An Industry Oriented Mini Project

On

IOT BASED DOOR LOCKING SYSTEM

A dissertation submitted in partial fulfilment of requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRONICS AND COMMUNICATION ENGINEERING

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CERTIFICATE

This is to certify that project report entitled **"IOT BASED DOOR LOCKING SYSTEM"** is being submitted by **R. Divya Sree(16BD1A0491) , Srihari Rasam(16BD1A0492) and Srividya Joshi(16BD1A0499)** students of **Keshav Memorial Institute Of Technology, JNTU** in partial fulfilment of the award of Degree of **"Bachelor of Technology" in "Electronics and Communication Engineering"** as a specialization is a record of bonafide work out by them under my guidance and supervision in the academic year 2019-2020.

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We would like to thank the entire **ECE Department** faculty who helped us Directly and indirectly in the completion of the project.

DECLARATION

We,

Hereby declare that the project report entitled **"IOT BASED DOOR LOCKING SYSTEM"** is done in partial fulfilment for the award of the degree of Bachelor of Technology in Electronics and Communication Engineering affiliated to Jawaharlal Nehru Technological University, Hyderabad. We have not submitted this report to any other university or organization for award of any other degree.

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INDEX

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Main objective of this project is to make an electronic door locker using arduino to store and protect our important things. Electronic door locks are a way to replace keys or to add additional automation features, like keypad locking or unlocking. These can be used for cutting-edge security providers offering as electronic door locks for homes and businesses. This is a basic locker programmed with a password using arduino software installed in our computers.

We dump required code programmable in c/c++ language into the arduino board to set password and make necessary connections using 4x4 keypad and a servo motor for building our electronic locker. When the user enters the password it is checked with predefined set password, if it matches it opens the door. We can also connect an LCD to the locker which displays our password. There are several types of arduino boards but we use arduino UNO board which is suitable for our process. The Uno board is the first in a series of USB-based Arduino boards. This is the basic functionality of this project.

CHAPTER 1

INTRODUCTION

Electronic door locks are a way to replace keys or to add additional automation features, like remote locking or unlocking. Although most commonly found on cars, many cutting-edge security providers are offering electronic door locks for homes and businesses.In any type of door lock, a latch or bolt is made to cross the opening between the side of the door and the door frame, preventing access. Each method of locking has pros and cons. Physical keys, such as metal keys, key cards or hand held remotes, can be lost or damaged, while numerical key codes can be forgotten (or learned and memorized by the wrong person). Key codes can be quickly and easily changed by the user when necessary, while changing physical locks and keys is much more involved, requiring specialized hardware and expertise.

Power failures are problematic for purely electronic door locks, causing them to remain locked or unlocked until the electricity has been restored.On most electronic door locks, you'll find some combination of physical and electronic locking control on the same door. For example, you may have a physical key for setup and emergency backup, but use the remote or keypad to lock and unlock the door on a day-to-day basis. This provides an extra layer of convenience and safety for the user, but may also provide additional functionality as well.

Coming to our project, Password Based Door Lock System is designed using ARDUINO UNO where in once the correct code or password is entered, the door is opened and the concerned person is allowed access to the secured area. Password Based Door Lock System using Arduino UNO is a simple project where a secure password will act as a door unlocking system. Old fashioned lock systems use mechanical locking and these can be replaced by new advanced techniques of locking systems. These methods are a combination of mechanical and electronic devices and are highly intelligent.

One of the distinct features of these intelligent lock systems is their simplicity and high efficiency. Such an automated lock system consists of electronic control assembly, which controls the output load through a password. The example of this output load can be a motor or a lamp or any other mechanical/electrical load. Here, we made an electronic code lock system using Arduino UNO, which provides control to the actuating the load.

It is a simple embedded system with takes input from the keyboard and the output being actuated accordingly. This system demonstrates a Password based Door Lock System using Arduino UNO, wherein once the correct code or password is entered, the door is opened and the concerned person is allowed access to the secured area. If another person arrives, it will ask to enter the password again. If the password is wrong, then door would remain locked, denying access to the person.

Main idea behind this project is of a door-latch opening using a password entered through keypad. As well as turning on the Buzzer when pass-code is entered wrong for multiple times. User can modify this password anytime he/she wishes using a keypad.

