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Automated Gate Opening System for Restricted Area using IoT

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Abstract - *In this paper, we propose an automated gate opening system for restricted area. Improvement of modern technology may affect the rapid growth of the wireless security based applications. Many gate automation systems were designed and implemented using different types of wireless communication technologies but in this paper, we proposed a system, which is implemented using RFID (Radio Frequency Identification) Technology and Arduino board. Radio Frequency Identification (RFID) technology is a wireless technology which can provide better ways to implement an inexpensive systems for security purpose. In this paper, the proposed system has a RFID reader is placed near the gate, whenever vehicle which having RFID card/tag with unique ID number comes nearer to the gate, RFID reader reads the data from RFID card/tag and compares it with stored data in the organizations database. If the captured data match with stored data then gate will opens and allows vehicles to enter into the restricted areas, otherwise not. In addition, admin can monitor the number of entries and exits of vehicles to the restricted areas. This type of systems can be operated without any manual effort and can be used in restricted areas like defense organizations, large industries, government forest areas etc.*

Key Words: **RFID, Arduino, IOT, automated gate opening system.**

1. INTRODUCTION

Security has a main concern for every restricted areas. The improvement in the modern technology introduces an automation which results in creation of many automated system used in the various fields like organizations, industries etc. Earlier, to think about the gate automation without any manual work was the difficult task for the common man but nowadays the introduction of automation using IOT technology made these tasks more easier and more cheaper than manual work. The proposed system described in this paper was implemented by using RFID technology and Arduino. RFID technology widely used in many areas like industries for automation, access control, Electronic Toll gates and many more. Safety of a restricted area mainly depends on its Gate security system. The Entry into the restricted areas will be given after getting the permission from special authorized person only. To reduce such kind of manual work the automated gates were introduced. The concept of automated gate opening system is that to control the gate automatically. In this method RFID reader is placed near the gate, whenever vehicle attached with RFID card/tag comes nearer to the gate, RFID reader reads the data from the RFID tag. This data is send to the Arduino board and it will compare the received data/number with valid data, which was previously stored in organization database. If both the data matches then gate will opens and allows vehicles to enter into the restricted areas otherwise not. Here admin can also monitor the number of entries and exits from the restricted areas using web applications. This type of systems can be implemented the not only main entrances but can be installed at all the sub-entrances of the restricted areas. The main aim of this paper is to describe how to design, develop, implement and install inexpensive and more secure automated gate opening system which allows only the authorized vehicles into the restricted areas and it will not allow the unauthorized vehicles and to provide more secure environment around the restricted areas.

2. SYSTEM COMPONENTS DESCRIPTION

2.1 Arduino Uno

Arduino Uno is microcontroller, which is used to control the operations of RFID reader at gate, and all the other components are connected to Arduino and it controls all the components too. It is based on the ATmega328 and It has 14 digital input/output pins 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

2.2 RFID Reader and Tags

A RFID reader is installed at gate and RFID tag is attached to the authorized vehicle. RFID tag consists of a chip and an antenna and that chip can store a unique number for each vehicle. RFID reader reads data from tags which is attached to vehicle using electromagnetic mechanism. Here we are using RFID RDM630 tag reader. Either RFID tags or RFID cards are used on this system.

2.3 IR Sensor

An infrared (IR) sensor is used to detect the infrared radiation in its surrounding environment. It can measures motion of the object and heat of the object too. In this proposed system we used to IR sensor to detect the motion of the vehicle.

2.4 Servo motor

Servomotor is a closed loop control system, which uses the feedback signal to adjust the speed and direction of the motor

to achieve the desired result. In the proposed system servomotor is used to control the gate. Upon getting the signals from the Arduino, the servomotor opens or close the gate.

2.5 Buzzer and LED light

Buzzer is an audio signaling device, which can be either mechanical or electromechanical, and An LED is a small light that works with relatively little power. The Arduino board has one built-in on digital pin 13 for LED's. Both buzzer and LED get triggers when there is the unauthorized vehicle comes nearer to the gate.

2.6 LCD display

LCD display is a flat glass panel display, which is used to display the text, numbers etc. In the proposed system LCD display is used to display the messages of RFID based authentication, validation and the gate movements.

2.7 Jumper Wires

Jumper wires are the group of electrical wires, with connector or pins at the each ends, which are used to interconnect the different components either directly or by using the breadboard.

3. SYSTEM DESIGN AND WORKING

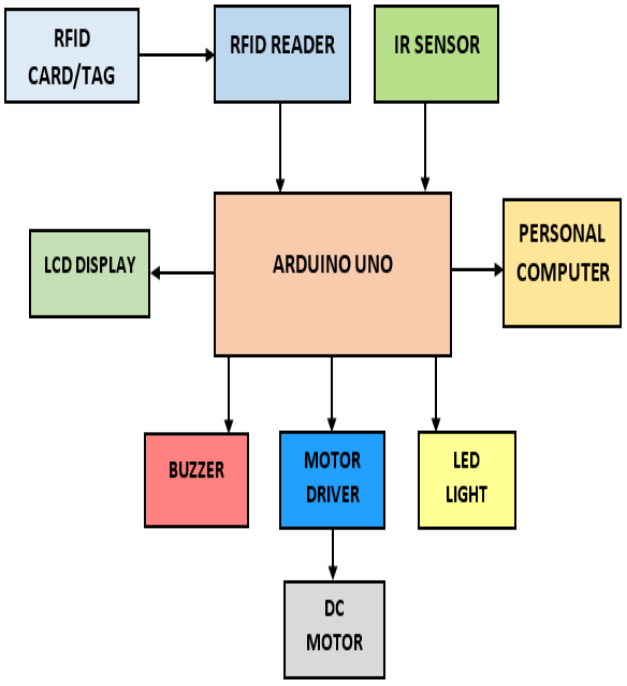

Figure 1.1: Block diagram of automated gate opening system.

