RFID BASED AUTOMATED BANK LOCKER SYSTEM

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Abstract

Banks provide locker system for their customers for safekeeping. In the current locker system, there is no separate banker to take care and attend to people wishing to access lockers. Every tim a customer wishes to access his locker, he must wait until a banker becomes free so that he can authenticate access to the locker. This results in waste of time for both the banker as well as the customer, as the customer has to wait until the banker becomes free and the banker has to stop his work and attend to the customer. This project aims to change the existing system and automate the locker system using RFID tags for customer identification. Every customer is given a unique RFID card with a unique number so that the customer can be identified and access can be granted to the customer's locker.

Keywords—RFID tag, RFID based locker, automated locker, time saving, easy access, 8051 microcontroller.

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1. INTRODUCTION

In the recent years, in spite of increased security and protection in banks, there are many thefts happening in banks. As the technology keeps growing, the need for safe and secure lockers keeps growing. The solution to this problem can be met with this project. It greatly reduces the waiting time and increases the security.

2. EXISTING SCENARIOS

In most of the banks, the locker systems involve manual lock. Whenever the user wishes the use the locker, he should be assisted by the bank employee which leads to waste of time for both the customer and the employee. The major drawbacks of such manual lock systems are lack of security and the waiting time of the customers. It should be noted that the person accompanying the customer can be any employee who is free at that instant of time. Solely, time is wasted. This can be overcome by any automatic locker system. There are many techniques in which this can be implemented. In this project, RFID tags are used which holds the user's information like locker number, username, etc, this RFID tag when read by the RFID reader will automatically open and close the locker. Thereby, security is guaranteed and the customers waiting time is drastically reduced.

3. METHODS USED

RFID technology is the fast growing technology in the recent years. RFID is similar to bar code technology but uses the radio waves to capture the data from the tags rather than optical scanning. One of the key characteristics of RFID is that it does not require any tag or label to be seen to read it's stored data. The RFID system interfaced with microcontroller requires the controller to continuously scan the input from the RFID reader. RFID reader module is also called as interrogator. They convert the radio waves returned from the RFID tag into a form tat can be passed on to controllers, which can make use of it. RFID system consists of two separate components: a tag and a reader. Tags are analogous to barcode labels and reader functions similarly to barcode scanners.

4. ARCHITECTURE OF THE SYSTEM

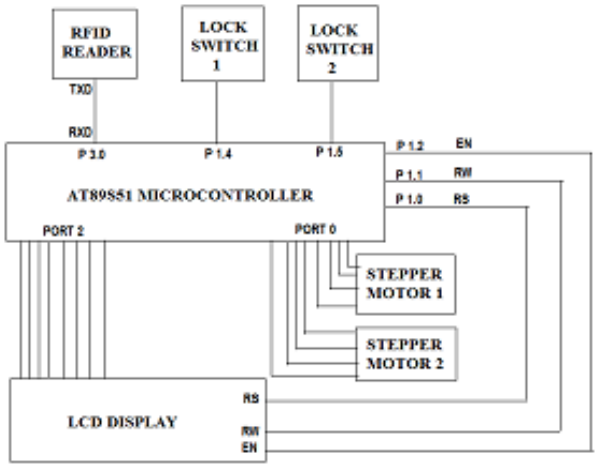

Fig 1 Block Diagram for the System

From the block diagram, it can be seen that RFID reader is interfaced to port 3.0. TXD of RFID reader is connected to RXD pin (port 3.0) of AT89S51. RFID tags when read by the reader will display the relevant information on LCD.LCD is interfaced to the microcontroller through port 2. The LCD is used for displaying the user's ID and status of the locker. In this project, we have considered two customers whose lockers are being controlled by stepper motor 1 and stepper motor 2. User 1 stepper motor is interfaced to lower bits of port 0 and user 2

stepper motor is interfaced to the upper bits of port 0. When user 1 is granted access, stepper motor 1 will rotate in anticlockwise direction which indicates the locker is opened. Similarly, when user 2 is granted access, stepper motor 2 will rotate in anticlockwise direction which indicates the locker is opened. Whenever the user is done with his work, he will close his locker by pressing the corresponding switch provided. This will automatically enable the lock. Two switches are interfaced to port 1.4 and 1.5 respectively.

5. HARDWARE COMPONENTS

5.1 AT89S51 Microcontroller

The AT89S51 is a low power, high performance CMOS 8-bit microcontroller with 4K bytes of In-system programmable flash memory. The device is manufactured using Atmel's high non-volatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out. The on-chip flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. The AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a five-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next external interrupt or hardware reset. The datasheet for AT89S51 is also enclosed.

Fig 2 AT89S51 Microcontroller

5.2 RFID Module and RFID Tag

RFID stands for Radio frequency identification. It is an automatic identification technology where digital data encoded in an RFID tag is read by the RFID reader. An RFID system consists of a reader device and a tag (transponder). A tag has a unique serial number which is identified by the reader. In this project, RFID has been interfaced with microcontroller to provide secured access. The relevant messages are also displayed on a 16x2 LCD.

