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RFID BASED ROOM AUTOMATION

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Abstract— This paper presents the design and development of a RFID based Room Automation using microcontroller. This paper has shown the concept of an automatic Door Access System with Automatic Room Light Controller and Visitor Counter. The concept of access control is brought about using a card, a corresponding card reader and a control panel. The card is a proximity card with a unique identification number integrated in it. The reader reads the data and sends it to the control panel. This controller checks whether he/she is allowed to enter the particular door or not. If the employee is authentic, then he/she is allowed access in the particular entrance. Automatic Room Light Controller with Visitor Counter using Microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately.

Keywords: Radio Frequency, Automation, Visitor Counter, Door Access, Room light controller.

1. INTRODUCTION

RFID i.e. Radio Frequency Identification is a device that refers to the electromagnetic waves having a wavelength suited for use in radio communications. Using RFID, the data can be serially transmitted to communicate. RF is used in many different applications. Such as identification systems, radio, televisions, etc.

Earlier Bar code was used to communicate but now RFID came into existence for better communication. RFID and Bar code are similar in concept. Bar code system uses a reader and coded labels that are attached to an item, whereas RFID uses a reader and special RFID devices that are attached to an item. Bar code uses optical signals to transfer information from the label to the reader; RFID uses RF signals to transfer information from the RFID device to the reader [1].

In today's world, with growth in technology, security has also become a major concern for any organization whether it is school, office or home. Earlier, there used to be security personnel at the entrance door to prevent illegal entry. But this system was never adequate for larger organization. This project uses RFID which utilizes radio frequency signals to provide automatic identification. Keeping security as a main concern, we have used RFID for encrypted data transferring and a control panel for door access while providing room automation. Also for energy saving, we have made automatic room light controller with bidirectional visitor counter. RFID uses a frequency in the range of 50 KHz to 2.5 GHz. RFID technology is an emerging technology used in wide range of applications. RFID technology is fast and reliable means for identification of objects. Primary goal of RFID technology is to automatically identify data that are contained in electromagnetic fields [2].

Radio frequency identification is a technology that allows simultaneous identification in a fully automated manner without the need for a line-of-sight via radio waves. Based on these advantages, RFID is widely spreading in various fields, such as smart card, localization, supply chain management, and so on [3].

For RFID based door access control system, when an authorized person try to enter into a room, a card is to be shown to the RFID receiver and the data is serially transmitted and the data is checked. If the data matches in the control panel i.e. with microcontroller memory, then the name is displayed on the LCD and the door will be opened so that the person will be able to enter into the room. And for energy saving, automatic room light controller with bidirectional visitor counter is implemented. When somebody enters into the room, then the counter is incremented by one and the lights in the room will be switched on automatically. The total number of persons inside the room is displayed on the seven segment display. When anyone leaves the room, the counter will be decremented by one. When the room is empty i.e. no person is inside the room, the lights will be switched OFF automatically so that the energy can be saved even if people forget to switch off the lights.

"RFID Based Room Automation" using

microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. Also, it only allows the authorized personnel to enter into the room ensuring security of the organization or home. The project uses AT89S52 microcontroller. The microcontroller receives the signals from the sensors and the signal is operated under the control of software which is stored in ROM. The microcontroller also monitors the infrared sensors continuously. When an object passes through the IR receiver then the IR rays falling on the receiver are obstructed which is sensed by the microcontroller.

2. SYSTEM HARDWARE

The proposed device counts the number of persons visiting a particular room and accordingly lights up the room. It also has a feature of RFID door access control system so that the unauthorized entry of person is prevented. RFID door access control system is provided with automatic room light controller along with visitor counter. When the room is empty, the lights of the room are automatically turned off.

