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RFID Based Secured and Fully Automatic Attendance System Using ARM

Sumita Singh[1], Sonali Singh[1], Rupam Srivastava[1] and Amit Kumar[2]
[1]Department of ECE, Buddha Institute of Technology, Gorakhpur, (Uttar Pradesh), INDIA
[2]Assistant Professor, Department of ECE,
Buddha Institute of Technology, Gorakhpur, (Uttar Pradesh), INDIA

ABSTRACT: Maintaining records of employees is one of the most important parts of an organization. The traditional methods of keeping records by calling names or signing on paper are very time consuming and inefficient. RFID technology provides a solution for such problems. This work eradicates the deficiencies associated with the manual attendance system with an automated approach. RFID or radio frequency identification is a method in which electromagnetic waves are used for transmitting data for the purpose of identifying tags attached to objects. The ability of the system to uniquely identifying each person based on their RFID tag type of ID card makes the process easier, faster and secure as compared to conventional method. The idea is to come up with a cost effective RFID setup that can be used to mark attendance and control access of employees. In order to have more capacity and less power dissipation, a more advanced microcontroller i.e. ARM7 LPC2148 is considered.

Keywords: RFID (Radio Frequency identification);RFID Reader and Tag;ARM7 LPC2148;Student Attendance;Access Control ; Microstrip;

I. INTRODUCTION

Access control and monitoring system has become a popular topic in research field. This paper provides knowledge on radio frequency identification (RFID) technology which can be incorporated to maintain attendance record of employees and overcome security threats within an institute.

There were two conventional methods for taking attendance, i.e. by calling out students' name or by taking their signature on paper. These strategies were however time consuming, stressful and laborious because the valuable lecture time that could otherwise have been used for lectures is dedicated to student attendance taking [1]. In addition to this, traditional methods were also prone to manual errors. Overall, the major problems are-

- Payment of an extra attention
- Disturbance to both lecturer and students
- Possibility to misplace the attendance sheets
- Difficulty of analyzing
- Proxy attendance
- Lecture time wasted in attendance taking
- Difficulty to collect attendance from a large number of students.

This led to the need of a more reliable and precise method. By using RFID technology, it is easier and faster to detect employees handling and manage access control.

The system serves the purposes [9] of identification, monitoring, authentication and alerting through the exchange of data between the tag and the reader. It evolves to prevent illegal entry of people into a particular area and preventing unauthorized people from gaining access to certain organization resources. The door locking system functions in real time, the door opens as soon as the mastercard is read by the reader.

The technology used is ARM (Advanced RISC Machine) which is a more advanced version of typically used microcontrollers like 8051, AVR or PIC technology. Thus, it provides various advantages over other technologies such as lower power dissipation, larger capacity of storage, modified Harvard architecture, etc.

II. REVIEW OF RFID TECHNOLOGY

RFID or Radio Frequency Identification is a method in which electromagnetic waves are used for transmitting data for the purpose of identifying tags attached to objects. It is an automatic identification technology which uses radio frequency electromagnetic fields to identify objects carrying tags when they come close to a reader. A basic RFID system is shown in Fig. 1.

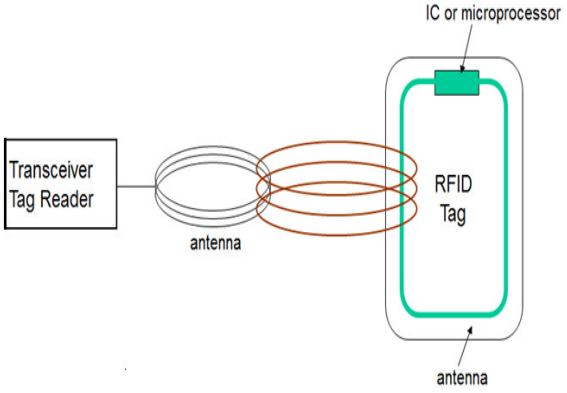


Fig. 1. Basic RFID system.

It is one family member in the family of Automatic Identification and Data capture technologies and is a fast and reliable means of identifying just about any object. The acronym RFID refers to small electronic devices that consist of a small chip and an antenna. The chip typically is capable of carrying 2,000 bytes of data or less.

The RFID device serves the same purpose as a bar code or a magnetic strip on the back of a credit card or ATM card; it provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information.

Radio frequency identification (RFID) is a matured technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. They are grouped under the automatic identification (Auto-ID) technologies.