RFID Reader Module, are also called as interrogators. They convert radio waves returned from the RFID tag into a form that can be passed on to Controllers, which can make use of it. RFID tags and readers have to be tuned to the same frequency in order to communicate. RFID systems use many different frequencies. The tag contains an antenna connected to a small microchip. The reader functions similarly to a barcode scanner; however, while a barcode scanner uses a laser beam to scan the barcode, an RFID scanner uses electromagnetic waves. To transmit these waves, the reader uses an antenna that transmits a signal, communicating with the tags antenna. The tags antenna receives data from the reader and transmits its particular chip information to the reader. The data on the chip is usually stored in one of two types of memory. The most common is Read-Only Memory (ROM) as its name suggests, read-only memory cannot be altered once programmed onto the chip during the manufacturing process. The second type of memory is Read/Write Memory; though it is also programmed during the manufacturing process, it can later be altered by certain devices.

Fig 3 RFID Module

Fig 4 RFID Tags

5.3 Stepper Motor

A stepper motor (or step motor) is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application. The use of stepper motor in this project is to mimic the locker operation.

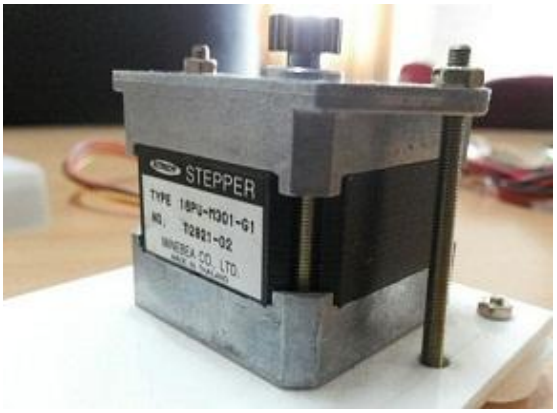

Fig 5 Stepper Motor

5.4 Liquid Crystal Display

LCD (Liquid Crystal Display) screen is an electronic module used in a wide range of applications. A 16x2 LCD is a very basic module and is very common in various devices and circuits. They are preferred over seven segment displays. There are many advantages when compared to seven segment displays. They are: LCDs can display characters, numbers and even graphics. There are refreshing controllers present inside the LCDs so 8051 need not refresh the displays. It is cost efficient and the current dissipation is low.

Fig 6 Liquid Crystal Display

6. ALGORITHM AND WORKING OF THE SYSTEM

Step 1: Start
Step 2: Wait until RFID card is detected.
Step 3: Read card data and identify the customer.
Step 4: Unlock the locker corresponding to the customer.
Step 5: Wait until the customer locks the locker.
Step 6: Repeat from step 2.

Fig 7 Working Model

Initially, when the connections are given and when the entire model is switched on, a message is displayed on the LCD "CUSTOMER ID:". When the RFID tag is brought into the sensing area, the RFID reader reads the data (user ID) form the tag and displays the ID on the screen. The microcontroller AT89S51 process the data i.e. identifies whether it is user 1 or user 2 and allows access to the corresponding user. For example, if user 1 is granted access, then the stepper motor 1 will rotate in anticlockwise direction which indicates that locker 1 is opened and the user 1 can use it. The message displayed on the LCD is "LOCKER 1 OPENED". As soon as the user has completed his work, he will press the switch 1. The control goes to the stepper motor 1 and it will rotate in the clockwise direction which indicates that the lock has been enabled. The corresponding message displayed is "LOCKER 1 CLOSED". The control again to the beginning where the message will once again be displayed as "CUSTOMER ID:". An important point to be noted is that at any instant during this process, if user 2 wishes to access the locker, he will be denied access. This process works in a similar way for user 2. If user 2 is granted access, then the stepper motor 2 will rotate in anticlockwise direction which indicates that locker 2 is opened and the user 2 can use it. The message displayed on the LCD is "LOCKER 2 OPENED". As soon as the user has completed his work, he will press the switch 2. The control goes to the stepper motor 2 and it will rotate in the clockwise direction which indicates that the lock has been enabled. The corresponding message displayed is "LOCKER 2 CLOSED". The control again to the beginning where the message will once again be displayed as "CUSTOMER ID:".

7. CONCLUSIONS

This projct is mainly aimed at reducing banker's workload. Time is considerably saved by this RFID based automated bank locker system as there is no need for any authentication by the bank employee. As this project is implemented using siftware tools Keil µVision, the outputs can be easily checked before they are embedded on the hardware. This project has the potuts can be easily checked before they are embedded on the

hardware. This project has the potentiaal to greatly reduce the manpower required during the access of bank lockers by the customers and also greatly saves time for both the banker and the customer. This project can be extended for more number of customers and banks by using RFID cards with identification numbers of more length.

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