Password Protected Locking System Using Arduino

Sriharsha B S[1], Zabiullah[2], Vishnu S B[3] and Sanju V[4]

Submitted in August, 2015, Accepted in January, 2016

Abstract - In this current situation, the degree of security is feeble. So there is a lot of robbery, theft going on in and around the world. So, people fear to keep any of their valuables in their homes. Henceforth, many people prefer to keep it in banks. However, in this insecure world even banks are not too safe enough to satisfy people needs. A common man feels his valuables are secured if there is efficiency in security. Hence this project can give effective security in minimal cost.

Index-Terms: Arduino, Servo motor, LCD 16x2, 4x4 Membrane Keypad, Buzzer.

1.0 INTRODUCTION

In this project we are providing enough security to satisfy the user's needs. The user will be prompted to enter a password to unlock the door. On successful password entry, the door unlocks for a specified amount of time enabling him/her to store or restore his/her valuables. On the other hand, if the user enters an invalid password then corresponding equivalent message will be displayed.

This project "Arduino based password protected locking system" can be used to provide enough security in various places like bank lockers, security doors, BIOS locking in computer etc.

This project uses an arduino kit that consists of ATMega 328 which is one of the most popular microcontrollers that consists of 14 digital pins and 6 analog general purpose pins, EEPROM of capacity 1KB and a ram of 2KB.

2.0 COMPONENTS USED IN DESIGNING

We will be providing the detailed description of every component used in designing this password protected locking system:

2.1 Arduino UNO

This microcontroller is based on the ATmega 328. There are total of 20 pins (0-19) out of which 6 are analog inputs which can also be used as general purpose pins, a ceramic resonator of frequency 16MHz, an USB connection, a power jack and a reset button. It contains everything needed to support a microcontroller. [1].

[1,2,3]Department of Computer Science & Engineering, Nitte Meenakshi Institute of Technology, Bangalore-560064, India
[4]Department of Computer Science & Engineering, Muthoot Institute of Technology & Science, Varikoli, Ernakulam, India

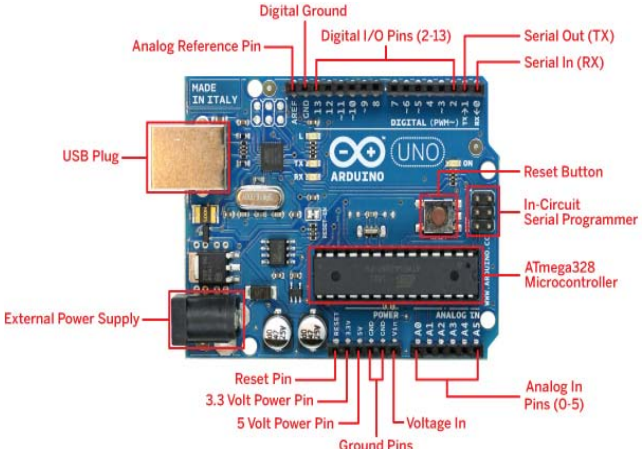

Figure 1. Arduino UNO with its parts

Summary on Arduino

Microcontroller	ATMega 328
Clock Speed	16MHz
Analog Input pins	6
Digital input output pins	14 (6 pins provide PWM voltage)
Input voltage	6-20V
Operating Voltage	5V

2.2 LCD

Liquid Crystal Display, which we are using in our project is JHD 1602A. This display consists of 16 columns and 2 rows. The library that is used is <liquidcrystal.h>.

PIN SUMMARY OF LCD 1602A

Pin 1: VSS.

Pin 2: To VDD 5V input.

Pin 3: VL to adjust LCD contrast with the help of 10K potentiometer. Low VL indicates light contrast and high VL indicates dark contrast.

Pin 4: RS for register select. Data registers used for high RS. Similarly, instruction register for low RS.

Pin 5: R/W signal stands for read/write. When R/W bit is high, it indicates a read operation. If R/W bit is low, it indicates write operation.

Pin 6: Clock Enable- Edge triggering.

Pin 7 to 14: Represents from Bit 0 to Bit 7.

Pin 15: back light Anode.

Pin 16: back light cathode.

