Secure Bank Lockers Using RFID and Password Based Technology (Embedded System)

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Abstract: **This paper addresses the need of a bank customer, who waits for an authorized bank staff, to open the customer's bank locker with a master-key. To resolve this issue, we have proposed a locker system, based on RFID and Password technology. This system also finds its application in house safes, Smart cash box, offices, etc to safe guard valuables. When a customer steps in front of locker room the IR sensor gets activated and the customer needs to give the access card, if the customer fails to do so in 60 seconds the buzzer gets activated, only authenticated person can enter the locker room. Once the customer is inside the locker room, the customer is again asked to give the access card for their respective locker. If the customer is authenticated, they are required to enter the correct password, otherwise safe gets locked.**

***Index Terms*— Bank locker, RFID and Password, PIC16f877a, UART Protocol.**

I. INTRODUCTION

Banking system plays vital role in developing nations. It is a place where customers feel safe and secure. It is an organisation which serves its customer, in terms of providing secure lockers for their customers so that they can save their hard-earned money or valuables. Customer's valuables may be placed in the bank for safe keeping. The bank provides different sizes of locker as per the customer requirement, and the sizes range from-small, medium, large and extra-large and their annual maintenance ranges approximately from Rs. 10,000-150,000. Safe Deposit Lockers are ordinarily leased out for a minimum period of one year and rentals at the stipulated rates are recovered in advance. The amounts so received are to be credited to commission account, sub-head 'Safe Deposit Locker Rent' [4]. So, it's very important to keep our banks safe and secure. Today's bank safe still uses a two-key mechanism to open, which is unpleasant and tedious process [1]. Lockers are not only used in banks, it is also used in houses to keep money, ornaments etc. In offices, some important documents that are confidential are safe guarded in safe boxes. If these safe boxes have the traditional lock system it can be easily picked by burglars. Hence, to safe guard such safety boxes modern methods have to be developed which make it nearly impossible to crack open the safes.

II. EXISTING METHOD

Current locker system in all banks uses traditional locks, which are heavy, not protective and manually operated [1]. Lockers are operated with the help of keys which can be duplicated by professionals. Each locker works on two keys, one master-key is with the bank and the other one is with the customer. Every time a customer wants to use his/her locker, a record (ledger book) is maintained manually, where the customer has to sign.

III. PROPOSED METHOD

In this paper, the presented system is economical and more secure. The IR sensors get activated by reflected radiations from an object/obstacle. When the customer tries to enter the locker room, the IR sensors get activated and ask for access card (passive RFID tag) provided by the bank authorities. Radio-frequency identification (RFID) based access-control allows only authorised person to get into locker room. The RFID tag is recognised by the reader and processed by a microcontroller (PIC16f877a) and sends a low signal on the IR sensor, which otherwise would alarm after 60 seconds. This helps to avoid unauthorised access to the locker room. Once the customer is inside, they are required to prove their credentials once again and enter the password provided for the customer's safe box. The password is processed by the microcontroller, and if matches it sends signal to the motor, which opens the safe.

IV. HARDWARE USED

A. PIC16f877a Microcontroller

The PIC microcontroller PIC16f877a is the most used microcontrollers in the industry and many other applications. This controller is very convenient to use, in terms of coding, debugging and programming of this controller. One of the main advantages is that it can be written-erased as many times as possible because it uses FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16f877a finds its applications in a huge number of devices such as industrial application, home automation, real time applications etc. An EEPROM (electrically erasable programmable read only memory) is also featured in it which makes it possible to store some of the information like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low and its handling is also easy.

