EMBEDDED AUTOMATION FOR ENTRY EXIT SYSTEM WITH ATTENDANCE MONITORING

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Abstract- Radio Frequency Identification (RFID) is an automatic identification method where in data stored in RFID tags can be remotely retrieved. Some tags can be read several meters away beyond the line of sight of the reader. RFID offers advantages over manual systems or use of bar codes. This paper implements a methodology in which a real time RFID hardware system is implemented in order to record the movement of people in an organization and at the same time store their movement in a database.

Keywords- RFID, Microcontroller, PC Interfacing, I2C Protocol, Embedded Systems.

I. INTRODUCTION

Radio Frequency Identification (RFID) is an automatic identification method where in data stored in RFID tags can be remotely retrieved. It is a device that can be attached to or incorporated in a product or an animal or person for identification. Some tags can be read several meters away beyond the line of sight of the reader. RFID technology can also be used in malls or in large organizations like industries, libraries, hospitals, universities etc. where it is difficult to monitor large no of products, data or persons. In large organizations, it is generally seen that it is hard to maintain and monitor the people, products or data. It’s hard to manage all the data and persons manually or through barcode readers, the conventional method of managing products. The barcode readers have a drawback that they can be read only one bar code at a particular time and the laser light should completely cover the bar code to read it. This is not the case with the RFID readers as the product does not have to be in the line of sight of the reader and it can detect hundreds of cards one at a time.

The RFID based systems for these applications have been implemented, but are less informative and secure. The system implemented in is able to detect the authorized person but does not provide with the accurate time details, nor there is a provision to store the record of the transits made during the day.

So this system is designed to overcome these problems. The main objective of the paper is to:

1. Provide the system with time details in order to make the system more accountable and informative.
2. To able to keep a track record of various transits made during the day and able to save it in a form which is easily user accessible.

The paper completely explains the implementation of the system. In section 3 interfacing of various modules is discussed followed by the algorithm description in section 4.

II. SYSTEM DESCRIPTION

In the RFID based attendance system, when the person arrives at the gate with the card, it has to be placed near the RFID reader. The range of the card detection depends upon the operating frequency of the reader. The reader reads the card and the card number should match with the card numbers already stored in the database. If the card is found to be authorized the gate boomer opens and allows the person to enter or exit. The person’s name, time of entry or exit is recorded and stored in the memory. The complete record is then serially sent to the computer interfaced with the microcontroller. In addition the system provides security to the organization by restricting the entry of unauthorized persons. This also maintains a complete set of record of the entry and exit of the people working in that organization in an easy way which can be easily handled and monitored.

![Block Diagram Representation](image_url)
The complete system consists of independent modules linked to each other and controlled by the microcontroller as shown in Fig. 1. RFID reader module is connected to the controller directly to its TX pin as shown in Fig. 2. Real Time Clock (RTC) is used to provide time to the system which is updated every second. The RTC also provides date and day and also accounts for leap years.

The RTC used in this case is DS-1307 which works on I2C protocol. For display 16 X 2 Liquid Crystal Display (LCD) screen is used in which the time and all the details of the user is displayed. Servo motor is used to open the gate boomer and allow the authorized person to enter or exit. All the data of the entries or exit of the authorized person is transferred to the personal computer connected to the system using RS 232. MAX 232 is a link between the microcontroller and the personal computer which is used to convert the RS 232 voltage levels to TTL level suitable for transferring data from microcontroller to PC.

III. HARDWARE DESCRIPTION

Fig. 2 shows the circuit diagram of the proposed model. The details of the components used in the circuit are discussed in detail in the following section.

A. P89V51RD2 MICROCONTROLLER
It is a low power, high performance low cost 8 bit microcontroller with 64K flash memory and 1Kb RAM manufactured by NXP-Philips. Its crystal frequency ranges from 0-40 MHz.

It is compatible with industry standard 8051 instruction set and pin out. The on chip flash allows the memory of the controller to be programmed. Other features include serial communication (UART), large internal memory, 4 input output port, programmable watch dog timer, three 16 bit timers, burn out detection and TTL and CMOS compatible logic levels.

B. RFID READER MODULE
A RFID system consists of an antenna or coils, a transceiver and a transponder electronically programmed with unique information. RFID systems are categorized on the basis of frequency as low frequency, mid frequency and high frequency reader. The RFID reader used here in this system is a mid-frequency reader of frequency specification of 125 KHz. The TX pin of the module is connected to the RX pin of the microcontroller for serial communication. When the card comes in the range of 10 cm of the reader module, it passes through the electromagnetic zone and detects the reader’s activation signal. The reader decodes the data encoded in the tag’s integrated circuit.

C. REAL TIME CLOCK (RTC)
Real time clock is widely used device that provides accurate time and date. The RTC chip provides time components of hour, minute, seconds In addition to date/ calendar components of year, month, and day. It uses an external lithium battery when the power is switched off to keep its time updated. DS 1307 IC is used which is programmed on I2C protocol. SCK is the time signal connected to pin P2.4 and SDK is the data pin which is connected to P2.3. The data transfer will only take place from the RTC to the controller when SCK is high.