Figure 1.1 is a block diagram of the automated gate opening system where all the components are connected to Arduino board, which is a microcontroller and it will process the data sent by the RFID reader and IR sensor and gives the respected result through personal computer, motor, LCD display, buzzer and LED light. RFID reader read the data from the RFID tag/card. All the components are interconnected via jumpers or through breadboard.

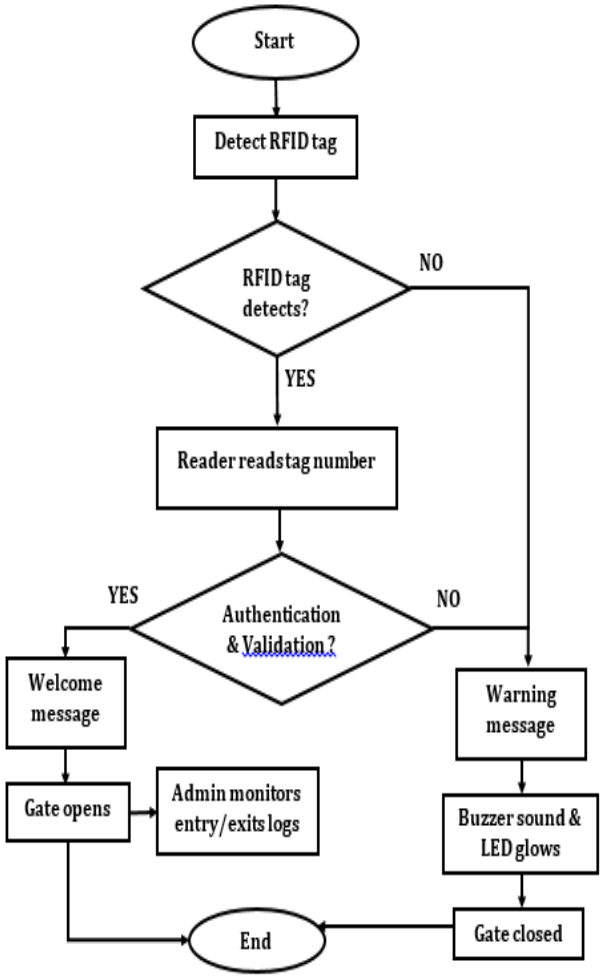

Figure 1.2: Flow diagram of automated gate opening system.

The proposed system is designed in a way that it responses quickly. Any vehicle, which was already authorized to the restricted area, is a attached with RFID tag/card and also their unique RFID tag number is registered and stored in the particular restricted area's database. At the entry point near the gate the RFID reader and Arduino board were placed. When vehicle comes nearer to the gate, the reader at the gate will try to detect the RFID tag/card attached to the vehicle and reads the data which is the unique number from the tags/cards. RFID reader send the data to the Arduino board, which is basically a microcontroller. Arduino will compare the received data(unique id) with the stored data. If both the data matches then the gate will open other wise gate remains closed to unauthorized vehicles. If unauthorized vehicles comes then buzzer sounds and LED glows thus respective gate authorities will get an intimation about the unauthorized vehicle. In addition, once the gate opens for the

authorized vehicles the admin will remotely monitor the number of entries and exits and this can be done by using the k-NN algorithm, which is used for classification. Thus, the system works more efficiently.

4. RESULT AND CONCLUSION

The proposed system presented in this paper has a GUI along with the hardware setup. Figure 1.3 is the prototype of the automated gate opening system where all the components are connected in their respective ports and can be identified easily.

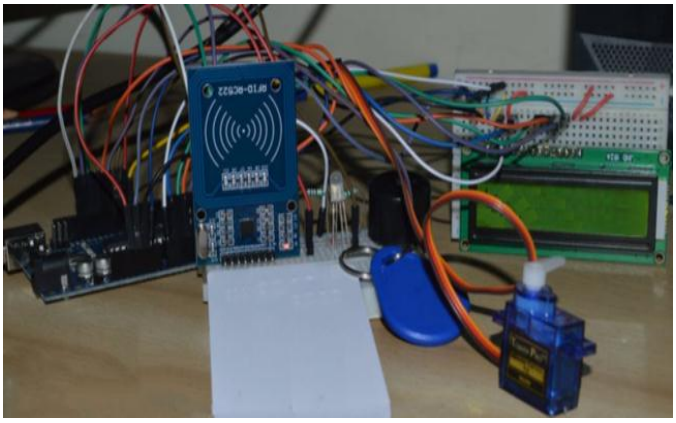

Figure 1.3: automated gate opening system Prototype.

In this paper, an automated gate opening system for restricted areas is presented and also we have implemented the system. Usage of RFID technology made the differentiation for the system between the authorized and unauthorized vehicles is more easier than using all other technologies. This system has many advantages. The system is reliable, reduce manual work and manual errors, easy to implement and inexpensive thus the system can be used in the large scale and also remotely monitor the number of entry/exit logs. This type system can be helpful and mainly used in restricted areas like military areas, large industries, government forest areas etc.

5. FUTURE SCOPE

Automated gate opening system will definitely have future scope. This system can be implemented by adding the image processing techniques. Smart phone application enhancement can be done for this system, creating a smart phone app to give access to authorized person when that person is away from his/her home will enhance this system numerously and also by adding the GSM Module to system can easily intimate the admin by sending alert messages.

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