

SMS Supported Password Door Security Control System

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Abstract

Security is an essential issue for individuals, companies and for a country. Security includes those performed by human patrol, surveillance camera, password locks etc. Those systems which require high attention and confidentiality like money boxes, VIP person doors, dangerous and military compounds etc. requires a password security system in order to activate the system. The system will open the door when the right password is entered and an SMS text will be sent for the person who is responsible for the room.

The password door security system is designed for all doors/gates to open the system only when the right person enters the right password using the keypads. The system is done using microcontroller technology as the heart of the system and GSM modem as a notifying device. The microcontroller will wait for the individual till he/she enters the password to activate the electromagnetic relay of the door which locks and unlocks the door. The GSM modem then sends the SMS notify someone who is responsible for the door or asset.

1 Introduction

Security in any country, compound, and residence is a priority since they all have worries about their loved ones, valuable assets, documents etc. Thus, to do so a security system must be designed, developed and implemented. This can be done by using a password

activated door having a notifying alarm system. Therefore, only those individuals who have the right password will enter the room.

This system will be able to secure the people, the valuable assets and documents through the password activated door-rooms.

The aim of this project is to develop a password door security control system which is able to:

- Scans regularly the keypads pressed and activate the electromagnetic relay
- Turns ON the green LED when the right password is entered.
- Turns OFF the red LED and triggers the Buzzer when a wrong password is entered.
- Send SMS text when the right password is entered saying "The Door is Opened" for the person who is responsible for the asset.
- It also sends SMS when a wrong password is entered saying "Wrong Password is entered" for the person who is responsible for the asset.

The following block diagram indicates all the devices involved in this project and brief explanation of each of the devices:

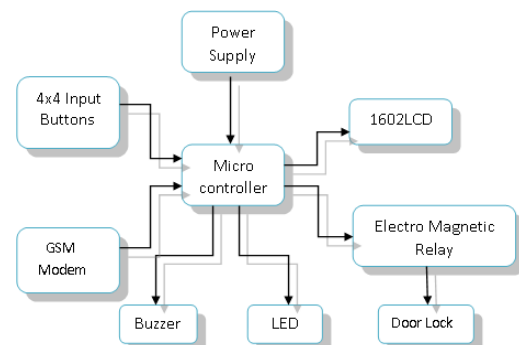


Figure1: Block diagram of SMS supported password door security control system.

1. Micro-controller: - is the brain of the security system where it gets the inputs from the 4x4 buttons and it activates the relay of the door and it notifying through SMS.
2. The 1602 LCD display: - the purpose of the LCD is to display the password entered and to tell the user if he/she makes password error.
3. 4x4 buttons: - these are used to enter the password to the micro controller.
4. Relay: - is used to activate and deactivate depending on the password entered.
5. Buzzer: - is used to trigger an alarm when the door is opened.
6. GSM Modem:- is used to send SMS message for a person who is responsible for the door/asset.

2 Hardware Development

2.1 Microcontroller Circuit (PIC18f4520)

Microchip PIC18F4520 microcontroller was chosen for this project due the high computation capabilities with relative low cost. This 40 pins 8-bits microcontroller comes with 5 PORTs and able to operate at the speed of up to 40MHz with high temperature endurances.

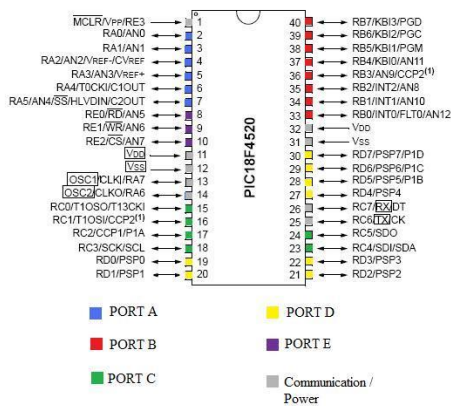


Figure2: PIC18F4520 Pins Diagram

2.2 4x4 Keypad

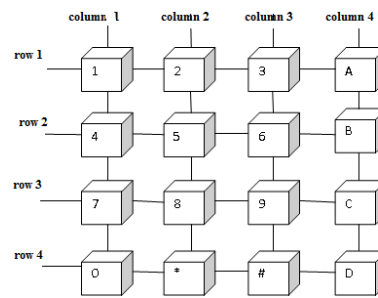


Figure3: Structure of the 4x4 keypad[18]

