DESIGN AND IMPLEMENTATION OF AUTOMATIC SAFETY ENTRANCE SYSTEM IN SCHOOL GATE

Khaing Zar Win[1], Thet Zaw Aye[2]

[1]Faculty of Precision Engineering, University of Technology (Yatanarpon Cyber City), Pyin Oo Lwin 05087, Myanmar
[2]Faculty of ICT, University of Technology (Yatanarpon Cyber City), Pyin Oo Lwin 05087, Myanmar

Abstract

In our daily life, doors are used to give access to a room or a hall. For Security purposes, automatic doors are used with the latest technology. The proposed system aimed to solve security problems such as robbery, illegal weapons, the safety of people caused by the lack of security in the environment. Every function was controlled by the microcontroller. Motors were used to control the doors. Infrared sensors (IR) were used to count the people that pass through the doors. Alcohol (MQ3) sensor and inductive proximity sensor were used for detecting metal and alcohol gas. Passive infrared sensor (PIR) sensor was used to open and close the door automatically by detecting motion. When metal and alcohol sensors were not active and an authorized RFID tag was read through the RFID reader, the door would open. The buzzer and LED turned on when the above condition did not meet. The main focus of this thesis was the coding of the Radio Frequency Identification (RFID) by using PIC microcontroller. The system can be used to reduce the number of crimes so the users felt safe by using an automatic gateway system.

Keyword: Microcontroller, RFID, Security, Automatic Gateway

1.INTRODUCTION

Safety has always been of prime concern to every individual or an organization. In our daily life, security system plays an important role to prevent unknown user or robbery entry without authorization. When we consider about Security the distinct ways are Authentication, Authorization and Access Control. Nowadays, the door security systems are implemented with one of those type of security control. There are several automatic identification technologies that exist including barcode, magnetic stripe and Radio-frequency identification (RFID) applied in door security system. Radio-frequency identification (RFID) is an emerging technology and one of most rapidly growing segments of automatic identification data collection industry. RFID usage is steadily increasing.

The main idea of this system is to control the automatic door system using the radio frequency identification (RFID). Every function is controlled by the micro controller. Motors are used to control the doors with motor bridge driver. IR sensors, metal sensor, alcohol gas sensor and PIR sensor are used to count the people that pass through the doors and to detect metal and alcohol gas to secure safety and motion detection, to open and close the door automatically. When metal and alcohol sensors are not active and an authorized RFID tag is read through the RFID reader the door will open. The buzzer and LED will turn on when the above conditions do not occur. The overall block diagram of the system is shown in Figure 1.

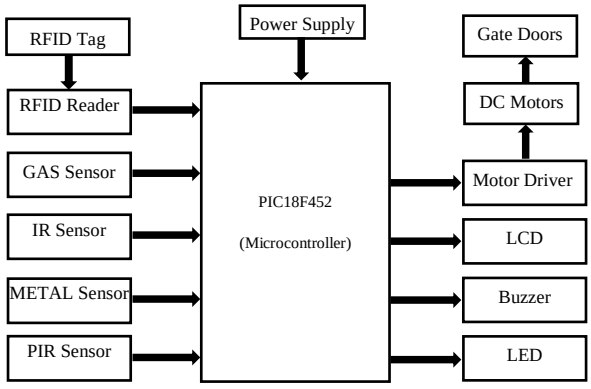


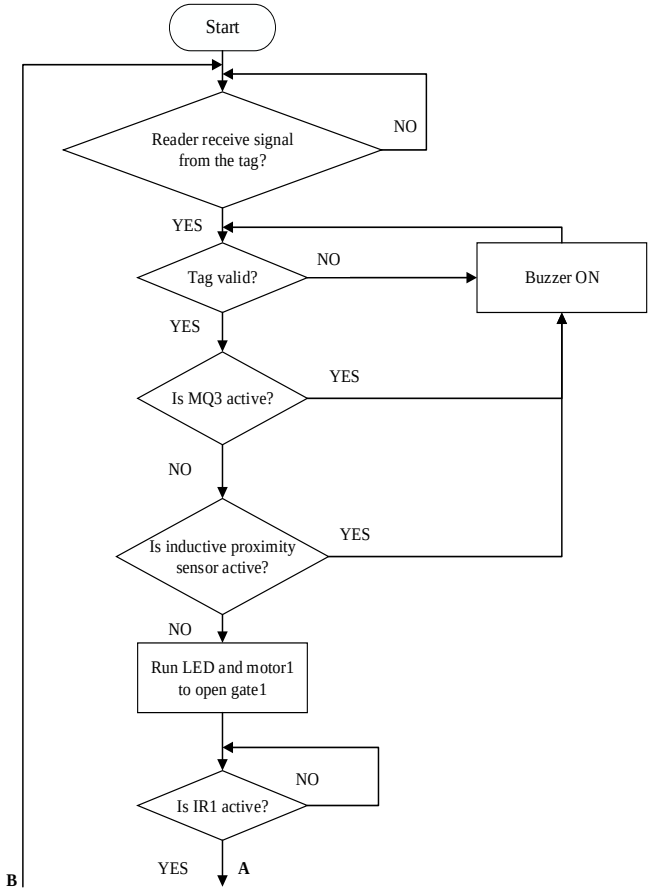
Figure 1. Overall Block Diagram of the System