The main component in the circuit is Arduino UNO which is basically used to send a text message to owner of the house about the breach of security.4*4 keypad is used to enter the password. The entered password is compared with the known password. If it is correct password, the system opens the door by servo motor and displays the status of door on LCD. If the password is wrong then door remains closed and displays “WRONG PASSWORD” on LCD. And if the password was entered wrong more than 2 times then the buzzer gets activated and gives out a siren. Let us discuss, hardware and software requirements of door locking system in detail.

CHAPTER 2

HARDWARE BLOCK DIAGRAM

The whole system demonstrates a Password based Door Lock System using Arduino UNO, wherein once the correct code or password is entered, the door is opened and the concerned person is allowed access to the secured area.

The following shows the block diagram of the door locking system wherein an Arduino UNO board with ATMega328P micro-controller is used.

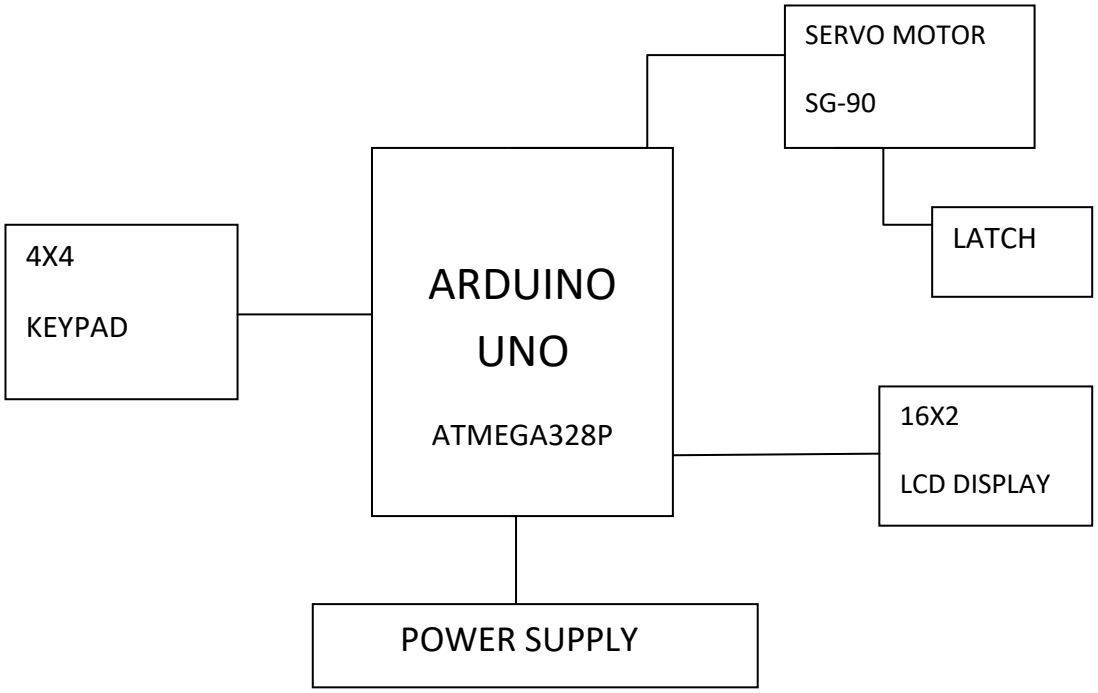

Fig 1.1: Block Diagram

The components used in the door locking system are as follows:

1. Arduino UNO
2. 4x4 Keypad
3. 16x2 LCD
4. Servo Motor-SG90
5. Volt Power Supply or Battery or Adapter
6. Connecting Wires