Figure 2. LCD JHD16x2A

2.3 Membrane Keypad

In our project we used 4X4 matrix membrane keypad. This 16 button keypad provides user interface component for Arduino project. this is programmed using the library <keypad.h>. It has the following features:

1. Easy interface to Arduino.
2. Ultra-thin design.
3. Cheap and economical

Figure 3.4x4 Matrix membrane keypad

SUMMARY about Keypad pins:

1. Maximum operation rating: 24V_{DC}, 30 mA.
2. Insulation Resistance : 100M ohm
3. Interface: 8 pins can be accessed in the form of 4X4 matrix.

2.4 Servo Motor: The servo used in the project is SG90 Micro Servo weighing about 9g. This is programmed using the library <servo.h>. It has the following operating conditions:

Figure 4. SG90 Micro Servo

Modulation	Analog
Torque	25.0 oz-in (1.8kg/cm)
Speed	0.12 s/60 deg
Weight	0.32 oz (9.8g)
Motor type	3 pole
Gear type	Plastic
Rotation/Support	Bushing
Pulse Width	500-2400 micro-sec

2.4 Buzzer

In our project the buzzer is used for beep sound either indicating the countdown time or wrong password. It is as shown below:

Figure 5. Piezo Buzzer

2.5 Potentiometer

In our project we have used a trim potentiometer of 10Kohm resistance in order to adjust the contrast of the Liquid crystal display. It is as shown below:

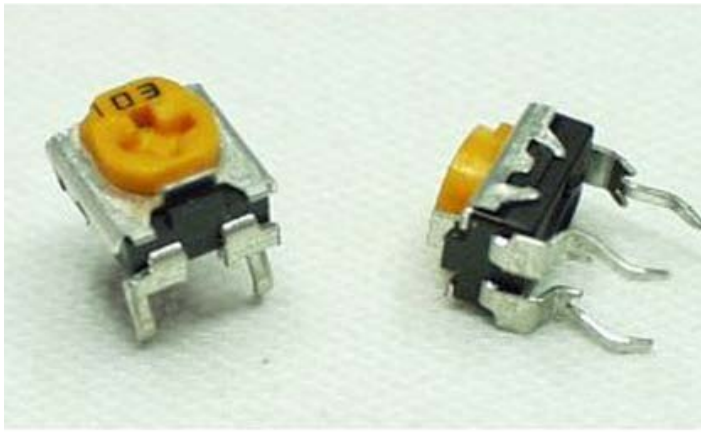

Figure 6. 10KΩ trimpot

3.0 IMPLEMENTATION- CONNECTION WIRING SPOT DIAGRAM AND CIRCUIT DIAGRAM

The following table shows the connection wiring spot diagram of our circuit.

The entire circuit diagram can be tabulated as shown below. This tabulation is called connection wiring spot diagram. The entire circuit connection is being available in this table

Labeling of the pins as per the above tabulation:

D'N': D- Digital pins in arduino. N is the pin number
A'N': A-Analog pins in arduino. N is the pin number
LCD'N': Liquid Crystal Display pins. N is the pin number
DB0-DB7: Data byte pins from 0-7
R/W- Read/Write
VD0 and LED+- Positive connection of the LCD
VD1 and LED- - Negative connection of the LCD.
ROW'N'- Rows of the hex keypad. N is the pin number
COL'N'- Columns of the hex keypad. N is the pin number
Motor- Servo motor Connection
MICRO- Arduino UNO Connection
FR- From Connection
TO- To connection
E- Enable
RS: Reset

The following figure shows the schematic diagram for the project. The components used in design and connections of the project are as follows:

- ARDUINO UNO
- LIQUID CRYSTAL DISPLAY(LCD JHD1602A)
- 4X4 MEMBRANE KEYPAD
- SERVO MOTOR
- 10K POTENTIOMETER

Note**: all the description of the above compontents is provided in **section2.1-2.6.

The connections in the above circuit diagram is derived and explained in the connection wiring spot diagram