III. RELATED WORKS

The RFID idea is not new but rather has been around for a considerable length of time; actually, it was first seen in WWII by the Air-Force to distinguish between friend flying planes to that of opponent airplane utilizing radars. From that point forward, this invention has been utilized for different corner applications, for example retail industry, keeping track of goods anti-theft frameworks, gear following in air terminals, electronic tolls, and many others. This was the starting period of RFID technology era.

Cronin [10] compares RFID with its predecessor technology viz. barcodes. Barcodes require that the barcode and scanner are in direct line of sight for them to be scanned and the items have to be physically moved against the scanner for data collection. RFID tags, on the other hand, automatically transmit data to the reader even without a line of sight. Singh *et al.* [11] provides a brief overview of the RFID technology and also the recent advances towards standardization of the system. The authors also describe some of the recent applications in the field of apparel, and fresh produce. Ngai *et al.* [12] summarize the research findings in this area from 1995 up to 2005. Alani *et al.* [13] summarize the various aspects involved in a RFID system and their classification schemes. Chen et al. [2] developed a dual-function metallic RFID tag with barcodes for use in the steel industry.

Many researchers have also proposed many theft prevention systems. This system contains new technologies. System included in it uses a GSM which serves as an mediator between outside world and system, there is need of DTMF decoder for converting frequencies into voltage levels of zeros and ones. Microcontroller used in it is an 8-bit microcontroller which serves lesser than other 16-bit, 32-bit microcontrollers.

IV. SYSTEM OVERVIEW

The system technical specifications consist of two main categories- Hardware specifications and Software specifications as listed below:

A. Hardware Specifications

RFID reader and tag. The RFID reader sends a pulse of radio waves to the tags and listens for its response. The RFID tag is primarily a kind of a memory device that can transmit its contents when being scanned by the reader. The EM-18 module RFID reader and tags are used which is shown in Fig. 2.

Fig. 2. RFID tag and reader.

LPC2148 microcontroller. Microcontroller used here is ARM7-LPC2148. The controller is responsible for detection and making decisions for the connected devices. LPC2148 is the widely used IC from ARM-7 family shown in Fig.3.

It has two general purpose I/O ports each of 32-bit. It is the major part of the system which controls all the operation of the circuit such as LCD interfacing, receiving RFID data. It also decides the messages to be displayed on the LCD along with the time duration for which they should be displayed on the LCD.

Fig. 3. LPC2148 microcontroller.

2x16 LCD. A liquid-crystal display (LCD) is a flat-panel display or other electronic visual display that uses the light-modulating properties of liquid crystals. A 2x16 alphanumeric LCD as shown in Fig.4 has 2 rows and 16 columns and it can display a maximum of 32 characters.In this LCD each character is displayed in 5x7 pixel matrix.

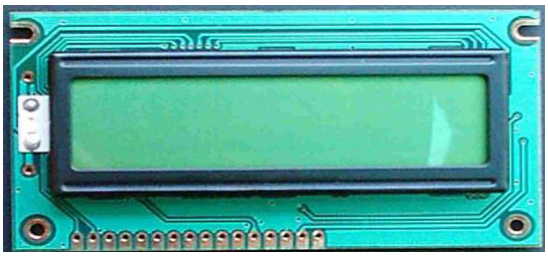


Fig. 4. LCD.

DC Motor. A DC motor is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. DC motors are widely used in control applications like robotics, tape drives, machines and many more. A simple dc motor is shown in Fig. 6.

Fig. 6. DC motor.

L293D (motor driver IC). L293D is a typical Motor driver IC which allows DC motor to drive on either direction. It converts direct current electrical power into mechanical power. L293D is a 16-pin IC as shown in Fig.5 which can control a set of two DC motors simultaneously in any direction. It means that we can control two DC motors with a single L293D IC.

In a single L293D chip there are two h-Bridge circuits inside the IC which can rotate two dc motor independently. H-bridge is a circuit which allows the voltage to be flown in either direction and are ideal for driving a DC motor.

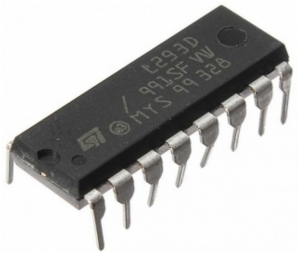


Fig. 5. L293D IC.