The proposed system must be efficient and cost effectively reducing and preventing crime as much as

possible. It also can improve the quality of the living environment for residents by reducing all forms of anti-social behavior as much as possible. By employing modern technology to fight against crime to ensure residents benefit from the latest tools available in the fight against crime.

2. OPERATION OF THE SYSTEM

In this system, the whole process is controlled by a microcontroller. The door system is controlled by RFID system. DC motors are used to operate the doors. IR sensors are used to count the people's passes through the gate. Metal and alcohol sensors are used to detect the presence of metal and alcohol gas. If the authorized tag passes through the RFID reader and no metal and no alcohol gas are detected, the entrance door will open. The door will close after 5 seconds. Otherwise, LED and Buzzer will turn on. The exit door operates when PIR sensor is active. The door will also close after 5 seconds. The overall flow chart of the system is shown in Figure 2.



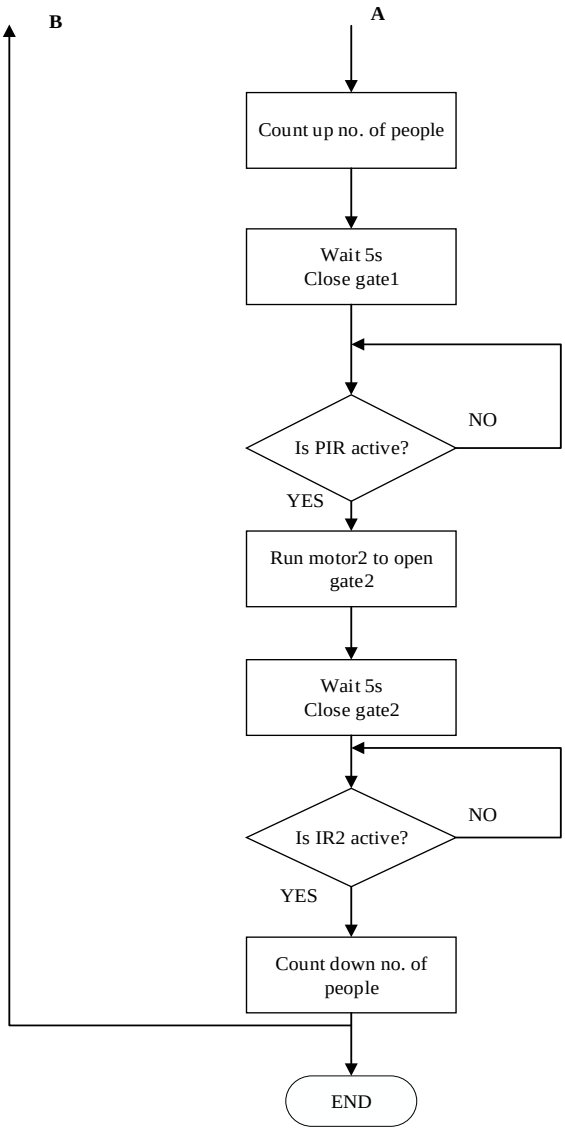


Figure 2. Overall Flow Chart of System Operation

3. HARDWARE COMPONENTS

The hardware components which are used in this system are: PIC 18F452 microcontroller, RFID tag, RFID reader, DC motor, H-bridge motor driver, Liquid crystal display, IR sensor, PIR sensor, Metal sensor, Alcohol sensor, LED and Buzzer. The following section explain about the main components of this system.

