

Multi-Level Secured Bank Locker System

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Abstract— The main goal of this paper is to design and implement a bank locker security system based on RFID, Pin and GSM technology which can be organized in bank, secured offices and homes. In this system only authentic person can be recovered money, jewellery from bank locker. We have implemented a bank locker security system based on RFID, Pin and GSM technology containing door locking system using RFID and GSM which can activate, authenticate, and validate the user and unlock the door in real time for bank locker secure access. The main advantage of using passive RFID and GSM is more secure than other systems. This system consists of PIC microcontroller, RFID reader, GSM modem, keyboard, and 16*2 display, Locker. In this system, the RFID reader reads the id number from passive tag and send to the microcontroller, if the id number is valid then authorised user press 4 digit pin on keypad. Then, microcontroller send the SMS request to the authenticated person mobile number, for the original password to open the bank locker, if the person send the password to the microcontroller, which will verify the passwords entered by the key board and received from authenticated mobile phone. If these two passwords are matched the locker will be opened otherwise it will be remain in locked position, this system is more secure than other systems because two passwords required for verification.

Key words: GSM, RFID, Locking System, Keyboard, Microcontroller, Jewellery

I. INTRODUCTION

In this present age, safety has becomes an essential and important issue for most of the people especially in the rural and urban areas. Some people like thief will try to cheat or steal the property which may endanger the safety of money, jewellery, important document in the bank, house, and office. To overcome the security threat, a most of people will install bunch of locks or alarm system. There are many types of alarm systems available in the market which utilizes different types of sensor. The sensor can detect different types of changes occur in the surrounding and the changes will be processed to be given out an alert according to the pre-set value. By the same time this system may not be good for all the time. In this paper we have implemented safety of the money in the bank locker, house, and office (treasury) by using RFID, Pin and GSM technology which will be more secure than other systems. Radio-frequency identification (RFID) based access-control system allows only authorized persons to open the Bank locker with GSM technology. Basically, an RFID system consists of an antenna or coil, a transceiver (with decoder) and a transponder (RF tag) electronically programmed with unique information. There are many different types of RFID systems in the market. These are categorized on the basis of their frequency ranges. Some of the most commonly used RFID kits are low-frequency (30-500 kHz), mid-frequency (900 kHz-1500MHz) and high- frequency (2.4-2.5GHz)[1]. The

passive tags are lighter and less expensive than the active tags [2]. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is a common European mobile telephone standard for a mobile cellular radio system operating at 900 MHz In the current work, SIM800 GSM module is used. The SIM800 module is a Quad band GSM/GPRS solution in a compact plug in module featuring an industry-standard interface. It delivers voice, data and fax in a small form factor with low power consumption. [3].In this paper we have designed and implemented a bank locker security system based on RFID, Pin and GSM technology. In this system only authentic person can be recovered money, jewellery, etc. from bank locker with three password protection method.

II. RELATED WORKS

In [4] has developed a Prepaid Water Meter System for prepaid billing of water consumption through remote monitoring without any human involvement. This system may be fast and accurate billing of water as well as preventing any mishandling of it. However, [5] developed a water meter reading using GSM system that suitable for remote places to monitor the water meter reading before any billing process. This could reduce the use of human resource for reading the meter and issuing a bill. There was also a work on monitoring of electrical meter reading using GSM network done by [6]. The system was able of monitoring the meter reading and sent an SMS to the official center for billing purpose. This could reduce the number of estimated reading when the empower person unable to reach the meter.

In [7], this system is used to control home appliance tenuously and offer security when the owner is away from the place. The similar work presented in [8] which designed and developed a smart home application system. The system allows the property owner to be able to monitor and control the residence appliances via a mobile phone set by sending commands in the form of SMS messages and receiving the home appliances status.

In [10] [11], this paper projected a Zigbee-GSM based Monitoring and Remote Control System. In this systems used both Zigbee and GSM for communicating between user and devices. This system allows user to monitor and control devices in the home through a number of controls, including a Zigbee based remote control. Users may remotely monitor and control their home devices using GSM.