1. ARDUINO UNO:

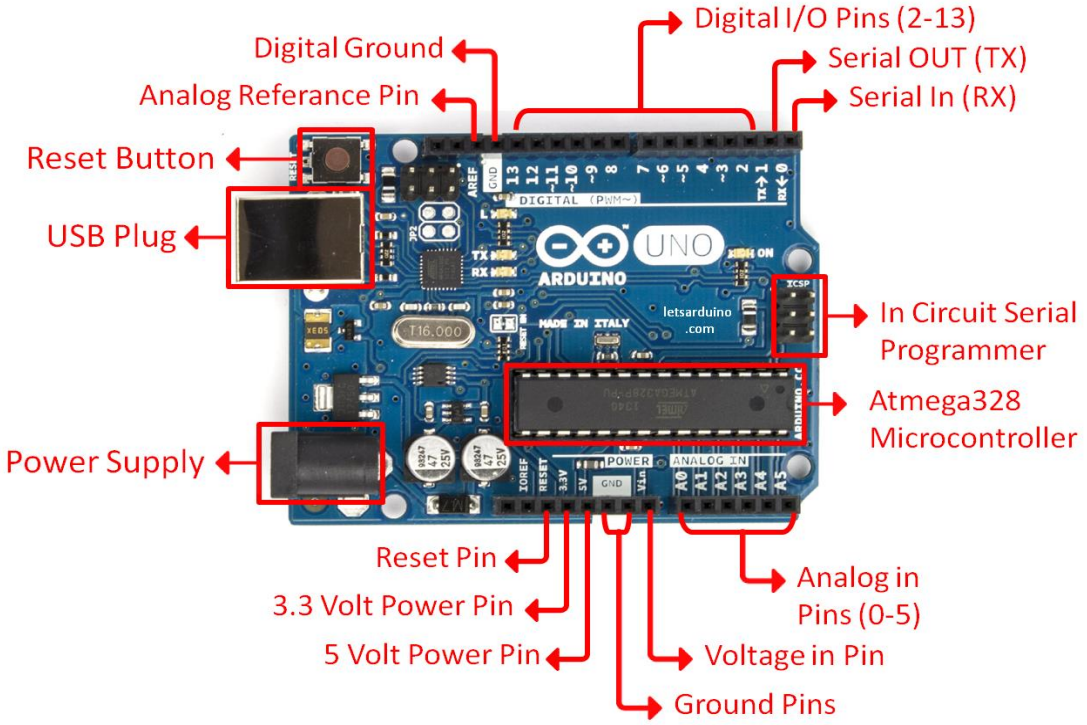

Fig 1.2: Arduino Board

This micro-controller is based on the ATmega328P. There are total of 20 pins (0-19) out of which 6 are analog inputs, 14 are digital input output pins(6 pins provide PWM voltage) which can also be used as general purpose pins, a ceramic resonator of frequency 16 MHz, an USB connection, a power jack and a reset button. It has an operating voltage of 5V. It contains everything needed to support a microcontroller.

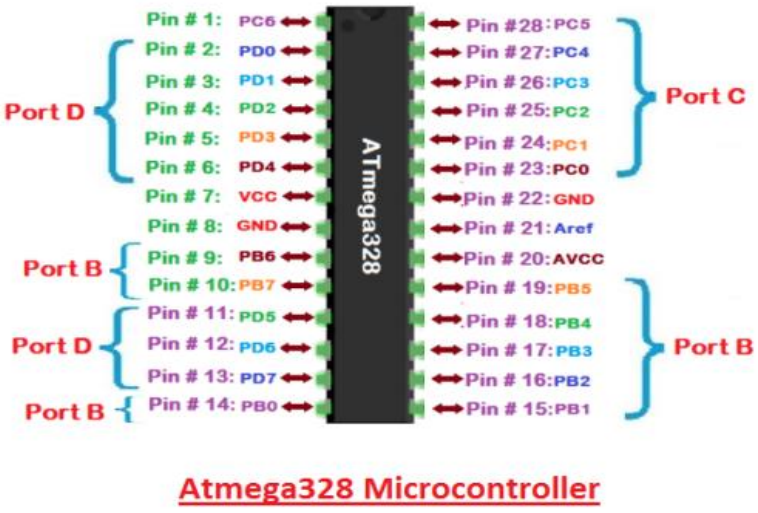

Fig 1.3: ATMega 328P Micro-controller

Arduino UNO is programmed via type B USB connector mounted on board. A USB cable is used to connect the Arduino board to the PC or laptop. When plugged in to the USB cable it is also powered up which means you do not need an additional power supply while programming your Arduino with your laptop or computer.

