RFID and IR Sensor as an Integrated Security System

Sounder Raj S[1], Sridhar S K[2], Pradeep M[3]

[1-2]Department of Electronics and Instrumentation Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India
[3]Department of Mechatronics Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

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Abstract - *This paper is written to develop a new type of low-cost security system with the existing technology. This project is idealised with the consideration of cheap and effective identification and security systems for industries and other social gathering places. In this rapidly changing world security is a major concern but building security systems for large areas is costly and complex, but RFID and IR security systems will be a low-cost alternative that sends instantaneous messages via the internet. This project helps in places where security is necessary at a low budget. This project is most suited to places which are frequently used and requires a minimal security system to avoid unauthorized personnel.*

Key Words: *RFID reader, RFID tag, security system, IR sensors*

1. INTRODUCTION

In this rapidly changing world, security plays an important role. It is hard to keep track of individual persons in a place where a lot of human interactions happen. An easy way of tracking people even without a camera is the RFID and IR security system. This project is based on the interfacing of some components such as IR sensors and RFID with an Arduino microcontroller. This circuit can be used to identify the person entering the room and count the number of persons entering and leaving. When somebody enters the room, the RFID reader activates and signals the tag, if it doesn't receive a return signal it will warn the user for intruders or unauthorized personnel. When the RFID reader receives a response, it will show the identity of the person entering the room. This information will be transmitted over the internet to a computer or a mobile. Small organizations rarely have camera security and even if they have it will not be a live feed rather it will be recorded for later review. If an intruder enters with the intent to cause damage the above-mentioned security system will fail whereas if this project was implemented, we would immediately know when there's an intruder.

2. TECHNICAL BACKGROUND

2.1. 8051 MCU (AT89S52)

This microcontroller is the main controlling unit of this proposed idea. AT89S52 is a family of 8051 microcontrollers. The project needs are met by the AT89S52 microcontroller. Also, AT89S52 controller has an inbuilt ISP feature which helps us program the microcontroller while installing in a system, rather than programming it before installation.

2.2. IR Sensor

This IR proximity sensor is used to detect the presence of nearby objects or humans without any physical contact. This sensor emits an infrared ray and checks for any changes in the return signal. This type of object detection sensor has a good life due to lack of any mechanical parts and lack of any physical contact between the object and the IR sensor. GP2Y0A710K0F is a long-range infrared sensor that can detect objects up to 5 m. This IR sensor can easily cover a wide doorway and detect any person passing by.

2.3. RFID Tag

The RFID tag used in this project is passive. The tag consists of two parts, an antenna and an IC. The antenna is used for transmitting and receiving RF signal and the IC is used to store the tag's ID and other information. Unlike the active tag, the passive tag doesn't have a power source and it depends on the reader for the power. The passive tag receives the power through radio waves and emits a signal that transmits a message that is pre-programmed in it. The passive tag works under a frequency range of 860 - 960 MHz and has a read range of 25 metres depending on the frequency. Since the passive tag doesn't need a power source for its operation it can be manufactured to the size of a name tag. These types of tags are used in supermarkets and other industries for asset tracking.

2.4. RFID Reader

The RFID reader is the main part of the RFID system. In this project, a fixed RFID reader is used for detecting the RFID tags. The RFID reader usually has antennas to power the RFID tag and receive information from the tag through RF signals. An RFID reader has multiple ways to communicate data to a computer, it can be a LAN, Wi-Fi or Bluetooth. External antenna ports are an option to increase the read range. The YR8004 UHF RFID reader is used in this project which gives us a read range of 3m. Other costly RFID readers have GPIO pins to connect with other

accessories like light stacking etc., they also have online processing to compute rather than depend on a computer.

