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Smart Toll Collection System based on Arduino UNO Controller & ESP8266 Wi-Fi Module

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Abstract*: the rapid growth in the population has result ns more number of vehicles on the road. The proposed system eliminates the long of queues of vehicles at the toll plaza by making the collection of toll tax collection automatic. The proposed system is capable of providing single RFID card for every vehicle and every driver has to swipe the RFID card In front of the RFID reader present at the toll plaza and automatic deduction of amount will be done from the user available balance. The driver's total amount available and deduction amount information will be also sent to registered mobile number and over web server with the help of GSM and Node MCU ESP8266 module.
Key words: RFID, toll plaza, web server, GSM, Node MCU

I. INTRODUCTION



Fig.1 Toll Plaza

The growing interest of automobile vehicles that assist one to fulfil their day to day activities is emerged out to be new market. The proposed system in this paper eliminates the long queues of the vehicles at toll plaza by making it fully automatic by utilizing Arduino UNO controller which is the heart of project, GSM (Global System for Mobile communication) for sending messages, RFID card and reader modules, servo motor, Buzzer, 16X2 LCD display, LED, Buzzer, Node MCU ESP8266 Wi-Fi module and L293D motor driver IC. The proposed system provides automation is toll collection system by providing Rechargeable RFID cards that acts as unique cards for every driver, whenever the driver arrives at the toll plaza he/she has to swipe the respected RFID card in front of the RFID reader and the required amount at the toll plaza will be automatically deducted by the Arduino UNO processor. The message of deduction amount and the available amount in the drivers account will be sent over web server with the help of ESP8266 Node MCU module and to the registered mobile number with the help of GSM module. The proposed system also incorporates 16X2 LCD, buzzer and on board power supply circuitry.

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II. LITERATURE SURVEY

In [1] the paper provides "Automated Toll Collection System" that provides automation in the collection of toll money with the help of RFID communication technology and Arduino UNO processor. The proposed system in this paper also consists of android phone to update the processing information through GSM in the form of message. The proposed system create the opportunity to reduction improve management and create market for effective intelligence.

In [2] the paper provides "Automatic toll collecting system based on RFID". The proposed system is prepared with AT89552 microcontroller, RFID tag, RFID reader, 16X2 LCD display, 4X4 keypad, motor driver & DC motor. The proposed system provides efficient and automatic toll collection system to eliminate the long of queues at the toll plaza.

In [3] the paper provides "Arm7 and Node MCU based Automatic toll collecting system." The proposed system consists of ARM7 processor and ESP8266 Node MCU Wi-Fi module to provide automation in the collecting processor of toll amount at the toll plaza.