In [12], the most important objective of the paper is to design and develop a highly developed vehicle locking system in the real time situation. The design & development of a theft control system for an automobile, which is being used to prevent/control the theft of a vehicle. This system consists of an embedded system and Global System Mobile communication (GSM) technology. This system developed by Pravada P. Wan hade and Prof. S.O. Dahad, the developed system is installed in the vehicle. The mobile is connected to

the microcontroller, which is in turn, connected to the engine. Once, the vehicle is being stolen, the information is being used by the vehicle owner for further processing. The information is passed onto the central processing insurance system which is in the form of the SMS, the microcontroller unit reads the SMS and sends it to the Global Positioning System (GPS) module and says to lock it or to stop the engine immediately. The main concept of this paper vehicle is controlled by GSM and GPS. The designed unit is reliable and efficient system for providing security to the vehicles through GSM, GPS and serial communication.

III. PROPOSED METHOD

In this proposed work, the RFID reader reads the data from tag and send to the PIC microcontroller, if the card is valid then microcontroller display the number. Then the user need to enter the password, if the password is valid then PIC microcontroller sends the SMS to account holder mobile number. Then account holder sends the OTP password to the PIC through mobile phone using GSM. The PIC compares the passwords entered by keyboard and received through mobile phone. If these passwords are correct the PIC microcontroller provides necessary control signal to open the bank locker. This method is simple and more secure than other system.

A. RFID Fundamentals

Basically, an RFID system consists of an antenna or coil, a transceiver (with decoder) and a transponder (RF tag) electronically programmed with unique information. There are many different types of RFID systems in the market. These are categorized on the basis of their frequency ranges. Some of the most commonly used RFID kits are low-frequency (30-500 kHz), mid-frequency (900 kHz-1500MHz) and high-frequency (2.4-2.5GHz). Basically, an RFID system consists of three components: an antenna or coil, a transceiver (with decoder) and a transponder (RF tag) electronically programmed with unique information.

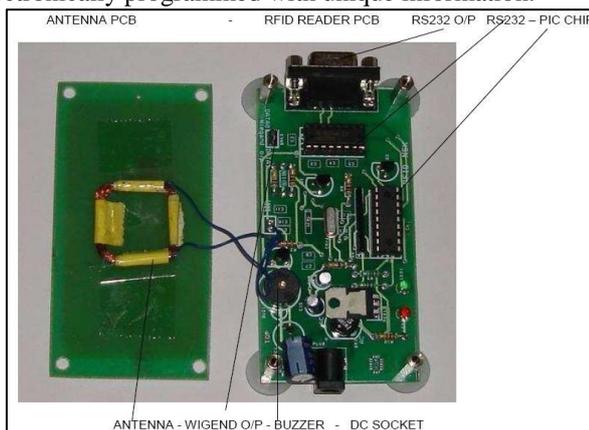


Fig. 1: RFID Reader

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RFID system consists of three components: an antenna or coil, a transceiver (with decoder) and a transponder (RF tag) electronically programmed with unique information. An RFID reader is a device that is used to interrogate an RFID tag. The reader has an antenna that emits radio waves; the tag responds by sending back its data. An RFID tag is a microchip combined with an antenna in a compact package; the packaging is structured to allow the RFID tag to be attached to an object to be tracked. "RFID" stands for Radio Frequency Identification. The tag's antenna picks up signals from an RFID reader or scanner and then returns the signal, usually with some additional data (like a unique serial number or other customized information). A passive tag is an RFID tag that does not contain a battery; the power is supplied by the reader. When radio waves from the reader are encountered by a passive RFID tag, the coiled antenna within the tag forms a magnetic field. The tag draws power from it, energizing the circuits in the tag. The tag then sends the information encoded in the tag's memory. The RX and TX pins of RFID reader connected to Tx and Rx pins of PIC Microcontroller respectively. Then the reader senses the data from the Tag and transmits the sensed data to microcontroller via serial port.