Fig 1.4: USB Cable

1.1 General pin functions:

- **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it's off.
- **VIN**: The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- **3V3**: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**: Ground pins.
- **IOREF**: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset**: Typically used to add a reset button to shields which block the one on the board.

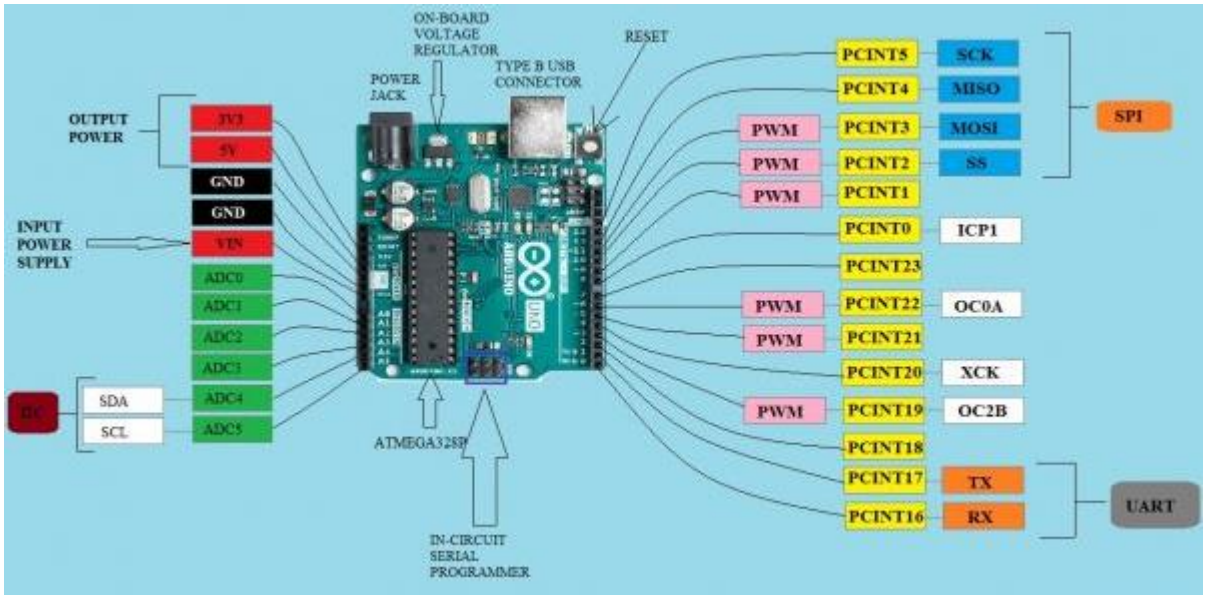

Fig 1.5: Pin Diagram Of Arduino

1.2 Special pin functions

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.

In addition, some pins have specialized functions:

- **Serial** / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.
- **External interrupts**: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM** (pulse-width modulation): 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite() function.

- **SPI** (Serial Peripheral Interface): 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- **TWI** (two-wire interface) / I²C: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
- **AREF** (analog reference): Reference voltage for the analog input

Fig 1.6: Power Cables

1.3 Automatic (software) reset

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Uno is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

2. 4x4 KEYPAD:

Interface 4×4 matrix keypad to an arduino board is the main aspect of this project. Most of the electronics devices use them as user inputs. Knowing how to connect a keypad to a