List of Components

The major components that were used to build RFID based room automation circuit are listed as:

> Microcontroller – AT89S52
> IC – 7805
> Sensor – TSOP 1738 (Infrared Sensor)
> Transformer – 12-0-12, 500 mA
> Preset – 4.7K
> Disc capacitor – 104,33pF
> Reset button switch
> Rectifier diode – IN4148
> Transistor – BC 547, CL 100
> 7-Segment Display
> IR Sensor
> Relay Circuit
> Holder
> Gear Motor

2.1 Automatic Door Access System

The basic block diagram of the door access control system using RFID is as shown in figure 1. In this circuit, +5V power supply is used. The main function of power supply is to provide the required amount of voltage to essential circuits. +5V dc power supply is provided using 7805 IC which ensures regulated +5V dc supply. The card used in our project is a passive Radio Frequency Identification device for low-frequency applications (100 kHz-400 kHz). The device is powered by rectifying an incoming RF signal from the reader. The device requires an external LC resonant circuit to receive the incoming RF signal and to send data also. The device develops a sufficient DC voltage for operation when its external coil voltage reaches approximately 10V.

The microcontroller used in this project is AT89S52 which is a low-power, high performance CMOS 8-bit microcontroller. In the microcontroller AT89S52, AT

refers to the ATMEL series, 89 is the series number, S represents serial communication or parallel communication and 52 is the series number. When compared to other microcontrollers, AT89S52 has 8kB Flash memory, erasable read only memory (EROM) and 256 bytes of RAM [4]. A 16 x 2 LCD module is used for the displaying purpose. The LCD is connected to the microcontroller for displaying certain text to the user. A potentiometer is used to vary the brightness of the LCD display.

Since RS-232 (Recommended Standard 232) is not compatible with today's microprocessors and microcontrollers, we need a line driver to convert the RS-232's signal to TTL voltage levels that will be acceptable to the 8051's Txd's and Rxd's pins. The max 232 converts RS232 voltage levels to TTL voltage levels and vice-versa [5]. One advantage of max 232 chip is that it uses a +5V power supply which is same as the source voltage of microcontroller. The H-bridge motor drive circuit is shown in figure 2.
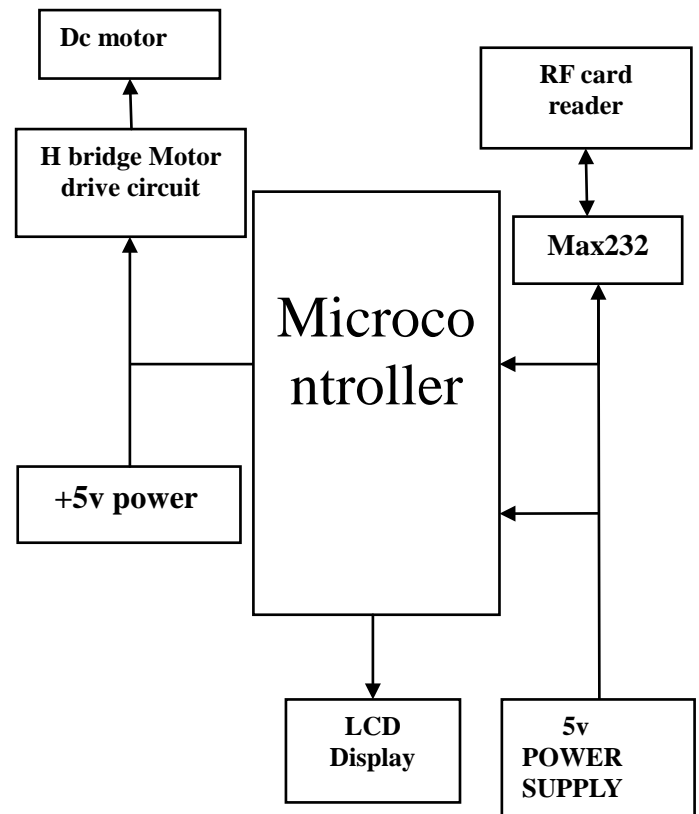

