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ARDUINO Based Hybrid Security System Using RFID: A Digital Security Based Project

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Abstract: ***There has been a rising demand for secure system that must be dependable and quick respond for the home industries and companies. Today there is also a rise in demand for hack proof system due to the increase in level of programming. Our system gives both protections from manual theft like breaking the lock and also from logical theft like hacking the system. Our system works mainly through the Radio Frequency Identification (RFID). RFID is one of the consistent and fast means of identification of the material object. Nowadays RFID is easily available and more convenient to use. ARDUINO MEGA makes the circuit and programming a lot easier to understand. We have additionally introduced a PIR (Passive Infrared Sensor) and a LASER and LDR (Light Dependent Resistor) sensor module which will give more protection. There is also a lock which we will guide through the rotation of the servo motor. We can also control an AC lamp inside the house through the triggering of a relay. This security system is very convenient to home, office and any kind of commercial buildings.***

Keywords: Arduino; Fresnel Lens; Laser module; LDR (Light Dependent Resistor); PIR (Passive Infrared Sensor); SPI (Serial Peripheral Interface)

1. Introduction

Today there is a havoc increase in crime including hacking inside an important system and also breaking in private sectors through any kind of physical means. We can counter the physical means by using a mechanical lock. This lock can provide protection up to a certain limit. Mechanical locks work by using a lock and key. If we insert the exact same key then only it is possible to open the lock. Keys which do not match will never open the lock. But breaking it is very easy by any means of physical methods without being noticed. Thus a Reliable protection is required for countering these kinds of thefts especially when the owner or user is away from that protection demanding zone. Information about any kind of theft is required to be sent to the authorized person by any means. So we have made this experiment to show that by using RFID module we can overcome these problems. RFID is not a very recent technology but now it has become very easy to make interface with any microcontroller so it is convenient to use RFID module. Radio Frequency Identification system allow us to identify subjects or objects without physical contact. RFID is a very simple technology which is easy to implement for any kind of identification and authentication applications [3].

The Aim of this paper is to develop a security system which is able to create an access only for the authorized person. The proposed system also can notify the person when someone tries to break in. So this system can be implemented for small scale security purpose and it can also be implemented for large scale security purpose.

This system can be made more protective by adding a GSM module which will send a desired message to the authorized person when there is any kind of theft.[6]

2. Hardware Design

In our experiment ARDUINO MEGA is the main control unit. It is a development board with a microcontroller ATMEGA 2560. It has 54 digital input and output pins of which 14 can be used as PWM signals, 16 analog input pins, 4 UARTs (hardware serial ports), a 16 MHz oscillator, an USB connection, a power jack and a reset button [8]. It has each and everything needed to supplement the microcontroller, we can power it up through an USB connection to computer or an AC to DC adapter or a battery. It can be powered from 6-20 volt.

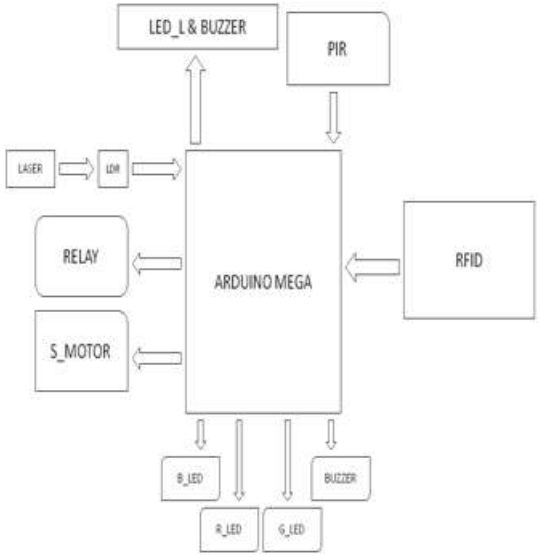

Figure 1.1: Block Diagram of This System

RFID can operate on 3.3 volt which is taken from the ARDUINO MEGA 3.3 volt pin. It is a best choice for reliable security system which can be implemented at low cost. The RFID module has two parts mainly the reader and UID tag. [9][3] The reader gets coupled with the ARDUINO board through SPI (Serial Peripheral Interface). The 13.56 MHz frequency is creating a magnetic field which is essential for the communication of the UID tag with the RFID module. [7][5] The communication is possible only if the distance between the tag and reader is less than 50mm.[1]