B. GSM Module SIM800

The GSM module is a specialized type of modem which accepts a SIM card operates on a subscriber's mobile number over a network, just like a cellular phone. Basically, it is a cell phone without display. Modem SIM800 is a quad band GSM/GPRS engine that works on 900MHz / 1800MHz frequencies. GSM Modem is RS232-logic level compatible, i.e., it takes -3v to -15v as logic high and +3v to +15 as logic low. MAX232 is used to convert TTL into RS232 logic level converter used between the PIC and the GSM module.

C. Specification of GSM Module SIM800

- Quad band 850/900/1800/1900MHz
- GPRS class 2/10
- Supply voltage 3.4 - 4.4V
- Low power consumption
- Operating temperature -40+85C
- Control via AT commands

IV. BLOCK DIAGRAM

The block diagram of Multi-level secured bank locker system is shown in the figure2. It comprises the power supply section, keyboard, RFID Reader, PIC18F4520 microcontroller, MAX232driver, relay driver and GSM module SIM800.

V. CIRCUIT DESCRIPTION

A. Power Supply

The power supply section is the important for any electronics circuits. The power supply, the 230V, 50Hz AC mains is stepped down by transformer X1 to deliver a secondary output of 12V, 500 mA. The transformer output is rectified by a full-wave rectifier comprising diodes D1 through D4, filtered by capacitor C1 and regulated by IC 7805. Capacitor C2 bypasses the ripples present in the regulated supply. LED1

acts as the power indicator and R1 limits the current through LED1. The power supply section is upper part in the figure 3.

B. Circuit Diagram

Fig.3 shows the circuit diagram of the Multi-level secured Bank locker system. The compact circuitry is built around PIC microcontroller 18F4520. The PIC 18F4520 is a low-power consumption, high performance 10-bit microcomputer with 256 Bytes of data EEPROM. The pin RB0-RB6 are given keypad which can be useful for a press a digit of OTP. The RB7 pin used to generate a voltage required for relay driver. The pin RC0-RC6 are used to drive a LCD display of project. The OSC1 & OSC2 pin provides 40 MHz quartz crystal connected to pins 13 and 14 provides basic clock to the microcontroller. The user will note that address 300000h is beyond the user program memory space. In fact, it belongs to the configuration memory space (300000h-3FFFFFFh), which can only be accessed using table reads and table writes. Programming the Configuration registers is done in a manner similar to programming the Flash memory. The WR bit in the EECON1 register starts a self-timed write to the Configuration register. In normal operation mode, a TBLWT instruction with the TBLPTR pointing to the Configuration register sets up the address and the data for the Configuration register write. Setting the WR bit starts a long write to the Configuration register. The Configuration registers are written a byte at a time. This section discusses Resets generated by MCLR, POR and BOR and covers the operation of the various start-up timers. The MCLR pin provides a method for triggering an external Reset of the device. A Reset is generated by holding the pin low. These devices have a noise filter in the MCLR Reset path which detects and ignores small pulses. A Power-on Reset pulse is generated on-chip whenever VDD rises above a certain threshold. This allows the device to start in the initialized state when VDD is adequate for operation. The PIC18f4520 devices incorporate three separate on-chip timers that help regulate the Power-on Reset process. Their main function is to ensure that the device clock is stable before code is executed. PIC18 microcontrollers implement a 21-bit program counter, which is capable of addressing a 2-Mbyte program memory space. Accessing a location between the upper boundary of the physically implemented memory and the 2-Mbyte address will return all '0's (a NOP instruction). GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine-SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commands. Unlike mobile phones, a GSM modem doesn't have a keypad and display to interact with. It just accepts certain commands through a serial interface and acknowledges for those. These commands are called as AT commands. There are a list of AT commands

to instruct the modem to perform its functions. Every command starts with "AT". That's why they are called as AT commands. AT stands for attention. In our simple project, the program waits for the mobile number to be entered through the keyboard. When a ten digit mobile number is provided, the program instructs the modem to send the text message using a sequence of AT commands. The GSM modem can be tested by connecting it with a PC. The modem is equipped with a RS232 cable. Just use a Serial to USB converter and connect it with the PC. Now you can proceed with sending the commands to the modem using any serial communication program like Hyperterminal, minicom etc. Ensure the serial parameters are configured to 8N1 and the baud rate is set to 9600bps. For each command you send the modem acknowledges with a message. Example: Just try sending "AT" to the modem. It sends back a result code "OK" which states that the modem is responding. If it's not working fine, it sends "ERROR".