Fig. 1: Block Diagram of Automatic Door Access System

2.2 Automatic Room Light Controller

The basic block diagram of the bidirectional visitor counter with automatic room light controller is as shown in figure 3. In this block, +12V and +5V dc power supply is used. +12V is provided to the relay driver. +5V is provided using 7805 IC.
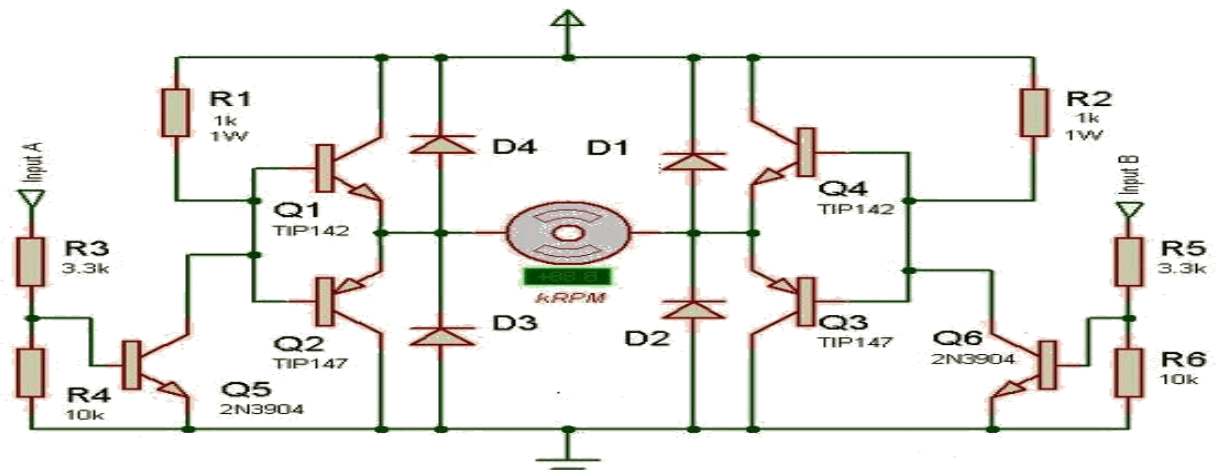
Fig. 2: H-bridge Motor drive Circuit [6]

The main part of this system is "entering and exit" circuit. This circuit senses the person. For sensing the person and light, a light dependent register (LDR) is used. By using this sensor and its related circuitry, we will be able to count persons. The microcontroller AT89S52 is used.

Relay driver circuit has the potential to drive various controlled devices. This block consists mainly of transistors and relays. One relay driver circuit is used to control the light. Output signal from AT89S52 is given to the base of the transistor, which is used further to energize a particular relay.

Automatic Room Light Controller with Visitor counter device is used to save the energy in our residential areas, offices or in industries. This system makes the use of infrared sensor to sense the person. The IR sensors are placed at the entrance gate as well as at the exit gate. When the person enters the gate, the counter will automatically increment by one whereas when a person leaves the room, the counter will automatically decrement by one. The number of person will be shown on LCD display.
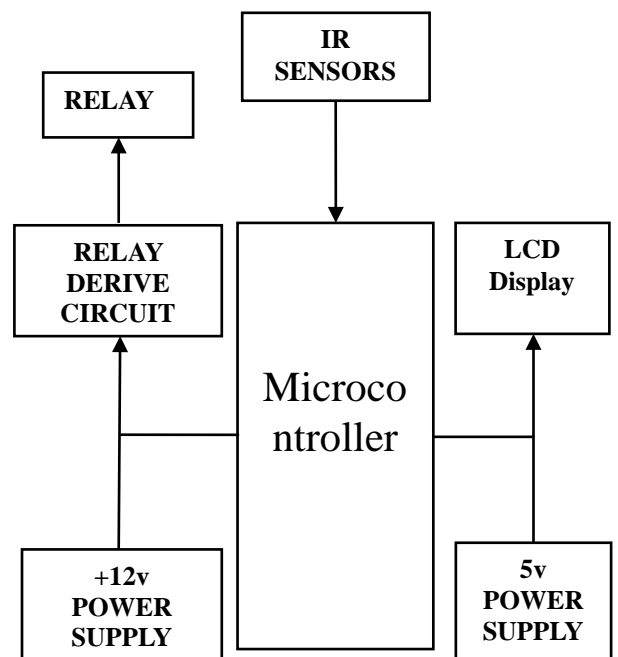