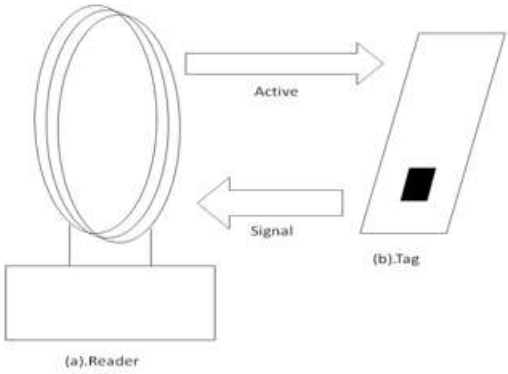

Figure 1.2: RFID Principle

PIR Sensor stands for Passive Infrared Sensor. It is mainly used as a motion detector which can sense the radiation from any human or animal. Its operating voltage ranges from 5-20 volt. This sensor is based on pyroelectric sensing which can detect level of infrared radiation. The sensing module is split into two halves which enables it to not just sense the radiation from the body but senses when there is a change in radiation when an object enters into its range of sensing. This change in radiation generates a voltage which can be measured by an amplifier on the module. This is a very sensitive sensor ranging up to 7 meters. The top part has a spherical shape with a Fresnel lens mounted inside to increase the range of detection laterally. Array of Fresnel lenses is mainly used as it can take radiation from different directions and concentrate it to a single point. Due to this detection becomes more stable and distance of detection is also increased [2].

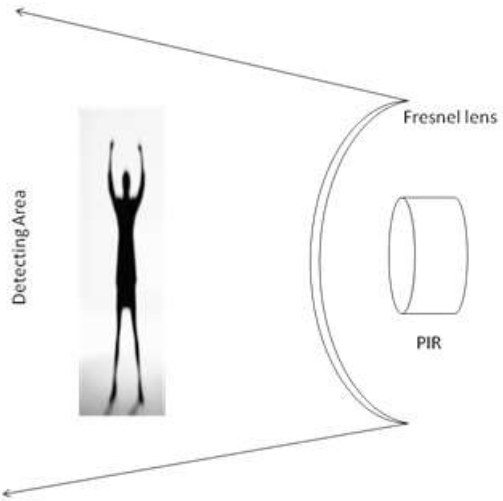

Figure 1.3: PIR Principle

Relay is mainly consisting of two parts. The first part has a coil which gets energized by the ARDUINO 5 volt DC input pin that is triggered according to the program [5]. The second part consists of a switch which has three contact points namely natural open, natural close and common. Initially the common is connected to natural open meaning the circuit is open. When the voltage energizes the coil a magnetic field is created which attracts the common point to connect with the natural close thus the circuit gets closed.

LDR stands for Light Dependable Resistor. It is basically a photoresistor or a Cadmium Sulphide Cell (CDS). This LDR module is based on the principle of photoconductivity. It contains a photoresistror whose resistance decreases when the intensity of light falling on the LDR decreases in our case we have used a 5 volt laser module. If the resistance decreases then the current will start flowing in the desired circuit [9].

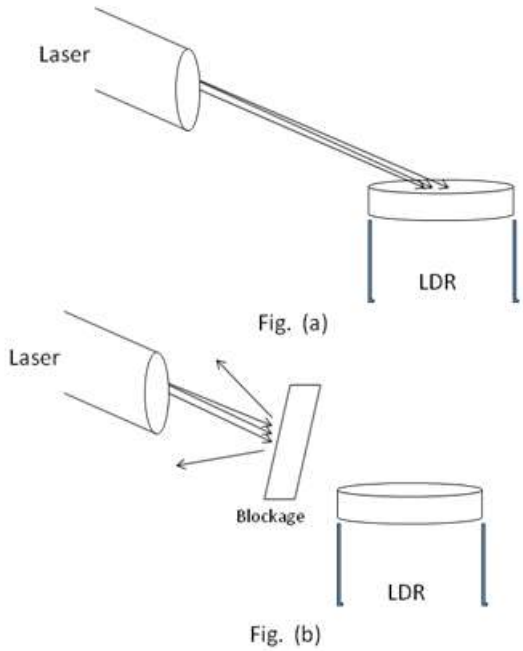

Figure 1.4.: (a) LDR Circuit Incomplete. (b) LDR Circuit complete

3. Software Design

ARDUINO MEGA can be programmed with ARDUINO software (ide).Mfrc522.H header file is added to library for the functioning of the RFID module. The ATMEGA 256 allows uploading new code on the ARDUINO board without the use of any external hardware programmer. The ATMEGA 2560 also support SPI communication. Here we also use servo.h header file to use servo motor as an output. The ARDUINO programming language follows the rules of C and C++ programming [8]. The ARDUINO software provides with sample programs making it easy to understand for the user.

4. Methodology

First we give 5 volt DC supply to ARDUINO MEGA. In our experiment we have taken the help of a power bank. All the input and output components get power from the 5 volt pin of ARDUINO Board. Now the RFID module plays into action by creating a 13.52 MHz frequency and all the conditions start from here[4]. The PIR sensor and the laser module will start. Here we are using the PIR sensor as a human detector. If the PIR senses human radiation then red led will glow and buzzer will trigger [2]. If there is a blockage in the laser then a red led and a buzzer in the laser module will get triggered. If we show the entry card whose UID number is already mentioned in the program to the RFID module when the PIR sensor does not sense any human radiation then a blue led will glow showing that some program is trying to hack into our system. Now if we show the entry card while the PIR sensor senses radiation then a green led will glow, lock will open for 10 seconds after which a bulb will glow through a relay module which will take 230 volt AC supply from mains and a 5 volt DC supply from ARDUINO MEGA for the program to apply on relay [9]. Now the relay will remain on until and unless the exit card whose UID number is also mentioned in the program is shown to the RFID module. The lock will also open for 10 seconds and green led will glow.