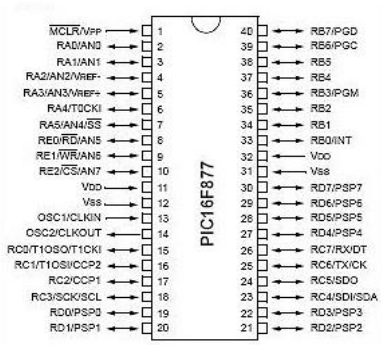

Figure 1. Pin diagram of PIC16f877a

B. RFID

RFID (Radio-frequency identification) signifies tiny electronic gadgets that comprise of a chip and an antenna. This chip is capable of accumulating approximately 1000-2000 bytes of data. Information in the chip is unique for each card like those used in our ATM (Any Time Money) cards. Passive tags have three key components, which are, built-in chip, a substrate and an antenna. Passive tag has an antenna which is attached to the chip. This antenna is used for transferring data using radio-waves having particular frequency. The passive tag performance depends on the size of the antenna. In terms of performance of tags, the shape of the antenna also plays a very important role. The final and last part of the tag is substrate. The substrate is a plastic coating which is employed to unite the antenna & the micro-chip. Passive RFID tags are smaller in size as well as cost effective.

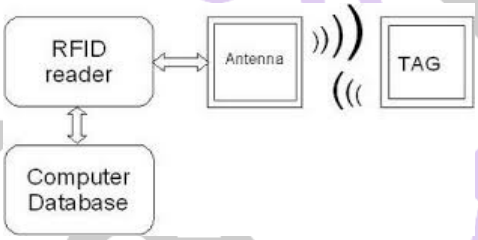

Figure 2. RFID System

C. IR sensors

Infrared (IR) sensors are normally used to estimate the distance of an object, but you can also use them to detect the presence of objects. IR sensors consist of an infrared transmitter and infrared receiver. The transmitter sends pulses of infrared radiation, while at the same time, the receiver detects any reflections. If the receiver does detect a reflection, it means that there is an object at some distance in front of the sensor. If there is no reflection, then there is no object.

D. LCD Display

An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16x2 LCD display is a very basic module commonly used in DIYs and circuits. The 16x2 translates a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5x7 pixel matrix.

E. 4x4 Keypad

Keypad is a set of various buttons having different symbols numbers and alphabets arranged in a 4x4 array. We have different types of key pads available in market like push button keypad, membrane switch keypad, resistive touch keypad, capacitive touch keypad, etc. In our project we need to type password so out of various keypads, the push button keypad is to be used due to high rigidity as well as low cost as compare to other keypads.

F. Motor and Driver

Motor converts electrical energy into mechanical energy. This motor helps in opening and closing of the locker box. The motor has to rotate both in clockwise and anticlockwise, for this purpose we use a driver known as L298N. This driver helps to control the speed and direction of the motor used.

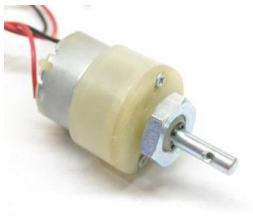

Figure 3. DC Motor

Figure 4. L298N

V. UART COMMUNICATION PROTOCOL

UART stands for Universal Asynchronous Receiver/Transmitter. It's a physical circuit in a microcontroller and not a communication protocol like SPI and I2C, or a stand-alone IC. A UART's main purpose is to transmit and receive serial data and one of the best things about UART protocol is that it only uses two wires to transmit data between devices. In UART communication, two-UARTs communicate directly with one-other. The conversion of parallel data takes place at transmitting UART side, from a commanding device like a CPU into serial form, transmits it in serial to the receiving UART, which then converts the serial data back into parallel data for the receiving device which may be a CPU or other peripheral device. Only two wires are needed to transmit data between two UARTs, data flows from the TX pin of the transmitting UART to the RX pin of the receiving UART.

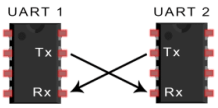

Figure 5. UART Communication

UART transmit data asynchronously, which means, output of bits from the transmitting UART is not synchronized, since there is no clock signal to synchronize the sampling of bits by the receiving UART. Instead of a clock signal, the transmitting UART adds start and stop bits to the data packet being transferred. These bits define the beginning and end of the data packet so the receiving UART knows when to start reading the bits. When the receiving UART detects a start bit, it starts to read the incoming bits at a specific frequency known as the baud rate. Baud rate is a measure of the speed of data transfer, expressed in bits per second. Both UARTs must operate at about the same baud rate. The baud rate between the transmitting and receiving UARTs can only differ by about 8-10% before the timing of bits gets too far off. Both UARTs must also be configured to transmit and receive the same data packet structure.