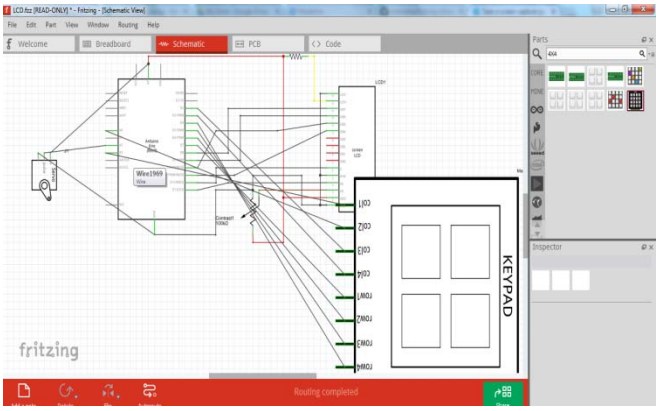

Figure 7. Schematic Diagram

4.0 WORKING OF THE CIRCUIT

The above flowchart gives a brief idea as to how the project" Password Protected Locking System Using Arduino" works. Initially the password is predefined. When the device is switched on, it resets the servo angle to lock the door. Now the user is prompted to enter the password. The user enters the password through a keypad which is read by the arduino. Now the entered password is checked with the predefined password. If the password matches, then the servo motor deflects and the door unlocks for 30s else the buzzer beeps indicating the invalidity of the password.

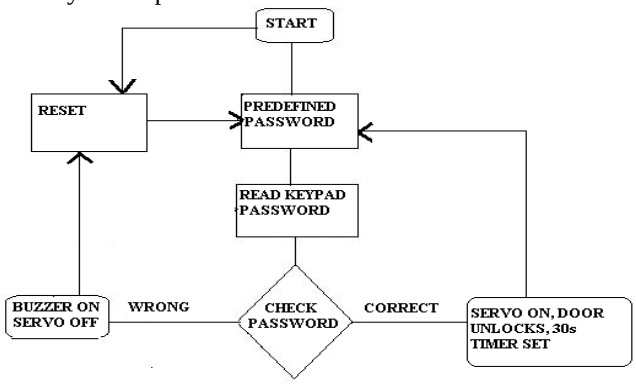

Figure 8. Flow chart of the working circuit

The step by step working is given as below. When the arduino is switched on, the LCD displays the entry screen message by initializing and configuring the LCD pins to arduino.

Step 1: *Configure the lcd pins.*
LiquidCrystal lcd(13, 12, 11, 10, 9, 8);
Next, the user is asked to prompt a password. Here the correct password is pre-initialized.
Step 2: *Initialize the correct password*
char pass="A1B2C";*
Next, the password entered by the user is compared with the correct password. If the password entered by the user matches with the correct password, then the following set of statements will be executed.

STEP 3:

myservo.write(90); //The servo motor deflects to an angle of 90 degrees enabling the user to unlock
unlockdoor();// Unlocks the door for a specified amount of time
currpos=0;//reset the password enabling the user to enter a new password
myservo.write(0);//after the time excceds the servo deflects the angle back to zero degrees.
Else, the following set of statements will be executed
myservo.write(0);// Due to the entry of wrong password, the servo does not deflect and hence the door will //be locked
invalidcode();//Message of invalidity will be displayed to the user via lcd and returns to the start
currpos=0;//the password is reset enabling the user to enter a fresh password
In the above case, the door will be unlocked by the movement of servo to a particular angle or remaining still depending upon the user's entered password.

Note: The entered password by the user is converted into '*' to provide strong privacy.

For(l=0;l<=currpos;++l)
{
lcd.print ('');*
}

Further, the buzzer is provided if the user enters a wrong password and also if the user exceeds the specified limit. Here we have given the specified limit to be 20 secs.

Step 4:

if(i==21){
digitalWrite(19,HIGH);// buzzer beep
lcd.setCursor(0,0);

5.0 HARDWARE OUTPUT SCREEN SHOTS

Figure 9.0. Showing user to enter the password

In the above figure, Fig 9.0. and Fig 9.1 the LCD displays the user "ENTER PASSWORD". The entered password is displayed as '*****' on the LCD.

In these figures, fig 10.0., fig 10.1., the user has entered the correct password.

The servo motor deflects thus unlocking the door.

Figure 9.1. Password displayed '*'

Figure 10.0. Showing correct password

Figure 10.1. Door unlocks

Figure 11.0. Timer activated

Figure 11.1. Deadline timer

In these figures, fig 11.0, fig 11.1., the timer activates automatically for fixed duration. The buzzer beeps if the user exceeds the grace period and deadline timer is activated.

Figure 12. Door locks.

In the Fig 12., the door locks when the timer crosses the deadline time. The user is prompted to enter the password once more and the process continues. Fig 9.0.