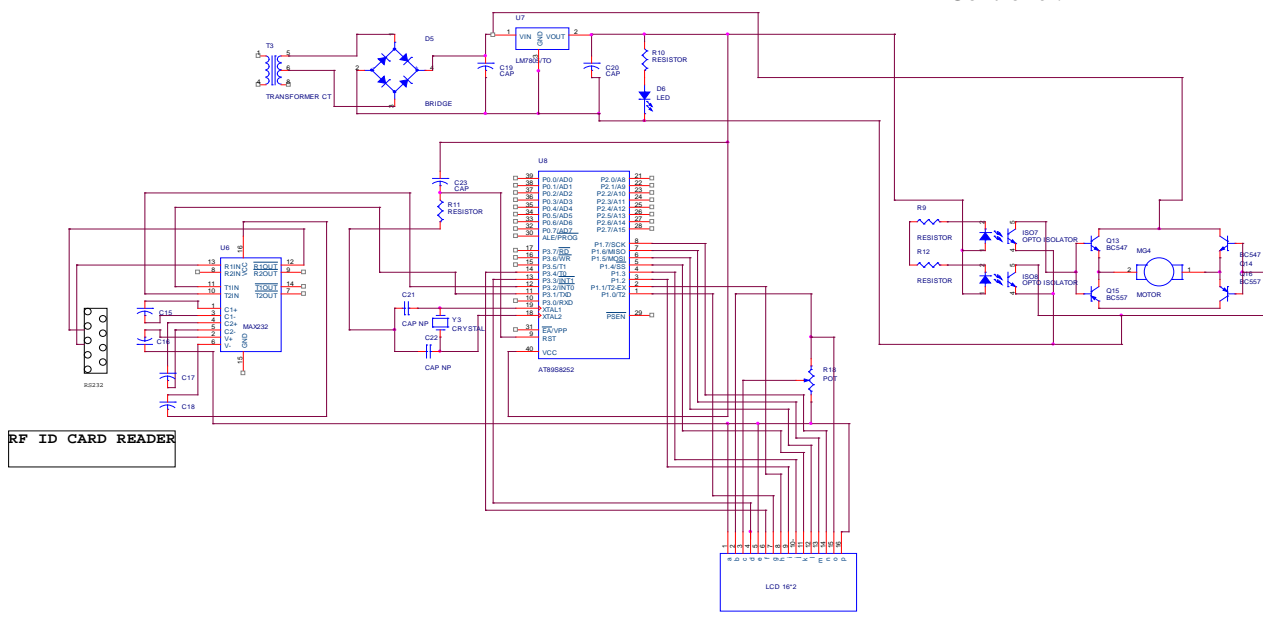Fig. 3: Block Diagram of Automatic Room Light Controller.

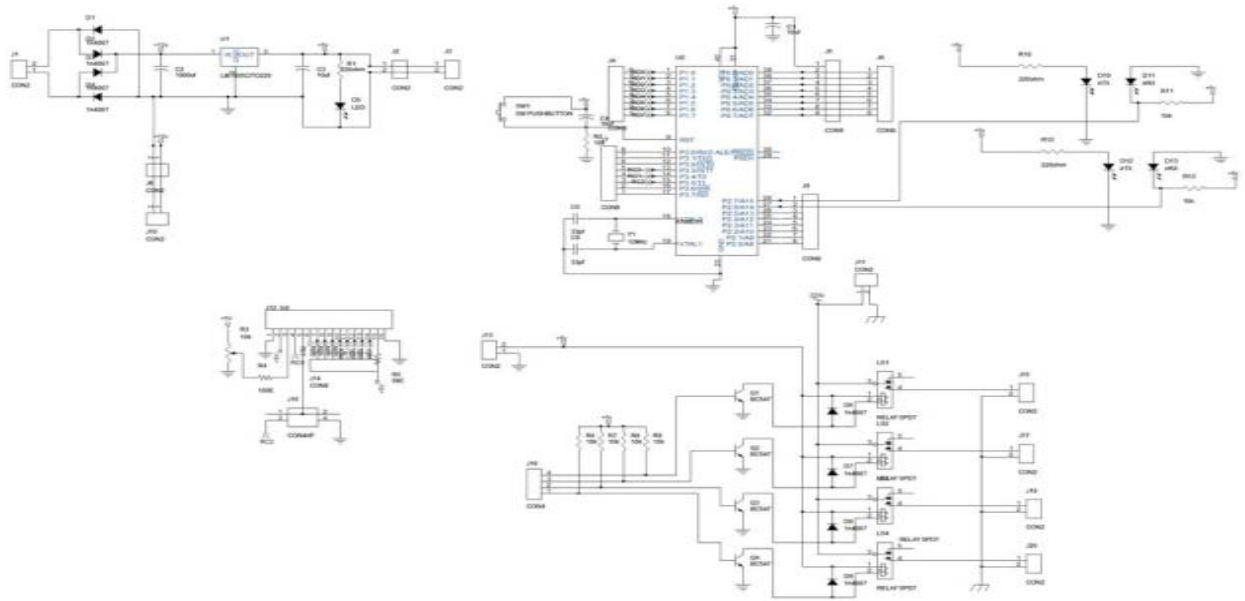Fig. 4: Circuit Diagram of Door Access Control System.