3.1. PIC 18F452 microcontroller

The PIC18F452 is one of the latest products from Microchip. It features all the components which modern microcontrollers normally have. For its low price, wide

range of application, high quality and easy availability, it is an ideal solution in applications such as: the control of different processes in industry, machine control devices, measurement of different values etc. Figure 3 show the pin diagram of PIC 18F452 microcontroller.

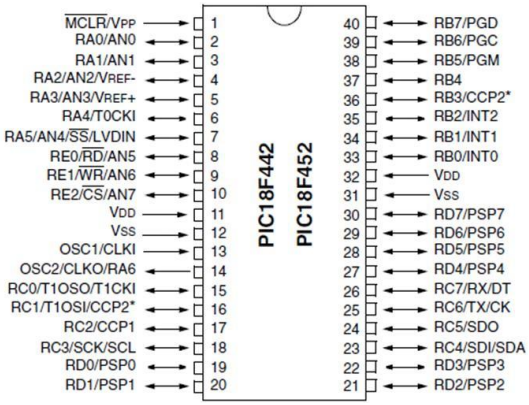


Figure 3. Pin Diagram of PIC18F452

3.2. Radio Frequency Identification (RFID)

RFID is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information.

RFID system is always made up of two components:

- The transponder, which is located on the object to be identified.
- The interrogator or reader, which depending upon the design and the technology used, may be a read or write/read device.

In this system, Mifare RC-522 is used as reader and contactless card is used as RFID tag. They are shown in Figure 4.

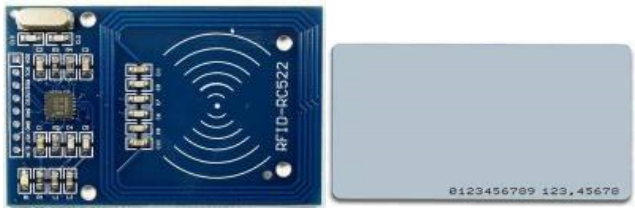


Figure 4. Mifare RC552

3.3. 16x2 Liquid Crystal Display (LCD)

A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. In this system 16x2 LCD is used to display the system responed message.

Figure 5. 16x2 LCD Display

3.4. Active IR Sensor

Active sensors are those that contribute to measure or sense the change in parameters. They exhibit a known parameter in the atmosphere and then measure the change in that parameter to study the change in the physical domain. In this system active IR sensor is used to measure the count of person who passed the door.

Figure 6. Active IR Sensor

3.5. PIR Sensor

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. A PIR-based motion detector is used to sense movement of people, animals, or other objects. In this system, PIR sensor is used to sense the movement of person near the exit door. Figure 7 show the PIR sensor.

Figure 7. PIR Sensor

3.6. Metal Sensor

An inductive proximity sensor can detect metal targets approaching the sensor, without physical contact with the target. Inductive Proximity Sensors are roughly classified into three types according to the operating principle: the high-frequency oscillation type, the magnetic type and the capacitance type. In this system, high-frequency oscillation type is used to detect the metal.

Figure 8. High-Frequency Metal Sensor

3.7. Alcohol Sensor

Gas Sensor (MQ3) module is useful for gas leakage detecting. It can detect Alcohol, Benzine, CH4, Hexane, LPG, CO. Based on its fast response time, measurements can be taken as soon as possible. Also, the sensitivity can be adjusted by the potentiometer.

Figure 9. MQ3 Alcohol Sensor

4.DESIGN AND IMPLEMENTATION

Firstly, the pins connection of the hardware component is design. The pin configurations are shown in Figure 10.

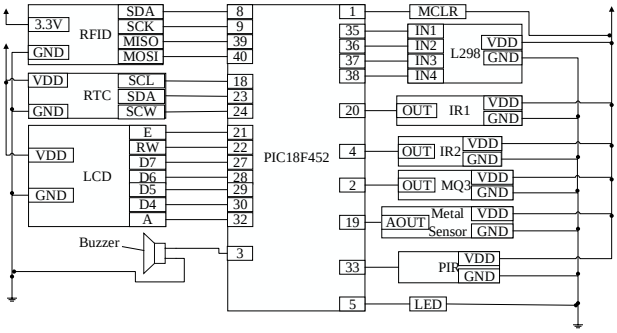


Figure 10. Overall Pin Diagram

And then, the system is simulated by using Proteus-8 PCB design & VSM simulation software as shown in Figure 11.