2.3 Relay

A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Current flow through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts.[11]

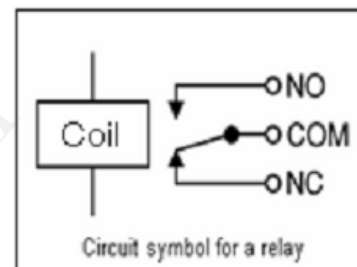


Figure4: Relay Circuit

2.4 TC35 GSM Modem

Global System for Mobile Communications (GSM) network started operation in 1991 with more than 100 countries. GSM modem has a variety of value added services such as voice mail, call handling facilities, and SMS messages.[12]

- Support 900/ 1800/ 1900 MHz GSM Tri band.
- Uses AT Command Set.
- SIM card holder/socket ready
- Ready with SMA antenna for better signal reception and transmission
- SMS (text) and voice communication is ready.
- Single board solution.
- Power with 7-15VDC.
- Ready with UART (2.65V TTL) and RS232 (COM Port) serial interface.
- Serial Interface, Baud rate: 9600bps, 8-1-N
- 5 LED act as indicator with different modes.



Figure5: Siemens TC35 GSM Modem

3 Interfacing with P18f4520

3.1 P18f4520 and Keypad Interface

The purpose of the 4x4 keypads is to insert the right password into the system. The keypad consists of 8 pins. The 8 pins remaining are separated into 2 groups, 4 pins (K1-K4 in Figure 8) connect to the input of microcontroller and 4 pins (K5-K8 in Figure 7) connect to the output.

User can decide any digital I/O pin for the input and output. Input must be pulled high to 5V using a resistor and this configuration will result an active-low input.

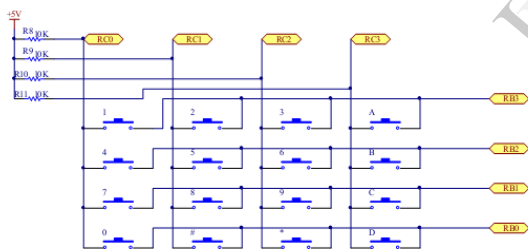


Figure6: Keypad interface circuit with p18f4520

3.2 1602 LCD Interface with P18f4520

1602 LCD display is used to display the password letters and/or numbers entered into the system. It is also used to display weather the user has entered the right password or not by displaying different messages.[15]

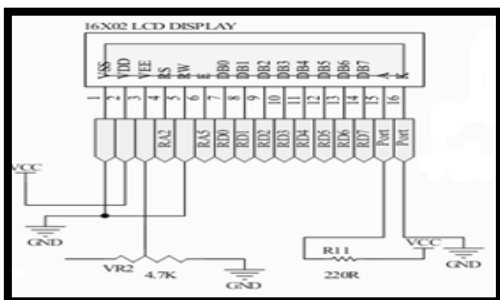


Figure7: 1602 LCD interface with p18f4520

3.3 Relay Output and P18f4520

This relay has 5 pins, 2 pins are for the 2 ends of the coil, 1 is COM, 1 is NO and 1 is NC.

One end of the coil is connected to 12V and another end is connected to an NPN transistor to amplify the small IC current to larger value required for the relay coil. COM pin is connected to 12V and NO is connected to the door magnetic lock.

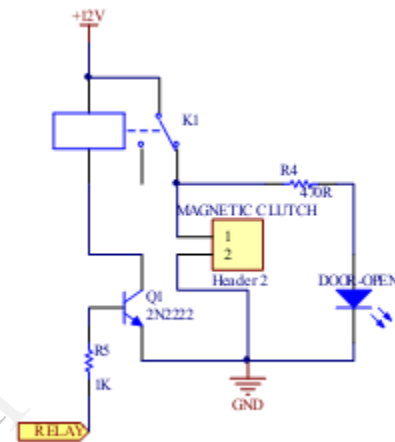


Figure7: Relay circuit connection with p18f4520

3.4 LED and Buzzer with P18f4520

Three LEDs and one buzzer are used as alarm unit for the system. When a right password is entered the GREEN LED and the YELLOW LED becomes ON and the buzzer beeps two times, when a wrong password is entered RED LED becomes ON and the buzzer beeps four times.