III. PROPOSED DESIGN METHODOLOGY

A. *Block Diagram*

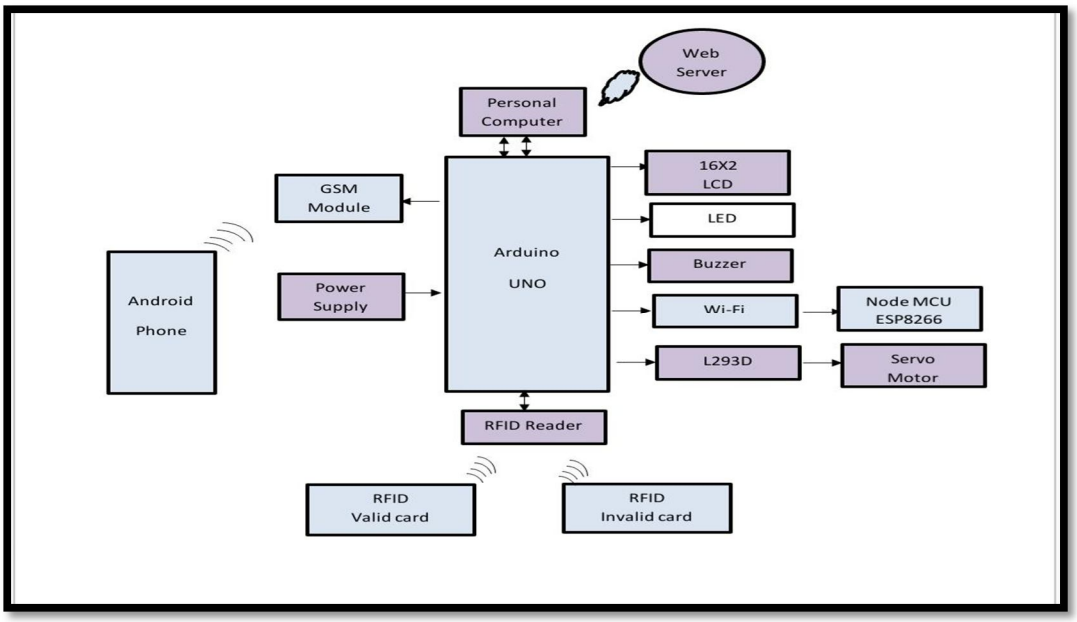


Fig. 2 Block diagram of proposed system

IV. HARDWARE IMPLEMENTATION

A. *The Followings Are The List Of Hardware Components Utilized In The Proposed System*

1) *Arduino UNO:* the Arduino UNO microcontroller board support Atmega328P processor that processes various signals.
2) *RFID Module:* RFID module consists of RFID reader and RFID tags whose communication can be established with the help of radio frequencies.
3) *Node MCU:* The ESP8266 Node MCU module provides IOT platform to various applications.
4) *GSM:* The proposed system utilizes GSM SIM808 module for sending messages.
5) *16X2 LCD:* these acts as small screen to various applications.
6) *Buzzer:* The electronic sensor which is responsible for generating sound.
7) *Servo Motor:* The servo motor for converting electrical energy to mechanical energy.

B. *The Followings Are The List Of Software Utilized For Designing Proposed System*

1) *Arduino IDE:* The Arduino IDE compiler software is utilized for writing and uploading code to the board.
2) *Proteus 8 Professional:* This software is utilized for designing of the proposed system.

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V. EXPERIMENTAL SETUP AND RESULT

The following figure provides the experimental setup of the system which is proposed in this paper. The proposed system utilizes two RFID card i.e. one is valid card and another one is Invalid card. The toll gate will be open when valid card is swiped & it will remains in closed state upon swiping invalid card. The proposed system in this paper eliminates the long queues of the vehicles at toll plaza by making it fully automatic by utilizing Arduino UNO controller which is the heart of project, GSM (Global System for Mobile communication) for sending messages, RFID card and reader modules, servo motor, Buzzer, 16X2 LCD display, LED, Buzzer, Node MCU ESP8266 Wi-Fi module and L293D motor driver IC. The proposed system provides automation is toll collection system by providing Rechargeable RFID cards that acts as unique cards for every driver, whenever the driver arrives at the toll plaza he/she has to swipe the respected RFID card in front of the RFID reader and the required amount at the toll plaza will be automatically deducted by the Arduino UNO processor. The message of deduction amount and the available amount in the drivers account will be sent over web server with the help of ESP8266 Node MCU module and to the registered mobile number with the help of GSM module. The proposed system also incorporates 16X2 LCD, buzzer and on board power supply circuitry.

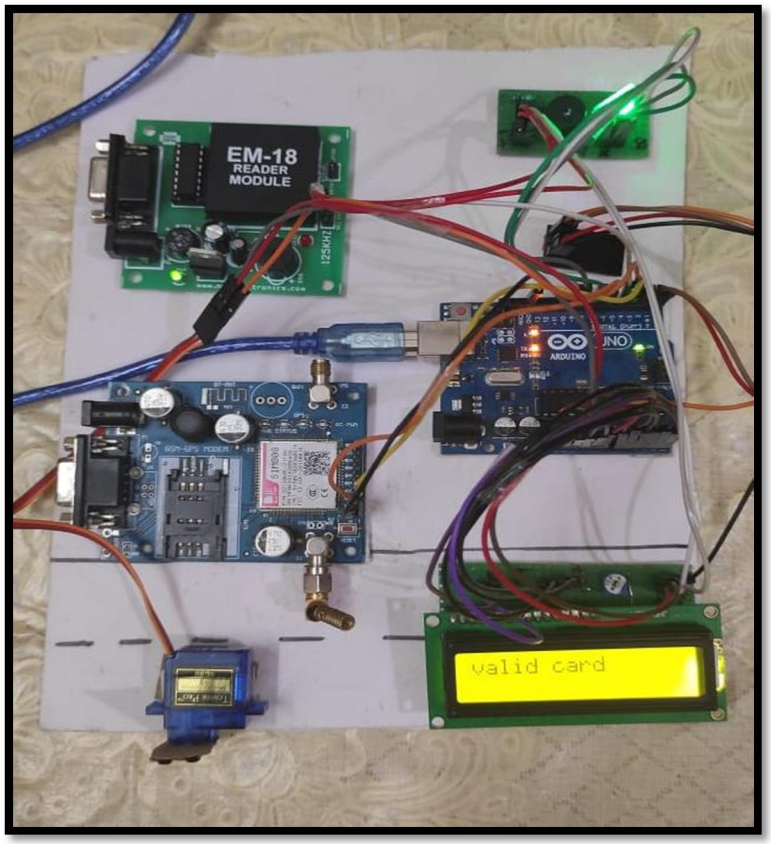


Fig. 3 Experimental setup of Smart Toll Tax System

The following figures represent the LCD displaying LCD displaying the working of the proposed system