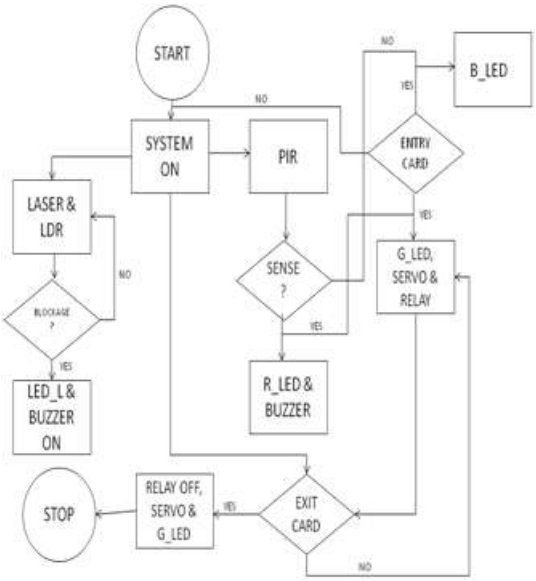

Figure 2: Working Flowchart of This System

5. Result

We have made all the connections on the bread board through the ARDUINO MEGA Board. We have been able to open a practical lock with the rotation of a servo motor and also switched on an AC lamp with the help of a relay and it is evident that our system is working exactly as per the logic.

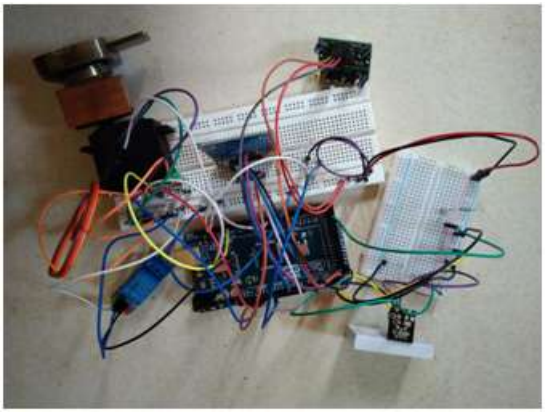

Figure 3: Implementation of This Experiment

6. Conclusion

By completing this experiment we are in a position to conclude that this system is eligible to be placed in a security demanding zone especially in commercial areas or highly secret areas where security is a must and our system can guarantee high security with minimizing the possibility of hacking. RFID system is a very simple method of security which is understandable by the user. This system is a very versatile system in which we can provide additional components to make it more protective. This can be a very beneficial device for VIPs.

References

[1] Sandip, "RFID Sourcebook", IBM Press, USA, (2005).
[2] Passive Infeared (PIR) Sensor Based Security System.
[3] Pema Chodon, Devi Maya Adhikari, Gopal Chandra Nepal, Rajen Biswa, Sanjay Gyltshen, Chencho, IJEECS. Vol: 14 Issue:2 June 2013
[4] Security analysis of RFID based devices in educative environments. Ahmed Saeed Alzahrani, faculty of Computing and Information Technology (Life Science Journal 2014).
[5] RFID Security System for Domestic Applications. Akshay Punjabi, Siddhart GV, Siddhant Singhal, K. V. N. Kavitha, Publication of Problems and Application in Engineering Research-Paper (December 2013).
[6] Design and Development of RFID Based Intelligent Security System, Sukhraj Singh, Neeraj Kumar, Navjot Kaur, International Journal of Advanced Research in Computer Engineering and Technology (January 2014).
[7] RFID Based Object Tracking System Using Collaborative Security Protocol. Ajinkya C Bapat, Sonali U Nimbhorkar, Dept. of Computer Science and Engineering (2016).
[8] Secured Attendance Management System Using RFID Technology. M. R. V. Venkatesa Vimal chand, M.

Sayed Meeran, V. Probabharan (IRJET) Novenber-2015.

[9] RFID lab management system using Arduino microcontroller approach associate with webpage. Norsuzila Ya'acob, Syed Fudhali Sayed Adnan, Azita Laily Yusof, Ainnur Azhar Nani Fadzlina Naim, Norfazira Mustafa, Nur Anis Mahmon. Journal of Scientific Research and Development (2016)

[10] Arduino Based: Smart Light Control System, Deepak Kumar Rath, IJERGS Vol: 4, Issue 2, March-April, 2016