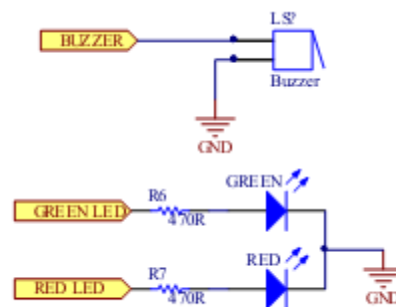


Figure8: LED and buzzer schematic

3.5 RS232 Serial Communication Interface

A Max232 serial interface driver IC is used to enable RS232 Serial Communication Interface between the microcontroller and the GSM modem. Through this serial communication interface, the microcontroller is able to send SMS (text) message to the one who is responsible for the door/asset.

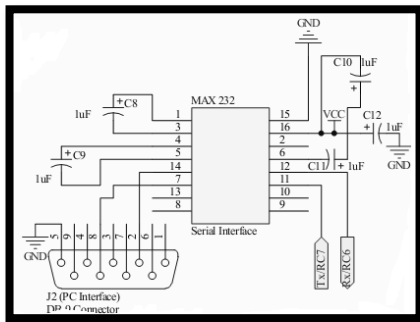
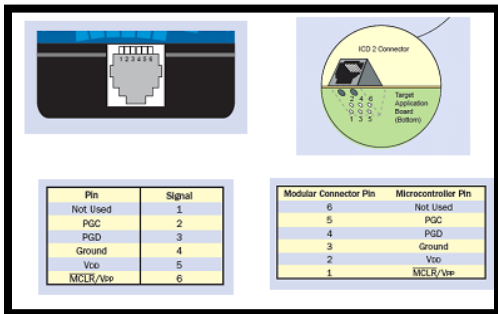


Figure9: max232 interface with p18f4520

3.6 ICD2 Connector Circuit

The ICD connector is connected to the MPLAB LCD 2 debugger using RJ11 cable for communication between microcontroller and computer. A thing to take note before connecting the RJ11 jack connector on the board is that MPLAB ICD2 RJ11 Jack pin out and the modular connection pin are not in sequence. It is of opposite direction as shown in Figure10.[9]



(Source: Microchip Technology Inc)

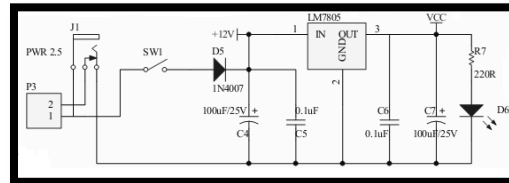
Figure10: RJ11 and ICD2 connection circuit

3.7 Power Supply Circuit

PIC18F4520 microcontroller operates from the voltage range of 2.0V to 5.5V. With the use of 9V DC battery, we require a 5V voltage regulator, LM7805. In order for the microcontroller to operate, the LM7805 step-down

the voltage from 9V to 5V. LM7805 is capable of handling input voltage ranging from 5V to 18V and output voltage ranging from 4.8V to 5.2V. [16]

A diode here is used to protect the power supply circuit if the battery or power source polarity is connected



reversely. The diode does not allow current to flow as it only allows electric current to flow in one direction only and blocks the flow in the opposite direction.

Figure11: Schematic of power supply circuit.

4 Software Development

The software programming for the PIC18F4520 microcontroller is C-program and will be compiled using C18 compiler of the MPLAB Integrated Development Environment.

4.1 Process Flow

The picture below shows the process flow diagram of the whole system.