Fig. 5: Circuit diagram of Automatic Room Light Controller.

When a person enters into the room, light will turn on automatically. When no person is inside the room, all lights will turn off automatically. The light will not turn off until all the persons inside the room leave. Relay driver circuit is used in this system to control 220 volt supply.

3. SYSTEM SOFTWARE

3.1 Circuit Diagram

The circuit was designed using DIPTRACE software. DIPTRACE is a circuit designing software. The circuit diagram of automatic door access system and automatic room light controller are shown in figure 4 and figure 5 respectively.

3.2 Simulation

After the circuit is designed using DIPTRACE, the next step is simulation which is done using proteus software. The software used in this project is Keil and proteus to complete simulation. Keil Software provides us with software development tools for the 8051 family of microcontrollers. With these tools, we can generate embedded applications for the multitude of 8051 derivatives [8]. Keil software is used for programming and generating corresponding Hex file. Hex file is used to simulate the circuit. Simulation is done in Proteus software. After the circuit is drawn in proteus, the Hex file generated from Keil software is loaded in the circuit in proteus and simulation was completed successfully. For serial communication, HyperTerminal is used. HyperTerminal is used to know the card's serial number. The coding was done using C language which is shorter than assembly language.
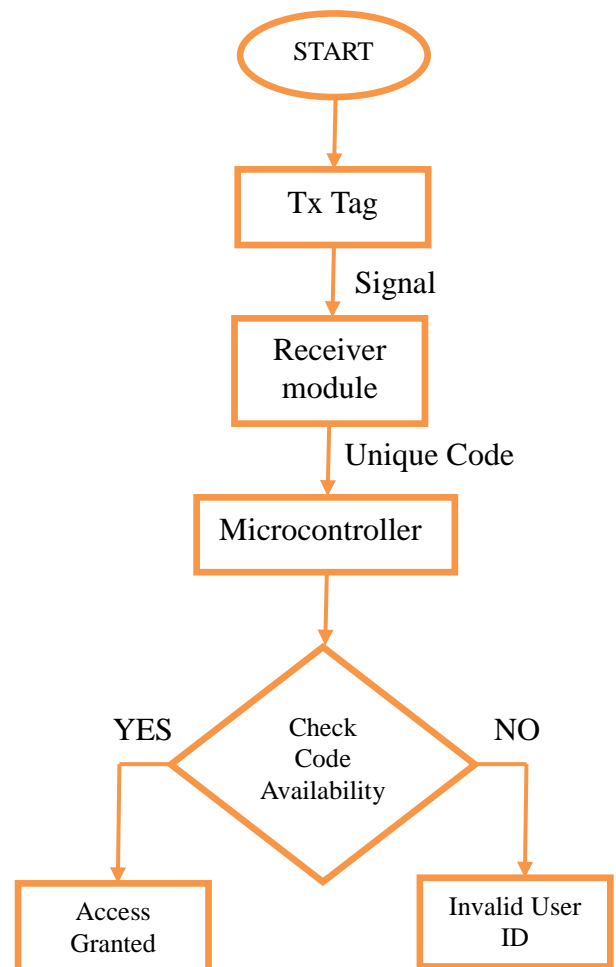
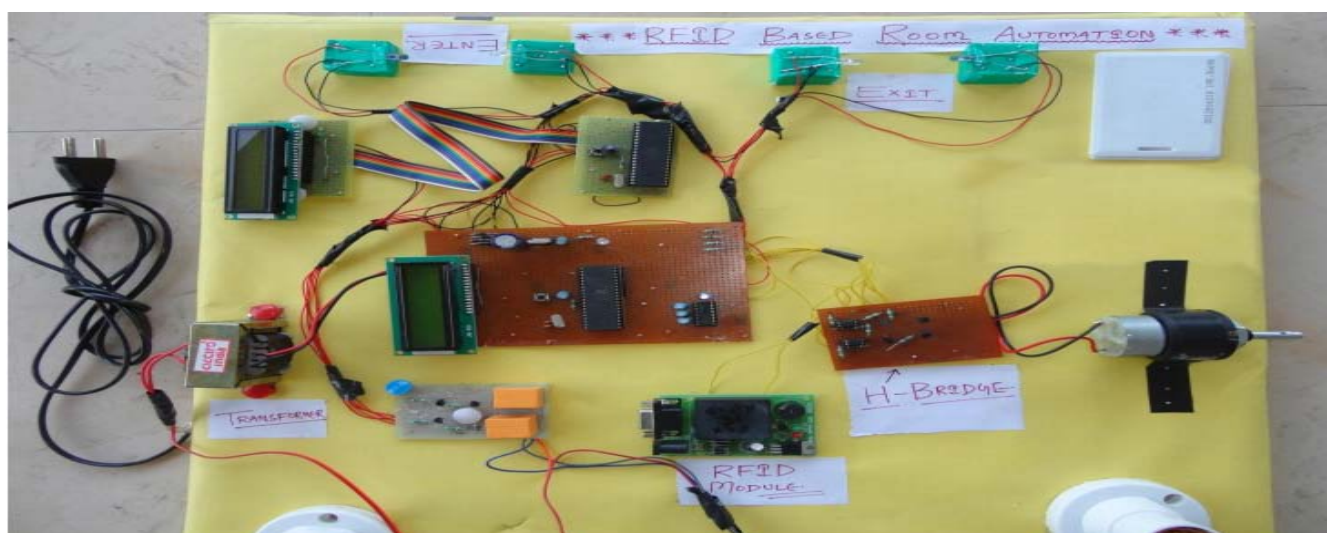## 4. FLOW CHART

Fig. 6: Flow chart

Fig. 7: Circuit Implementation

5. CIRCUIT IMPLEMENTATION

The implemented circuit is shown in figure 7. The major parts of the circuit are labeled in the figure.

6. RESULTS AND DISCUSSION