3. PROPOSED METHODOLOGY

This system is highly efficient in places like schools, colleges, universities, museums. This system will come in handy when an unknown person enters the region or to find the identity of the person entering or exiting the room. The IR sensor and the RFID reader is fitted like shown in the image below.
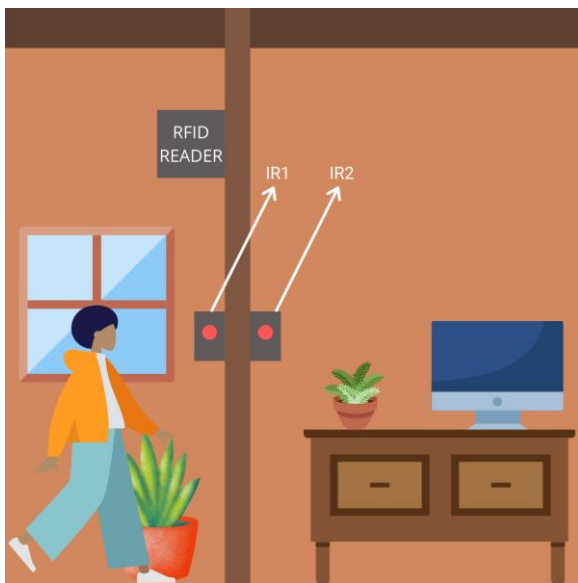

Fig1- Working Mechanism

When a person enters the room the IR sensors find a change in received wave and sends a signal to the MCU which in turn activates the RFID reader which checks for nearby RFID tags by transmitting Radiofrequency waves. If the RFID doesn't receive a return signal, the MCU sends an alert to the user via a Wi-Fi network. If the RFID reader receives a return signal, it can identify the RFID tag number and the MCU can identify the person using the number. The MCU can identify the person by finding the name linked to the tag number that is uploaded in the database. This information is then uploaded in a cloud database for easy access. This information can help in time stamping the employees or students entry and exit from a particular room. The data that is collected from this system is very small in size and it can be stored for longer durations, unlike video footage which takes a lot of memory, also this information can be accessed instantaneously and anywhere since it is stored in a cloud database. Two IR sensors are placed on each side of an entry point to find the entry or exit from a room. If IR 1 is triggered first, the MCU registers this as an entry into a room. If IR2 is triggered first, the MCU registers this as an exit. In this method, the MCU can register the entry and exit of a person and the duration of stay in a particular room. The IR sensors also play an important role in power saving by turning on

the RFID reader only when the IR sensors are triggered. This will reduce the power consumption tremendously since the reader will not be active all the time emitting RF waves.
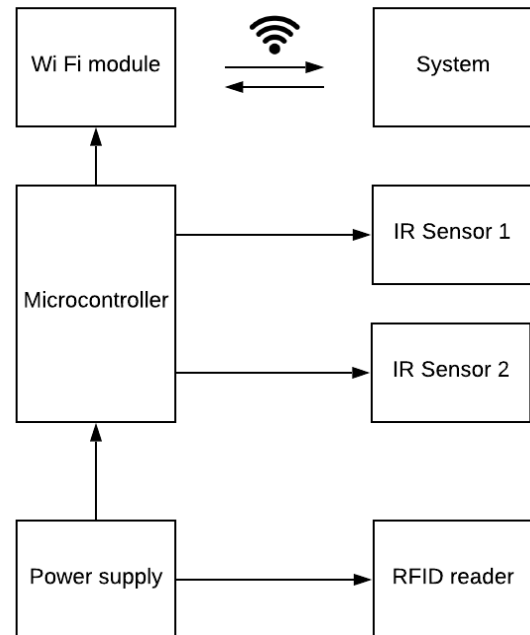

Fig2- Flowchart

4. Implementation

This project will prove to be of value in places like Schools, Museums, Hospitals. Buildings where there is a lot of social activity that needs to be monitored like schools, museums and other tourist places. Places where only a specialized person is allowed to enter like chemical labs and X-ray rooms in hospitals. Considering the application point of view for our idea, this can be implemented in schools or academic institutions' attendance management system. This will indeed ensure more precise attendance records, neglecting human error and malpractices. Apart from academic institutions, this proposed method could also be feasible in organisations where time management is a major priority since working hours are restricted to a certain time to time intervals.

5. Conclusion

There is always a need for a simple and cheap alternative. This goes for the security systems too, but there should be no compromise in its effectiveness. Our proposed idea will prove to be an alternative to CCTV security systems at a lower cost. Other than being a security system, this gives a better way to record the turnouts and enhance the time management system as far as any professional/commercial organization is concerned.