RS232. RS-232 (ANSI/EIA-232 Standard) is the serial connection found on IBM-compatible PCs. RS-232 is limited to point to- point connections between PC serial ports and devices.

Fig. 6. RS-232 cable with USB.

RS-232 hardware can be used for serial communication up to lengths of 50 foundations. RS-232 cable is shown in Fig. 6.

B. Software Specifications

The program is written in 'C' language and compiled using **Keil µVision4 compiler**. This is an Integrated Development Environment which is used for writing code for the LPC2148 microcontroller and compiling it. Several C files are created for the project using this compiler.

Flash magic programmer is used to burn the hex file generated by the keil software onto the ARM processor. The com port to which write is to be done is selected. Baud rate is set to a value of 9600. Interface is kept as ISP. The oscillator frequency is kept to 12 MHz . The hex file is selected. Verify and programming verifies if the hex file is in proper form and then uploads it to ARM after erasing the flash.

Proteus is used for simulation of hardware. The Proteus Design Suite is an Electronic Design Automation (EDA) tool including schematic capture,

simulation and PCB Layout modules. It is mainly popular because of availability of almost all microcontrollers in it.

V. FLOW CHART

The overall project overview comprises of following parts-

a) RFID based attendance system
b) Automatic gate system using dc motor
c) PC interfacing using Hercules setup and ARM programming

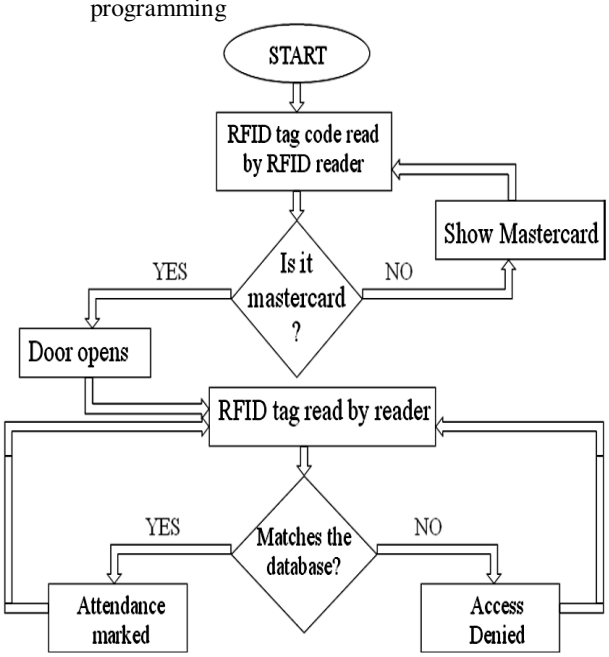
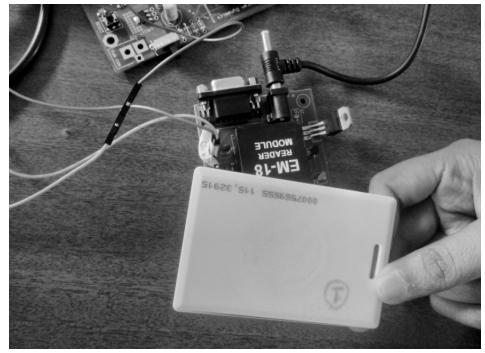


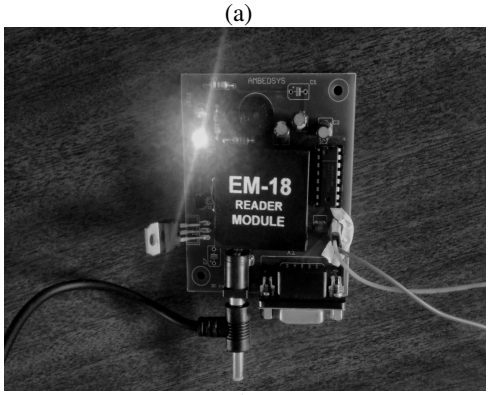
Fig. 7. Flow Diagram.

