are processed and transmitted to a central processing unit. Utilizing GSM technology, this unit promptly relays the violation data to the

RTA, facilitating swift action. Upon reception, the RTA verifies the violation and, if confirmed, generates an e-challan detailing the offense and associated penalties. This e-challan is then dispatched to the vehicle owner via their registered mobile number or email address. Through this automated process, the system not only streamlines enforcement but also serves as a deterrent to signal jumping behavior, contributing to enhanced road safety and traffic management efforts.

Schematic Diagram



This is the pin diagram where all the hardware components are been connected components. this ARDUINO microcontroller having 28 pins. In which 14 GPIO pins as digital pins and 6 GPIO pins. 16MHz crystal oscillator connected internally. The step down transformer, Bridge rectifier capacitor with 1000f Resistors and led are connected in Regulated power supply which provide the 5v to the Arduino and all input/output modules.

- 16*2 LCD Monitor has connected with the Digital pins 2,3,4,5,6,7.
- WIFI has connected to Digital Pins D0,D1 internal Transmitter and receiver pins.

- Ultrasonic connected to 12, 13 pins of the Arduino micro controller.
- IR sensor connected to digital pin A0
- LDR sensor connected to digital pin A1
- Buzzer alarm connected to digital pin 10
- LED sensor connected to digital pin A2
- GPS connected to digital pin 8

Design and implementation of smart city by using ARDUINO is done with 3 advanced applications smart drainage over flow, and Smart Street lighting system. Municipal drainage level will monitor and updated into over LCD and IOT module. Drainage system we use water detecting sensor which is automatically alert if it sense overflow of water. Street light applications we use LDR sensor along with LED indicator for street light.

ADVANTAGES:

1.Enhanced Efficiency: The automated nature of the e-challan system significantly reduces the occurrence of human errors. Unlike the traditional manual process, where challans are written by hand, this system ensures accuracy and consistency.Processing and issuing fines become faster, as the system instantly detects signal violations and generates e-challans without delays.

2.Real-time Detection: When a vehicle jumps a red signal, the proposed system identifies the violation immediately. It uses RFID technology to detect the signal break by the vehicle.An automatic e-challan is generated and sent to the vehicle owner via GSM communication. Simultaneously, the RTA is alerted about the violation.Real-time alerts enable prompt action, ensuring better compliance with traffic rules.

3.Green Technology: By eliminating the need for pen-and-paper-based challans, this system promotes eco-friendly practices.The entire process, from signal detection to fine issuance, relies on RFID tags and wireless communication, making it a greener alternative.

4.Reduced Corruption: Since the system operates automatically, there is minimal scope for corruption or manipulation.Traffic police cannot alter the challan details, ensuring transparency and accountability.

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DISADVANTAGES:

1.Complex Implementation: Deploying an RFID-GSM system involves integrating hardware components (such as RFID readers, microcontrollers, and GSM modules) with software programming. This complexity can lead to challenges during installation, maintenance, and trouble shooting. Ensuring seamless communication between RFID tags, readers, and the central system requires meticulous configuration.

2.Cost and Infrastructure: Implementing RFID technology across traffic signals and vehicles requires significant investment. Procuring and installing RFID readers, tags, and associated infrastructure (such as antennas and communication networks) can be expensive.Upgrading existing traffic infrastructure to accommodate RFID systems may not be feasible in all locations.

3.Maintenance and Reliability:RFID tags and readers are exposed to environmental factors (dust, moisture, extreme temperatures), which can affect their performance over time.Regular maintenance is essential to prevent malfunctioning or misreads. Failure to maintain the system can lead to inaccuracies in issuing e-challans.Reliability issues may arise due to damaged or malfunctioning RFID components.

4.Privacy Concerns: RFID technology involves tracking vehicles and associating them with specific owners. Privacy advocates may raise concerns about surveillance and data collection.Ensuring data security and protecting sensitive information (such as vehicle registration details) is crucial.

APPLICATIONS:

The RFID-GSM Based signal jump E-challan system with auto alert provides wide range of applications.

Here are some key applications:

1.Library Management: RFID-based systems streamline library operations.

2.Traffic Toll Collections: Efficient toll collection on highways.

3.Supply Chain and Logistics: Tracking goods and inventory.

4.Smart Cards: Secure identification and access control.

5.CONCLUSION

A working model of Electronic challan system using RFID reader, GSM, and microcontroller has been implemented successfully. One can explore this project with connecting Internet banking for automatic payment of challan. Also can design challan android app as alternate option. This up-routes manual challan and going on corruption since some traffic police don't pay proper amount to government. Use of this technology will become ubiquitous in coming day. And will be one of the greatest contributions to development of 21st century. And RFID technology will open new volumes in the field of security against vehicle stealing

REFERENCES :-

[1] Priya amble, SonaliBodkhe, "A new approach for design and implementation of AMR in Smart Meter", International Journal of Advanced Engineering Sciences and Technology, Vol. 2, PP. 57-61, 25April 2011.

[2] Abinadi Jain, Delap Kumar, Yikeria, "Smart and intelligent GSM based automatic meter reading system", International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol 2, Issue 3, pp. 1-6, May 2012.

[3]H. G. Rodney Tan, C. H. Lee and V. H. Murk, "Automatic power meter reading systems using GSM network", IEEE, 8th International Power Engineering Conference, pp. 465-469, 2007.

[4] Asha K, Sathish N Gorger, "GSM based automatic energy meter reading system with instant billing", IEEE International conference held at Kottayam, pp. 65-72, 2013.

[5] G Thanasi Raja and T.D. Sudhakar, "Electricity consumption and automatic billing through power line", International Power Engineering Conference (IPEC), pp. 1411-1415, 2007.

[6]Guilin Zheng, Zhifei Zhang, "Intelligent wireless electric power management and control system

based on ZigBee technology”, International Conference on Transportation, Mechanical, and Electrical Engineering (TMEE) Changchun, China, pp.1120-1124, December 16-18, 2011.

[7] Champ Parastatal, Kittitachpornprasitpol, Wanchalermpona, “Development of an automatic meter reading system based on ZigBee pro smart energy profile IEEE 802.15.4 standard”, International Conference on Electronic Devices and Solid-State Circuit (EDSSC), pp. 1-3, Dec2012.

[8] NajmusSaqibmalik, Friedrich kudzu, Michael Sonntag, “An approach to secure mobile agents in automatic meter reading”, IEEE, International Conference on Cyberworlds, computer society, pp. 187-193, 2010.

[9] SubhashisMaitra, “Embedded Energy Meter- A new concept to measure the energy consumed by a consumer and to pay the bill”, Power System Technology and IEEE Power India Conference, 2008.

[10] M. Sonika, V. Havoc, R. Boyle, "Image processing, analysis, and machine vision"2014, Cengage Learning.