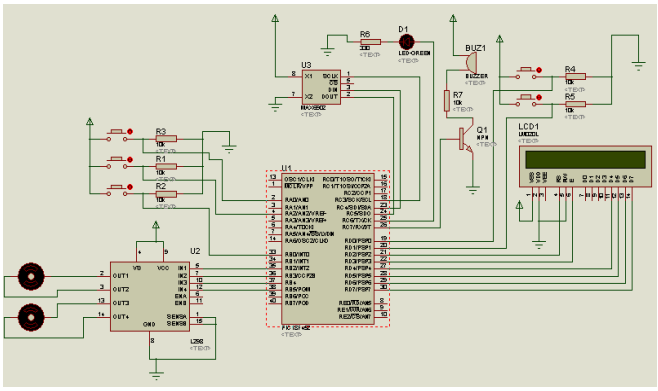


Figure 11. Overall Circuit Diagram

After successful simulation, all components are installed in practical. The final assembly of the proposed system is shown in Figure 12.

Figure 12. Final Assembly of Automatic Safety Entrance System

At normal condition, the system show the current date time on 16x2 LCD display.

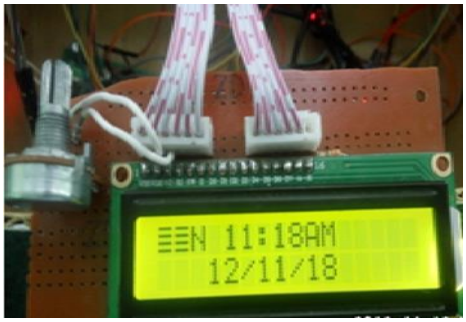


Figure 13. Normal Condition

When the valid RFID tag is placed near the RFID reader, the system check the tag. If the tag is valid, other sensors check wherther the person drink alcohol, or bring unpermit metal. If all of the condition are passed, the door will open and the entrance count will increased. This results of the test are shown in Figure 14, Figure 15 and Figure 16.

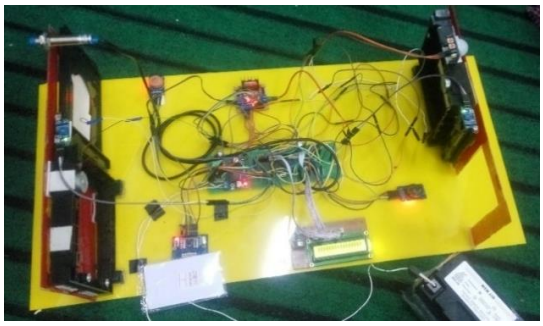


Figure 14. Placing Valid RFID Card

Figure 15. Checking Drinking and Metal

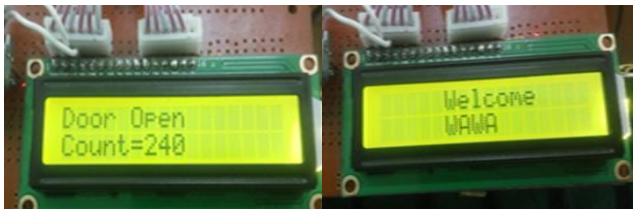


Figure 16. Door Open and Welcome Message

If some metal are detected by metal detector, the door doesn't open and the message will show as shown in Figure 17.

Figure 17. Placing Metal near Metal Sensor and Display Message

5.CONCLUSION

The number of crimes has been raised since entering the modern age and for that, security systems are used. The proposed system will help reduce the number of local crimes. The system will operate itself automatically as long as the power exits. The power consumption is also low and the installation cost is affordable. This automatic gate system can also identify the person who passes through the gate keeping stranger out of the vicinity of our home, work place and private places. So, the users can feel safe by using automatic gateway system.

REFERENCES

[1] Amin Rida, Li Yang, Manos Tentzeris "RFID-Enabled Sensor Design and Applications", Artech House, London, 2010

[2] Daniel M. Dobkin "The RF in RFID: UHF RFID in Practice", Newnes, 2nd Edition, 2012

[3] L. Suhong ,J.K Visich, M.K. Basheer, C.Zhang, "Radio Frequency Identification Technology: Application, technical challenges and strategies", Sensor review, Vol.23

[5] http://www.electrosome.com

[6] http://www.automaticdoorgroup.com