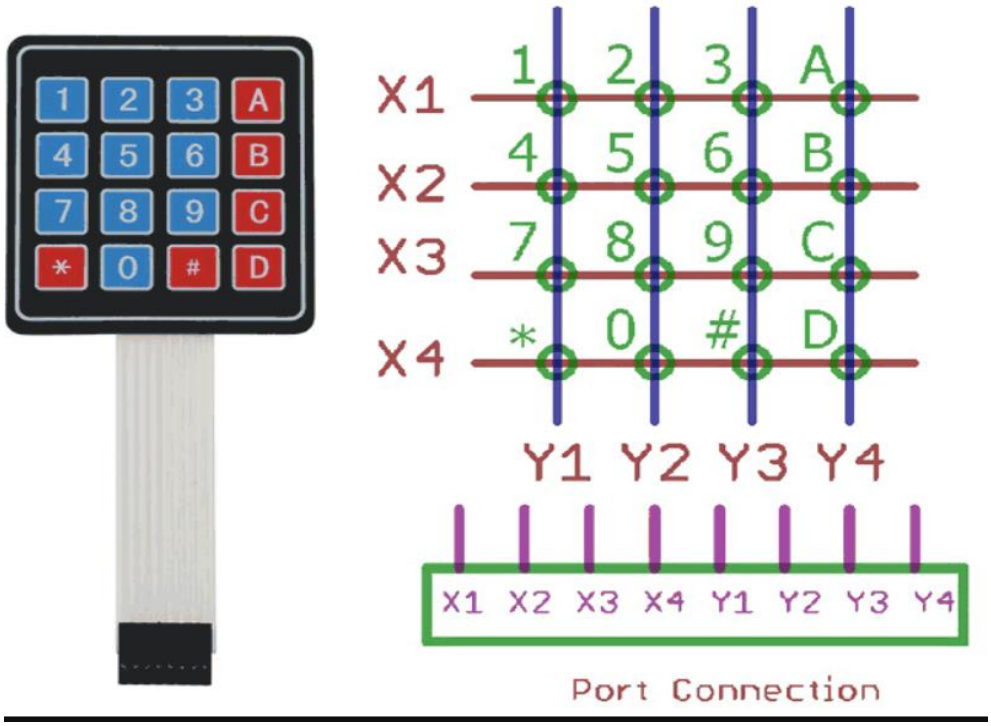

Fig 1.7: 4x4 Keypad Description

microcontroller like arduino is very valuable for building commercial products. Whenever a key is pressed corresponding action will be visible on the LCD screen. arduino is very valuable for building commercial products. Whenever a key is pressed corresponding action will be visible on the LCD screen.

3. Liquid Crystal Display (16x2) :

We come across LCD displays everywhere around us. Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time. An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module.

Fig 1.8: LCD Pin Description

3.1 Features of 16×2 LCD module

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight

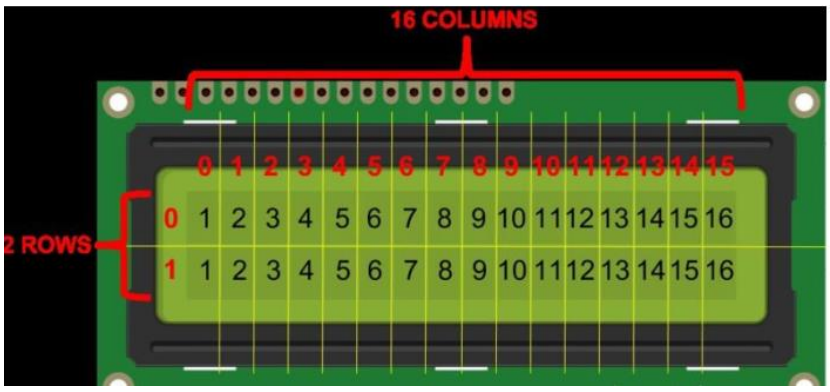

Fig 1.9: LCD Display

Table 1.1: Pin description of LCD

Pin No.	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; the best way is to use a variable resistor such as a potentiometer. The output of the potentiometer is connected to this pin. Rotate the potentiometer knob forward and backwards to adjust the LCD contrast.	Vo / VEE
4	Selects command register when low, and data register when high	RS (Register Select)
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given; Extra voltage push is required to execute the instruction and EN(enable) signal is used for this purpose. Usually, we make it en=0 and when we want to execute the instruction we make it high en=1 for some milliseconds. After this we again make it ground that is, en=0.	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight VCC (5V)	Led+
16	Backlight Ground (0V)	Led-

Table 1.2: Command Codes for LCD

Sr.No.	Hex Code	Command to LCD instruction Register
1	01	Clear display screen
2	02	Return home
3	04	Decrement cursor (shift cursor to left)
4	06	Increment cursor (shift cursor to right)
5	05	Shift display right
6	07	Shift display left
7	08	Display off, cursor off
8	0A	Display off, cursor on
9	0C	Display on, cursor off
10	0E	Display on, cursor blinking
11	0F	Display on, cursor blinking
12	10	Shift cursor position to left
13	14	Shift cursor position to right
14	18	Shift the entire display to the left
15	1C	Shift the entire display to the right
16	80	Force cursor to beginning (1st line)
17	C0	Force cursor to beginning (2nd line)
18	38	2 lines and 5×7 matrix

4. SERVO MOTOR SG-90:

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Due to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.