VI. BLOCK DIAGRAM

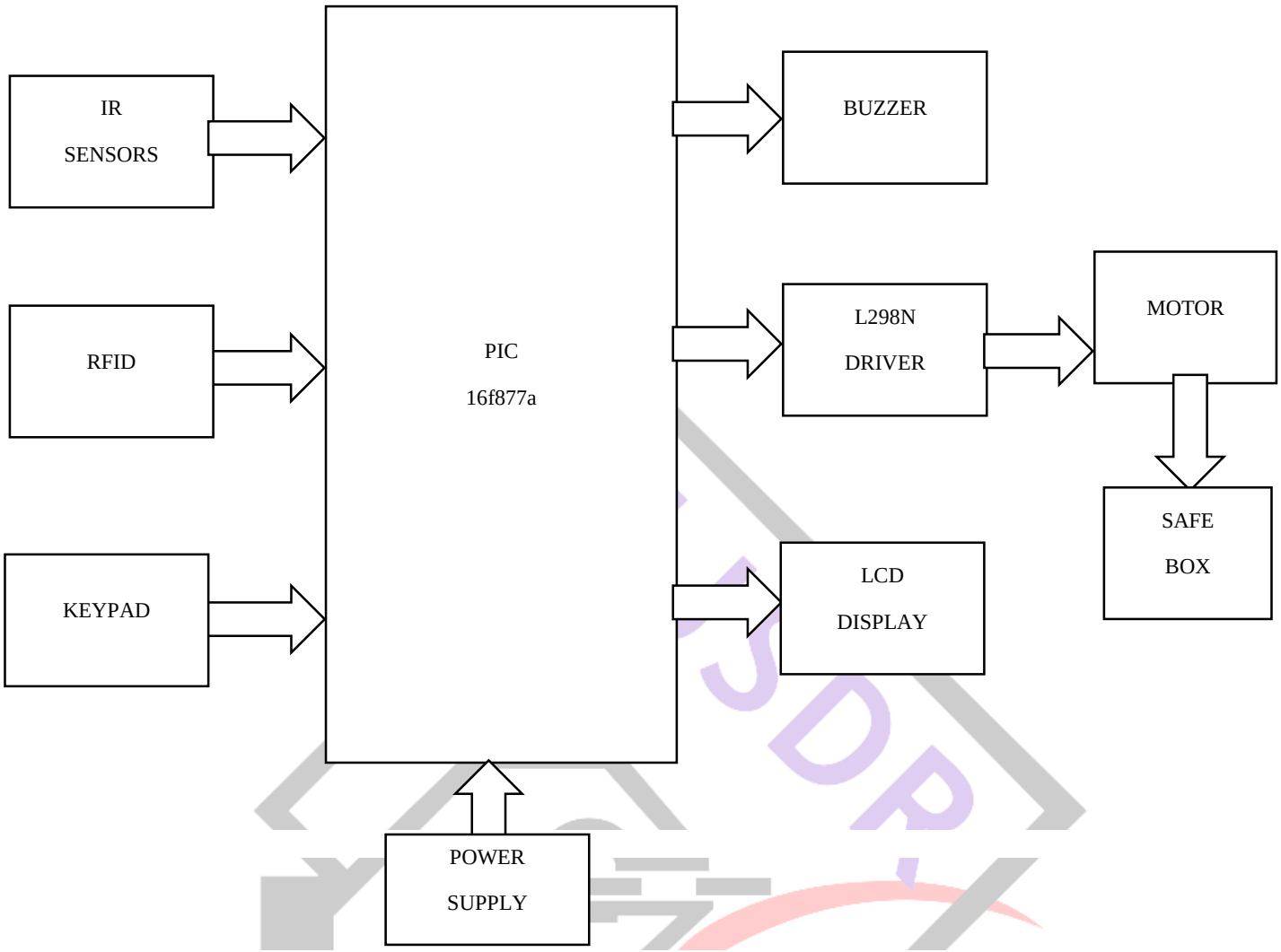

Figure 6. Block diagram of Bank Locker System

VII. SOFTWARE REQUIREMENT

We have used MPLAB as a programming software which compiles and debug the code. The code is converted to a hex file. By using PICKIT 2 tool, the program is loaded to the microcontroller (PIC16f877a). Simulation is done by using Proteus software, which gives real time output.