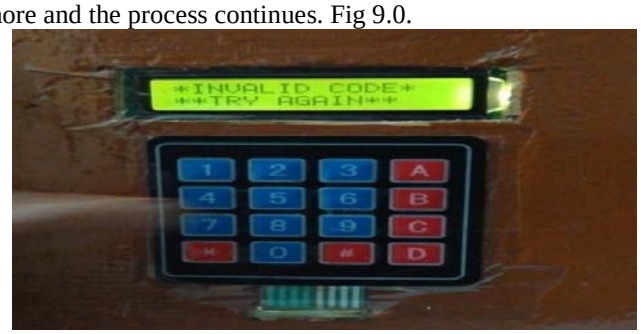

Figure 13.0. Incorrect password entry.

Figure 13.1. The door remains locked

In these figures, fig 13.0., fig 13.1., the user has entered an incorrect password. As a result the door remains locked and the user is prompted to enter the password once more.

6.0 CONCLUSION

This project is effective in providing enough security as long as the password is not shared. In future this "Arduino based password security locking system" can be provided maximum security by the above enhancements in order to completely satisfy user's needs.

Hence, a common man can afford to purchase such locking system in minimal cost to keep his valuables safely without any worries.

ACKNOWLEDGEMENT

The project on the locking system would be tedious without the help and support of the under mentioned people.

Firstly, we would like to thank the *Department of Computer Science & Engineering, Nitte Meenakshi Institute of Technology, Bangalore* for providing us with the opportunity to perform and apply our knowledge by developing a **'**Password Protected Locking System Using Arduino' .

We would like to express our deep gratitude to *Dr. N R Shetty, Advisor, Nitte Meenakshi Institute of Technology, Prof. H C Nagaraj, Principal, Nitte Meenakshi Institute of Technology, Dr. Venkatesh, Head of Department,* Bangalore for their enthusiastic encouragement and willingness to provide us their valuable time so generously.

Lastly, we would like to thank our families and friends who provided us with resources and their encouragement which lead to the successful completion of this project.

REFERENCES

[1]. Arduino Programming Notebook – Brian W Evans , First edition, Aug 2007

[2]. http://arduino.cc/tutorial

[3]. http://instructables.com

[4]. Getting started with Arduino, Mazzimo Banzi(co-founder), 2nd edition 2011, O'Reilly

[5]. Arduino Micro-controller Guide, W. Durfee, University of Minnesota, Ver-2011

[6]. Introduction to Arduino, a piece of cake, Alan G Smith, September 30 2011

[7]. M. Margolis, Arduino Cookbook, O'reilly, CA, USA, 2011

[8]. The Bluetooth based LED test control for Arduino using mobile, International Journal of Scientific & Technology Research.

[9]. The working principle of an Arduino, Abuja, Electronics, Computer and Computation (ICECCO), 2014 11th International Conference, IEEE

[10]. An RF Based relay for control and communication for systems for unmanned ground vehicle and air vehicle, 2nd international conference on computing for sustainable global development, BVICIAM, New Delhi, India, 03/2015

Table 1. Connection wiring spot diagram

Motor				Micro			LCD				Keypad	
	FR	TO		FR	TO			FR	TO		FR	TO
1	-ve	Gnd		3.3V			1	VD1	Gnd		COL1	Gnd
2	Pulse	MICRO A2		5V	MOTOR POS,10 K POT,RES		2	VD0	10K POT,5V,RES		COL2	MICRO A0
3	+ve	5V		Vin			3	WD	10K POT CONROL		COL3	MICRO D2
							4	RS	MICRO D13		COL4	MICRO D3
							5	R/W	Gnd		ROW1	MICRO D7
							6	E	MICRO D12		ROW2	MICRO D6
							7	DB0			ROW3	MICRO D5
				A0	KP COL2		8	DB1			ROW4	MICRO D4
				A1			9	DB2				
				A2	MOTOR Pulse		10	DB3				
				A3	Gnd		11	DB4	MICRO D11			
				A4			12	DB5	MICRO D10			
				A5	Buzzer +ve		13	DB6	MICRO D9			
				N/C			14	DB7	MICRO D8			
				GND	100K POT ,LCDVD1,MOTOR NEG, Buzzer -ve		15	LED+	RES-5V-100KPOT			
				D0			16	LED-	Gnd			
				D1								
				D2	KPCOL3							
				D3	KPCOL4							
				D4	KPROW4							
				D5	KPROW3							
				D6	KPROW2							
				D7	KPROW1							
				D8	LCDDB7							
				D9	LCD DB6							
				D10	LCD DB5							
				D11	LCD DB4							
				D12	LCD E							
				D13	LCD R5							