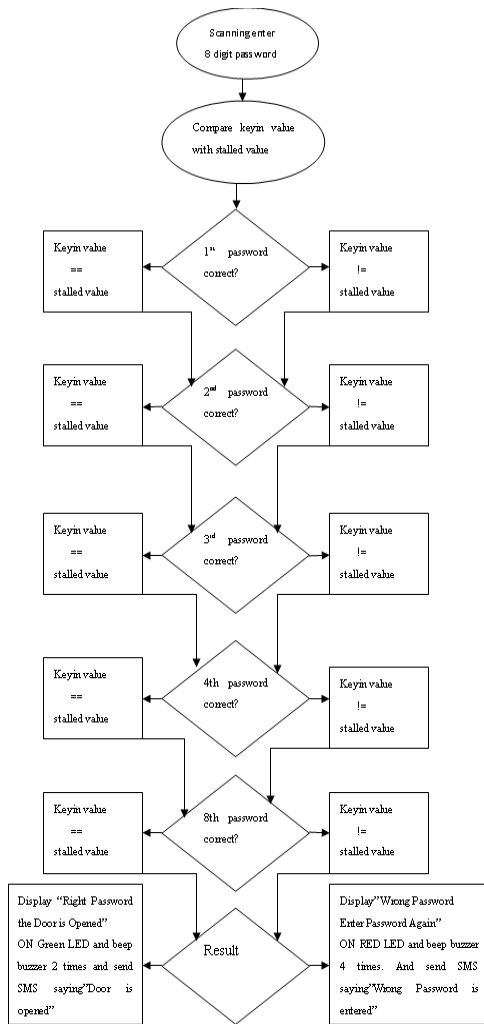


Figure12: process flow of the program

4.2 Software Algorithm

```

//Configuration of PORTA Analog to Digital Converter ADC
ADCON1 = 0b00111101; // configure RA2 and RA5 as digital I/O
ADCON2 = 0b10110100; // Set result right justified, manual acquisition time, Psc/4
TRISA = 0b11011011; //configure PORTA I/O direction(RA2 and RA5 as Digital Input)
TRISD = 0b00000000; //configure PORTD as output
TRISE = 0b01000000; //configure PORTB I/O direction(RB6 as input)
TRISE = 0b00000000; //configure PORTB as output

// Configuration of Modem
TRISC = 0b10001111; // RC7(RX) as input, RC6(TX),RC0 as output
SPBR0 = 25; // baud rate of 9600
TXSTA = 0b00100100; // asynchronous mode, 8-bit data
// transmit enable, high baud rate select bit
RCSTA = 0b10010000; // serial port enable, 8-bit data
// continuous reception

PORTA=0; //initial value of PORTA is zero
PORTB=0; //initial value of PORTB is zero
PORTC=0; //initial value of PORTC is zero
PORTD=0; //initial value of PORTD is zero
    
```

Figure13: Initialization of port and modem

```

void right_sms(void){
//Initializing Modem and send motion SMS message
putsUSART((const far rom char *)"AT\r\n");
while(!BusyUSART());
Delay10KTCYr(50); //50x10k instruction cycle = 0.5s delay
putsUSART((const far rom char *)"AT+CMGF=1\r\n"); //Operating in SMS text mode
while(!BusyUSART());
Delay10KTCYr(50); //50x10k instruction cycle = 0.5s delay
putsUSART((const far rom char *)"AT+CNMI=2,1,0,0,1\r\n"); //setting for reading SMS
while(!BusyUSART());
Delay10KTCYr(50); //50x10k instruction cycle = 0.5s delay
putsUSART((const far rom char *)"AT+CMGS=""15510971103\r\n"); //Sending SMS to recipient
while(!BusyUSART());
Delay10KTCYr(50);
putsUSART((const far rom char *)"Sir, The Door Is Opened\r\n!Av!");
while(!BusyUSART());
Delay10KTCYr(50); //50x10k instruction cycle = 0.5s delay
}

void wrong_sms(void){
//Initializing Modem and send motion SMS message
putsUSART((const far rom char *)"AT\r\n");
while(!BusyUSART());
Delay10KTCYr(50); //50x10k instruction cycle = 0.5s delay
putsUSART((const far rom char *)"AT+CMGF=1\r\n"); //Operating in SMS text mode
while(!BusyUSART());
Delay10KTCYr(50); //50x10k instruction cycle = 0.5s delay
putsUSART((const far rom char *)"AT+CNMI=2,1,0,0,1\r\n"); //setting for reading SMS
while(!BusyUSART());
Delay10KTCYr(50); //50x10k instruction cycle = 0.5s delay
putsUSART((const far rom char *)"AT+CMGS=""15510971103\r\n"); //Sending SMS to recipient
while(!BusyUSART());
Delay10KTCYr(50);
putsUSART((const far rom char *)"Sir,Wrong Password Entered\r\n!Av!");
while(!BusyUSART());
Delay10KTCYr(50); //50x10k instruction cycle = 0.5s delay
}
    
```

Figure14: Right and wrong password SMS

5. Tests and Results

5.1 Tests

The following shows the tests done to check the hardware and software implementation on the system. This is done to make sure that each of the individual parts and the complete system are working property.