Fig. 4 LCD display Toll TAX



Fig. 5 LCD display valid card

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Fig. 6 LCD display invalid card



Fig. 7 LCD display valid card no balance

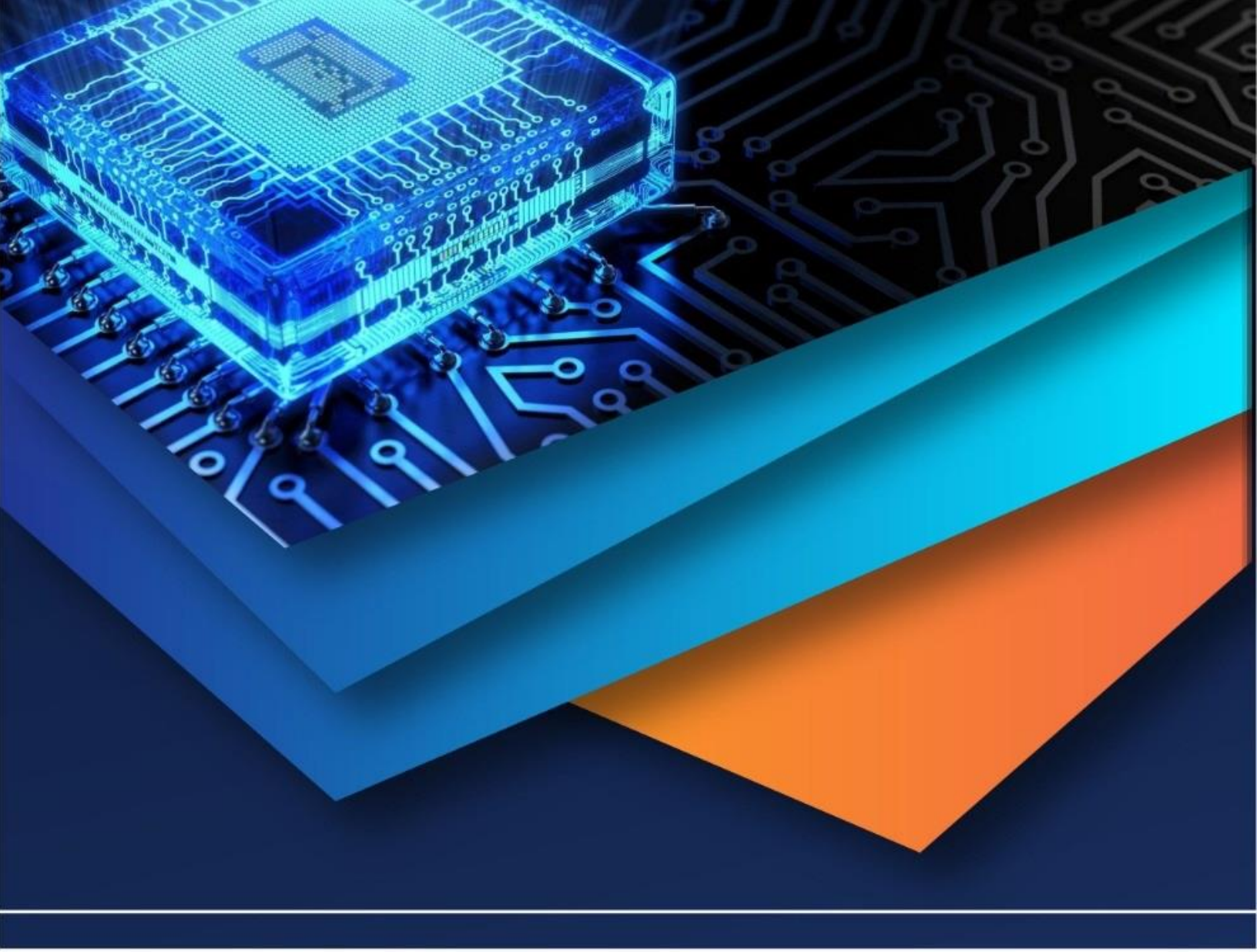
VI. CONCLUSION

The proposed system totally automated the existing toll system by utilizing the growing technology and also the overall systems information can also be reported over web server effectively thus eliminates the long queue waiting of vehicles at toll plaza. . The proposed system provides automation is toll collection system by providing Rechargeable RFID cards that acts as unique cards for every driver, whenever the driver arrives at the toll plaza he/she has to swipe the respected RFID card in front of the RFID reader and the required amount at the toll plaza will be automatically deducted by the Arduino UNO processor. The message of deduction amount and the available amount in the drivers account will be sent over web server with the help of ESP8266 Node MCU module and to the registered mobile number with the help of GSM module.

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