VIII. ASSEMBLY

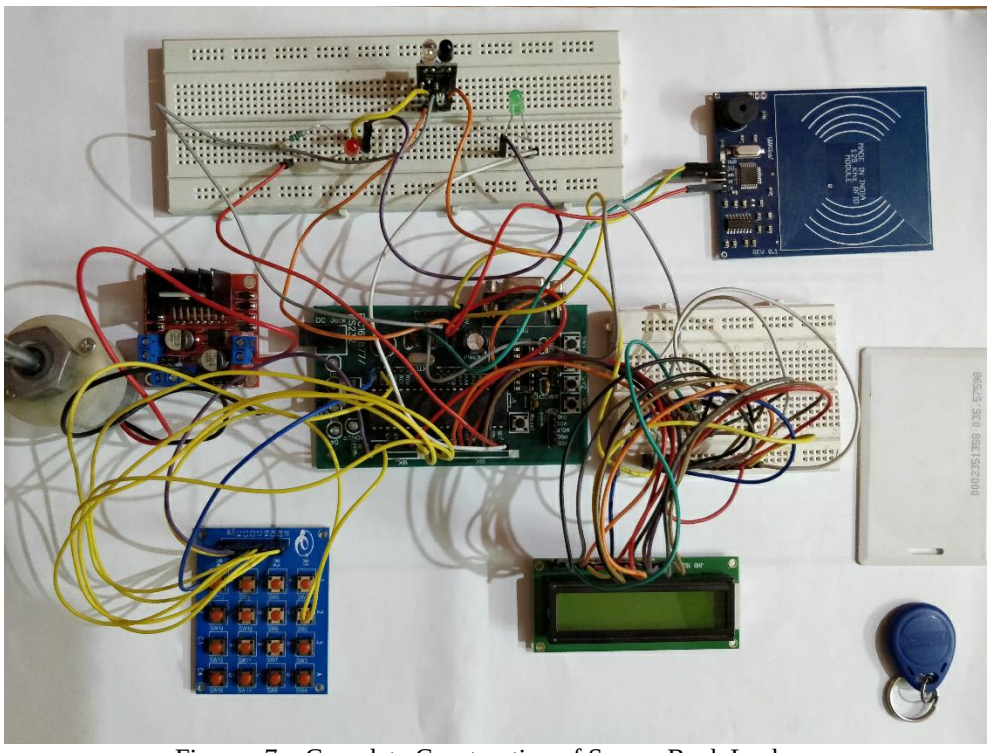

Figure 7. Complete Construction of Secure Bank Lockers

IX. TESTING

Figure 8. When the IR sensors detects a person, it asks for authentication

Figure 8.1. If authentication fails

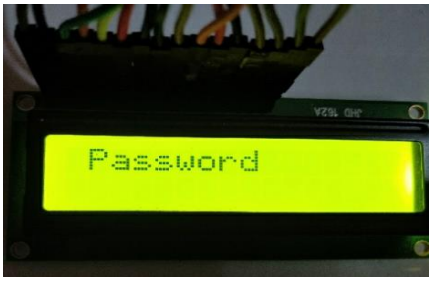

Figure 8.2. If authentication is valid

Figure 8.3. If password is wrong

X. FLOW CHART/WORK FLOW

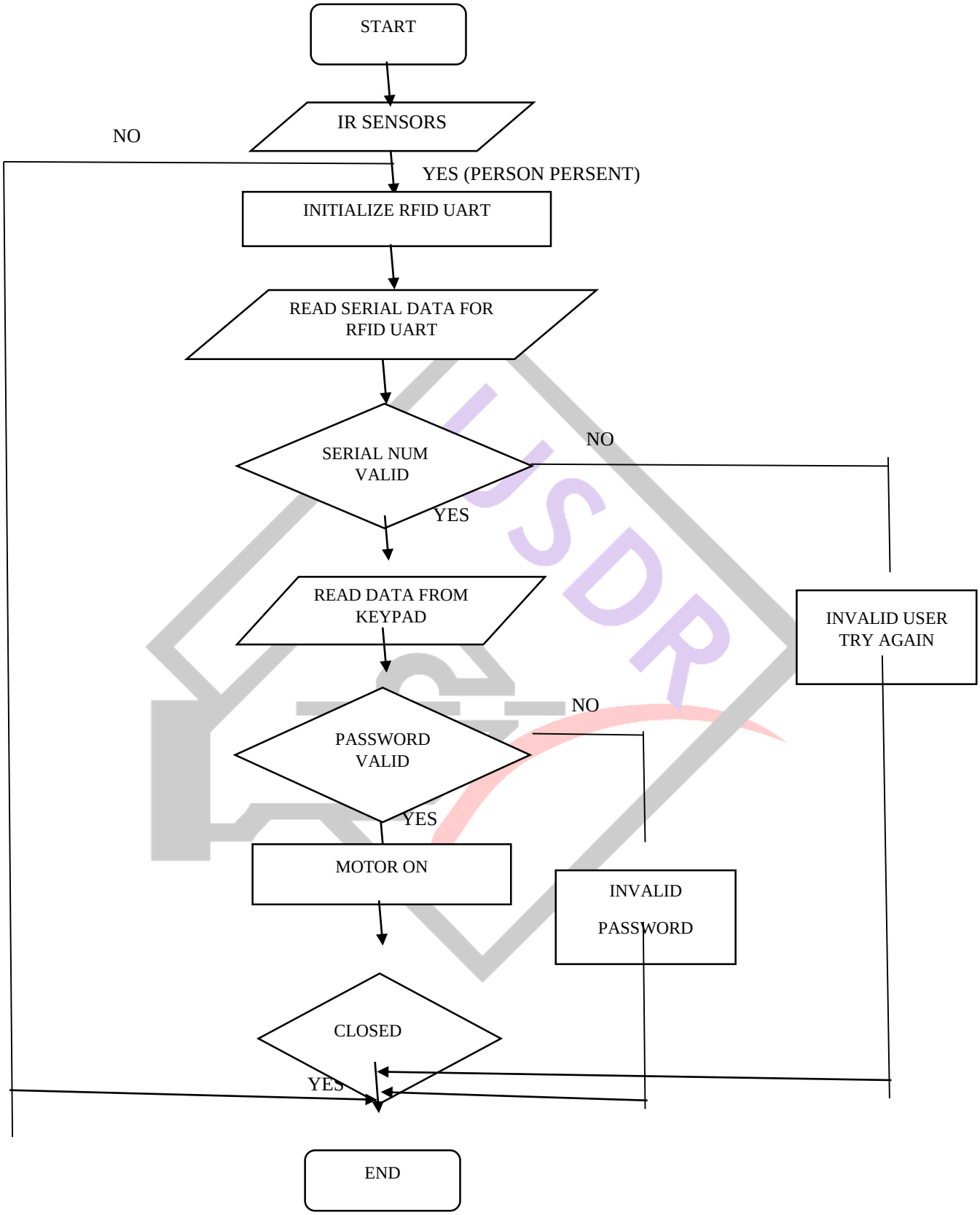

Figure 9. Process of Work Flow

XI. FACTS ANALYSED

- It provides a three-layer security.
- No person can enter the locker room without proper authentication.
- Access card is used for authentication.
- Password is required to open the safe box.
- In case of false identification, buzzer is initiated.

XII. CONCLUSION

We have used keypad and RFID which is a new technology growing on a larger scale, in terms of providing security. This project mainly focuses on the security of lockers in bank, houses, offices, industries etc. In this, the future extension can be made by using ATM card as access card and biometric verifications like finger print and face recognition, which can ensure high security.

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