D. SERIAL COMMUNICATION WITH COMPUTER
The TX pin of the microcontroller is used to transfer the data to the computer serially. The TX pin is connected to the computer via MAX 232 IC which is used to convert the voltage to TTL level. From the third pin of the IC the data is transferred using a RS 232 to USB cable. Brays Terminal software is used to receive the data on the PC screen. In the software the COM port number is selected and data bits are set to 8 with baud rate as 9600 and parity bit as none. When an authorized card comes across the RFID reader all the details of the person comes on the computer screen. This data is only accessible with the administrator of the organization.

IV. SOFTWARE IMPLEMENTATION

The algorithm mentioned below explains the step wise execution of the program, how the program checks for various conditions.

1. Start
2. Start the infinite loop.
3. Show the display message, the date and time.
4. If card is acknowledged, receive the card number and match it with the card numbers in the database.
5. If card number is matched, allow the person to enter or exit, show his details on the LCD and subsequently send them to the PC.
6. If card number does not match, do not allow the person to enter and display “INVALID USER”. The flow chart as shown in Fig. 3 is a diagrammatic representation of the algorithm mentioned above. It shows the flow of the program, how various conditions are checked and what steps are taken when the required conditions are not met.

V. WORKING AND HARDWARE IMPLEMENTATION

The whole system was implemented on a test board of P89V51RD2 microcontroller as shown in Fig. 4. The hex code of the program was burned using the Flash Magic software specially dedicated for the controllers manufactured by NXP Philips. The boomer was installed on the shaft of the motor. For testing of the circuit when the power supply is switched on, the LCD should have its backlight ‘ON’. It should display the message “WELCOME” and on the next line it will show the time, date and day, which will be updated every second. As soon as a card comes in the range of the RFID reader, the card will be detected and the buzzer will beep to give the presence of card. The card number will be transferred to the microcontroller serially. This card number will be checked by the controller in its database. If the match is found, the LCD will be interrupted and will show the details of the person like the name, designation, entry/exit time and the motor will rotate so that the boomer opens and wait for some time to allow the person to pass and then motor will again rotate to close the boomer. All the data of the person will be transferred to the computer through the RS232 cable and it will be displayed on the computer using the software ‘Brays Terminal’. The information will comprise of the name, card number and the time and date of the entry or exit. If the match is not found in the database, then LCD will display “INVALID ID” and motor will not rotate, so the boomer does not open. Hence, there will be no transfer of data to the computer.

VI. RESULTS

A. OUTCOMES OF THE PROJECT

The proposed circuit was successfully implemented on the test board. It displays the complete time, date and the welcome message as shown in Fig. 4. In the first case, if the person is registered then he/she is allowed to enter and the details of the person come on the LCD as shown in Fig. 5. In the second case when the person is not registered then he/she is not allowed to enter and the LCD displays a message “INVALID ID” as shown in Fig. 6.

With the use of RFID reader the microcontroller is able to distinguish between the authorized and unauthorized persons. The proposed model has made the system more accountable by providing time details. This is the extra feature added into the system. Another important feature which is added is transfer of data to the PC. These additions make the system better and apt for the purpose for which it is implemented as compared to the system implemented in.
B. COST COMPARISON FOR THE HARDWARE SETUP

The cost of the project is shown in Table I. As compared to the existing model, it is found that this model is cheaper as well as has extra features like time and date display as well as communication with the computer. Whereas the market price is Rs 5500/-. So the proposed model is cheaper as compared to that available on ‘kits n spares.com’.

<p>| TABLE I ESTIMATED BUDGET |</p>
<table>
<thead>
<tr>
<th>NAME OF THE COMPONENT</th>
<th>PRICE (Ruppes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICROCONTROLLER P89V51RD2</td>
<td>175/-</td>
</tr>
<tr>
<td>16 X2 LCD</td>
<td>170/-</td>
</tr>
<tr>
<td>RFID READER MODULE</td>
<td>950/-</td>
</tr>
<tr>
<td>MAX 232</td>
<td>20/-</td>
</tr>
<tr>
<td>SERVO MOTOR</td>
<td>450/-</td>
</tr>
<tr>
<td>RTC MODULE (DS 1307)</td>
<td>200/-</td>
</tr>
<tr>
<td>DISCRETE COMPONENTS, WIRES AND CONNECTORS and PCB</td>
<td>800/-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2,765/-</strong></td>
</tr>
</tbody>
</table>

CONCLUSIONS

With the use of RFID readers, disadvantages of barcode readers and issues related with the manual handling of the data can be minimized. RFID readers have more accuracy, less errors and more speed in handling the data related with persons or products of an organization. A prototype model of RFID based attendance system was successfully implemented on the test board of the microcontroller P89V51RD2. The cost of the developed model is less compared to the model available in the market.

Also, the program was made more efficient by using the interrupt service routine and I2C protocol.

REFERENCES