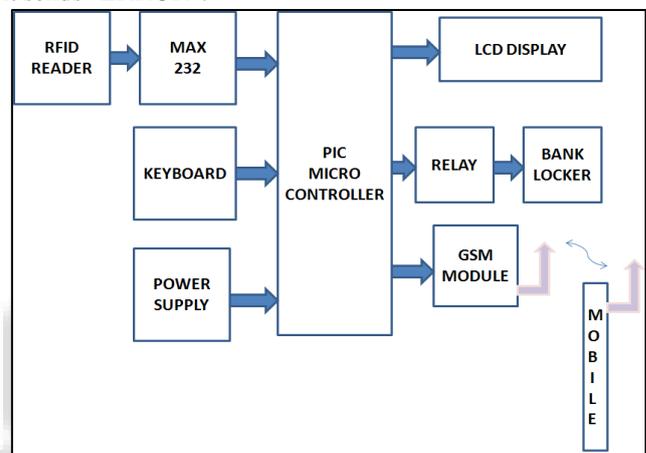


Fig. 2: Block Diagram of Multi Level Secured Bank Locker System

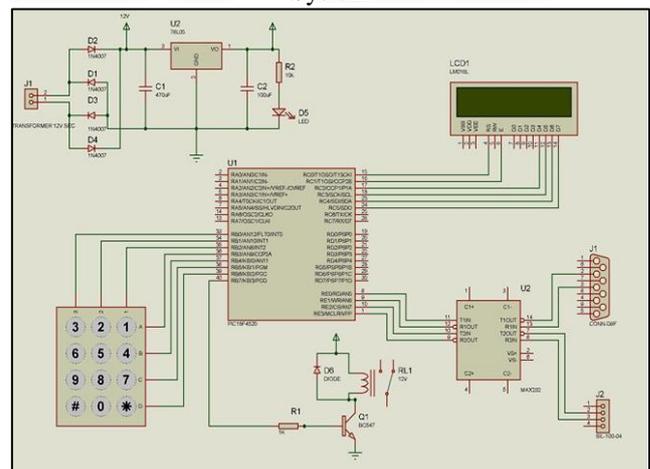


Fig. 3: Circuit Diagram of Multi Level Secured Bank Locker System

VI. SOFTWARE PROGRAM TESTING

The software program is written in c or assembly language and compiled using keil software. After compiler operation the hex code is generated and stored in the computer. The hex code of the program is burnt into the PIC 18F4520 by using Top win Universal programmer.

VII. HARDWARE ASSEMBLING AND TESTING

First step, we need to make single side PCB layout of the Bank locker system based on RFID and GSM technology for testing the circuit, proceed as follow

- 1) After assembling all the components on the PCB ,connect TX and RX pins of the GSM modem to pins 13 and 14 of MAX 232 and RFID Reader, respectively and insert a valid SIM in the card holder of the GSM modem.
- 2) Connect ground pins of the GSM modem and RFID to the ground rail of the circuit.
- 3) This projects are implemented and tested successfully by us.
- 4) This system is very useful for bank locker, office, homes to keep the money safely.

VIII. COMPARATIVE STUDY OF EXISTING AND PROPOSED LOCKER SYSTEM

| Sr.No | Existing system | Proposed system |
|-------|---|-------------------------------------|
| 1 | RFID Technologies used | RFID and GSM Technologies used |
| 2 | One password is referred | Two password are referred |
| 3 | May be in Secured due to robbery of RFID and password | More secured due to double password |

IX. CONCLUSION

We have implemented a Bank locker security system using passive RFID and GSM. It is a low cost, low in power conception, compact in size and standalone system. The microcontroller compares the passwords entered by keyboard and received through mobile phone. If these passwords are correct the microcontroller provides necessary control signal to open the bank locker. Alarm will be turn on whenever door is forced to open. Future work of this paper, is planned to a develop security system based on 3G camera for visual identification of the person.

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