Tests made are power supply, 1602 LCD display, relay, buzzer, LEDs and sending SMS.



Figure15: enter password

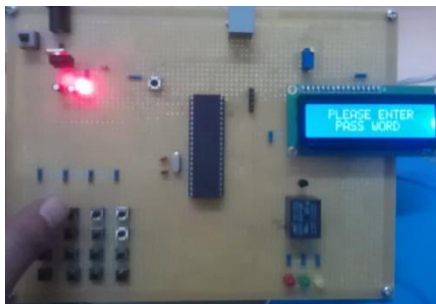


Figure16: prototype board

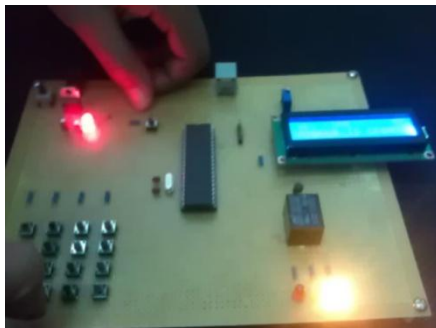


Figure17: right password relay energized

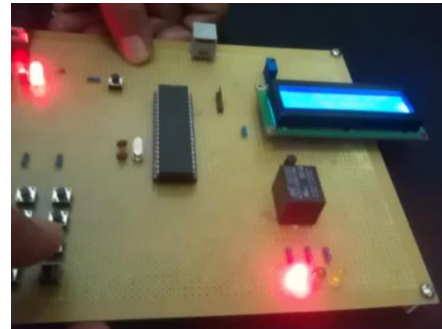


Figure18: wrong password Red LED ON

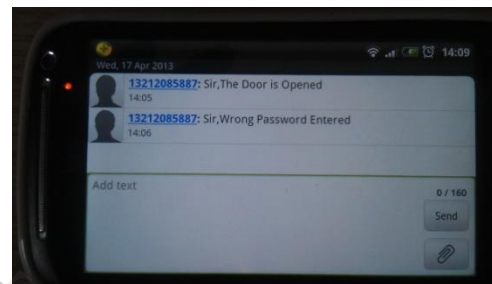


Figure19: right and wrong password SMS

Conclusion

Security in any country, industry, compound or residential is a priority to ensure the safety of the personnel, the documents they have, and the valuables they acquire. Surveillance systems alone are not enough to ensure the safety of the personnel, the documents and the valuables. Thus, a password security system must be used to ensure well the safety of the whole system. This is a system which asks everybody to enter the right password to get into the compound and notify the one who is responsible for the safety of the personnel, document or valuable assets.

This system performs well the intended target by asking to enter the right password, if someone misses to enter the right password the system activates the buzzer and wrong SMS text will be sent. The same step will be done when a right password is entered, that's it opened the door and activates the buzzer and send right password SMS to the one who concerns it.

Reference

[1]. Newnes. Advanced PIC Microcontroller Projects in C. Mar. 2008. eBook-BBL

[2]. Advanced PIC Microcontroller Projects in C From US B to RTOS with the PIC 18F Series

[3]. PIC in Practice A Project-Based Approach D. W. Smith

[4]. PIC microcontrollers for beginners, too! Authors: Nebojsa Matic and Dragan Andric

[5]. Kenneth A. Kuhn, Use of phototransistor, Feb 2008

[6]. Fairchild Semiconductor Corporation, Application Note AN-3005, Design Fundamental for Phototransistor Circuits

[7]. Guillaume Peersman, Srba Cvetkovic, Pual Griffithsa and Hugh Spearguillaume, The Global System for Mobile Communications Short Message Service, June 2000

[8]. PIC Microcontroller: An Introduction to Software and Hardware Interfacing Han-Way Huang

[9]. <http://dasl.mem.drexel.edu>

[10]. <http://www.microchip.com/>

[11]. <https://www.sparkfun.com>

[12]. tutorial.cytron.com

[13]. <http://www.wisageek.com/>

[14]. <http://s.taobao.com/search>

[15]. <http://www.8051projects.net/lcd-interfacing/>

[16]. www.developershome.com/sms/atCommandsIntro.asp

[17]. <http://www.cprogramming.com/tutorial.html>

[18]. <http://www.parallax.com/>