This system can replace the conventional system of security access in near future for home or office. The project showed the concept of an automatic door access system with automatic room light controller along with visitor counter. The control system was brought by using a card, a corresponding card reader and a control panel. This project used a proximity card on which a unique identification number was integrated on it. The RF card reader reads the data and sends the read data to the control panel, which is microcontroller in this case. The controller checks if the person is authorized to enter the gate or not. If the person was authorized then the door opened and the person was allowed to access in that room but if he/she was not authentic, the door did not open.

On the other hand, automatic room light controller with visitor counter was also successfully implemented. It used another microcontroller to control the light of a room based on the number of person entering or leaving a particular room. The visitor counter successfully counted the number of person entering or leaving the room. When a person entered the room, the counter was incremented by one and the light in the room was switched ON automatically. But, when a person left the room, the counter was decremented by one. And when all the persons left the room, the lights turned OFF automatically. It was noted successfully, that the counter returned to zero when there was no one left in the room and lights went OFF automatically. The total number of persons inside the room was displayed on the LCD.

This system is suitable when there are a large number of users where security is essential but difficult to provide. The implemented project is simple to operate, user-friendly, and flexible. The project can easily be modified by changing the program in the microcontroller according to our need. So, this project has a wide variety of application in security access control systems.

7. REFERENCES

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