The flow of the whole process as shown in Fig.7 is explained below:

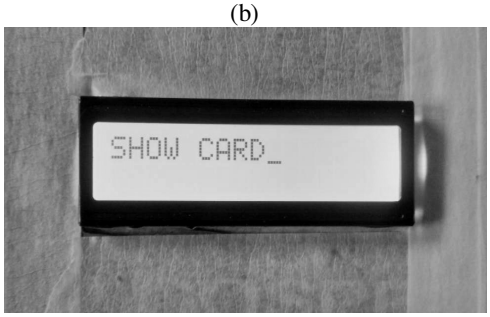
- When tag is interacted with RFID reader as in Fig.8(a)and(b), 12 characters from the tag are sent to the controller via serial communication. Before this, controller is loaded with the program that contains data of employees. When we provide power supply to the circuit, the circuit switches on and "RFID BASED ACCESS SYSTEM" is displayed on the LCD, followed by "SHOW MASTERCARD".
- When 12 characters are transferred to controller, the controller matches the characters with the saved characters. If the characters are matched with MASTERCARD characters, "MASTERCARD ACCEPTED" is displayed on the LCD, followed by "SHOW CARD" otherwise "SHOW MASTERCARD" is displayed in Fig.8(c).
- The acceptance of MasterCard opens the door and begins attendance taking process.
- Now, students' tags are interacted. If the characters are matched with saved characters, "WELCOME" is displayed otherwise access is denied.



(a)



(b)



(c)

Fig. 8(a). Interaction of tag with reader,(b) RFID Reader and (c) LCD display("SHOW CARD").

VI. WORKING

- The data is transferred onto the computer via serial communication through MAX-232. The data is displayed on a hyper terminal "HERCULES" on the computer.

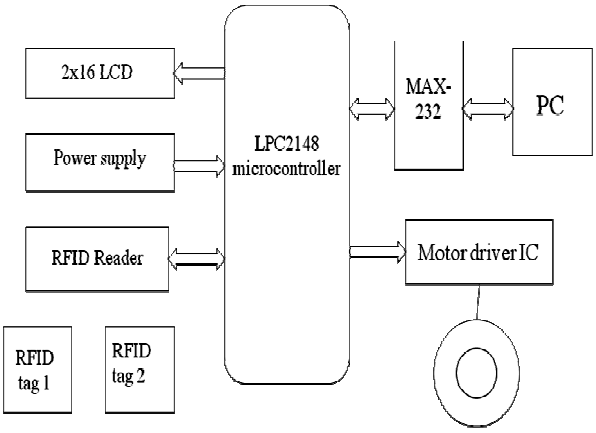


Fig. 9. Block Diagram.

- The major part of the system is LCD and microcontroller. Microcontroller is the heart of this system. Some points of this microcontroller are used for the programming purpose.
- The power supply provides the microcontroller with desired supply so that it can work properly.
- The RFID reader is interfaced with microcontroller by connecting the Tx pin of RFID reader to Rx pin of LPC2148 microcontroller.
- LCD is connected to LPC2148 and programmed to work in 4-bit mode. The LCD is responsible for displaying messages.
- The door mechanism is controlled by connecting a motor to the door. A motor driver IC L293D is used to provide proper voltages and currents to motor and prevent back emf.
- For interfacing computer, RS-232 is used. MAX-232 is also introduced as it acts as a communication interface between PC (RS-232) and microcontroller.
- When a person with RFID tag or transponder enters in the range of RFID reader, the RF field induces voltage in the coils of tag. The range can be set by using the appropriate reader of appropriate frequency. This induced field supplies the voltage in case of passive tags and act as a battery in that case. If active tags are used then the case will be different as they have battery of their own.
- The data transfer occurs from tags to RFID reader and then to the microcontroller.
- The microcontroller then instructs the LCD to display desired messages and transfers data to PC according to programming.

Block diagram is shown in Fig .9.

VII. CONCLUSION

In conclusion, the objective to build an RFID based attendance system with a door unit was successfully achieved. The overall system is also interfaced with a computer using serial communication and hyper terminal HERCULES is used. In terms of performance and efficiency, this project has provided a convenient method of attendance marking compared to the traditional method of attendance system. This system is also a user friendly system as data manipulation and retrieval can be done via the interface, making it a universal attendance system. Thus, it can be implemented in either an academic institution or in organizations.

RFID based security and access control system is more secure and fast responded as compared to the other system like biometric. The advantage of the RFID system is contact-less and works without-line-of-sight. By using ARM technology, it is easy to access and works very quickly while burning the code it is like plug and play device. In addition to this, ARM technology provides low power dissipation and more storage capacity. It is easier to use and accurate also. Hence this project can be useful for implementation of access control application for tracking system as well as providing the security benefits. This project can improve by raising the range of reader in which the tag read.

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