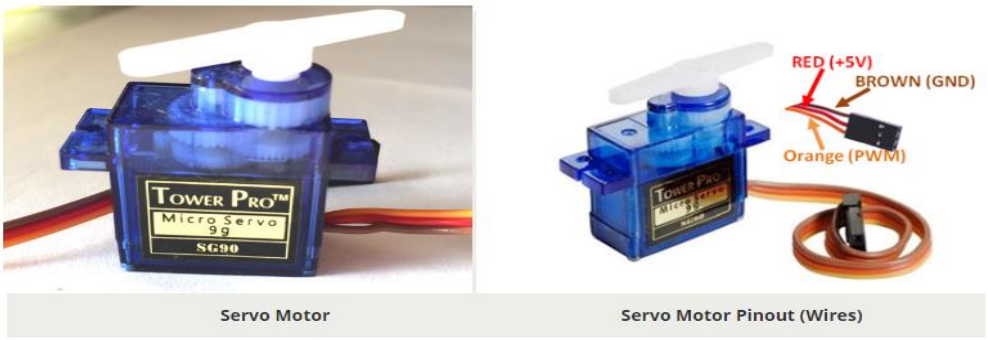

Fig 2.0: Servo Motor

Servo Mechanism: It consists of three parts:

- Controlled device
- Output sensor
- Feedback system

Table 1.3: Wire Configurations of servomotor

Wire Number	Wire Colour	Description
1	Brown	Ground wire connected to the ground of system
2	Red	Powers the motor typically +5V is used
3	Orange	PWM signal is given in through this wire to drive the motor

It is a closed loop system where it uses positive feedback system to control motion and final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal

4.1 Working principle of Servo Motors:

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly and a controlling circuit. First of all we use gear assembly to reduce RPM and to increase torque of motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now difference between these two signals, one comes from potentiometer and another comes from other source, will be processed in feedback mechanism and output will be provided in term of error signal. This error signal acts as the input for motor and motor starts rotating.

Now motor shaft is connected with potentiometer and as motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

4.2 Features :

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Gear Type: Plastic
- Rotation : 0°-180°
- Weight of motor : 9gm
- Package includes gear horns and screws

5.BATTERY:

Fig 2.1: Battery

A battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal.

6.CONNECTING WIRES:

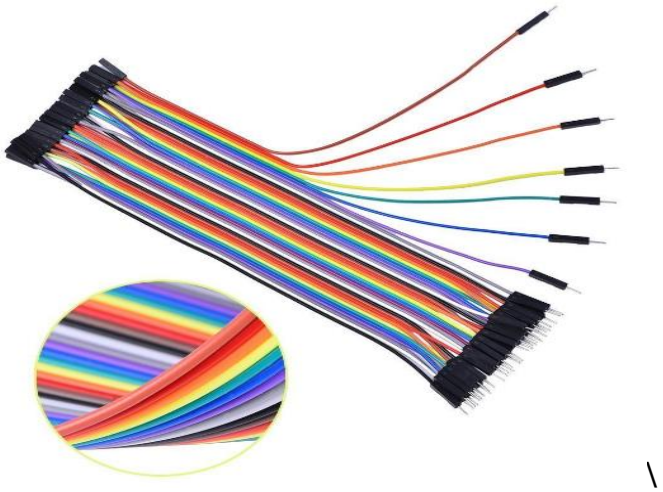

Fig 2.2: Connecting Wires

Connecting wires provide a medium to an electrical current so that they can travel from one point on a circuit to another. In the case of computers, wires are embedded into circuit boards to carry pulses of electricity.

CHAPTER 3

SOFTWARE IMPLEMENTATION

3.1 Arduino 1.8.9 IDE:

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution.

Fig 2.3: Arduino Software Icon

The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Fig 2.4: Arduino IDE

3.2 Working Principle:

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

The below figure describes about the process in the form of a flowchart.

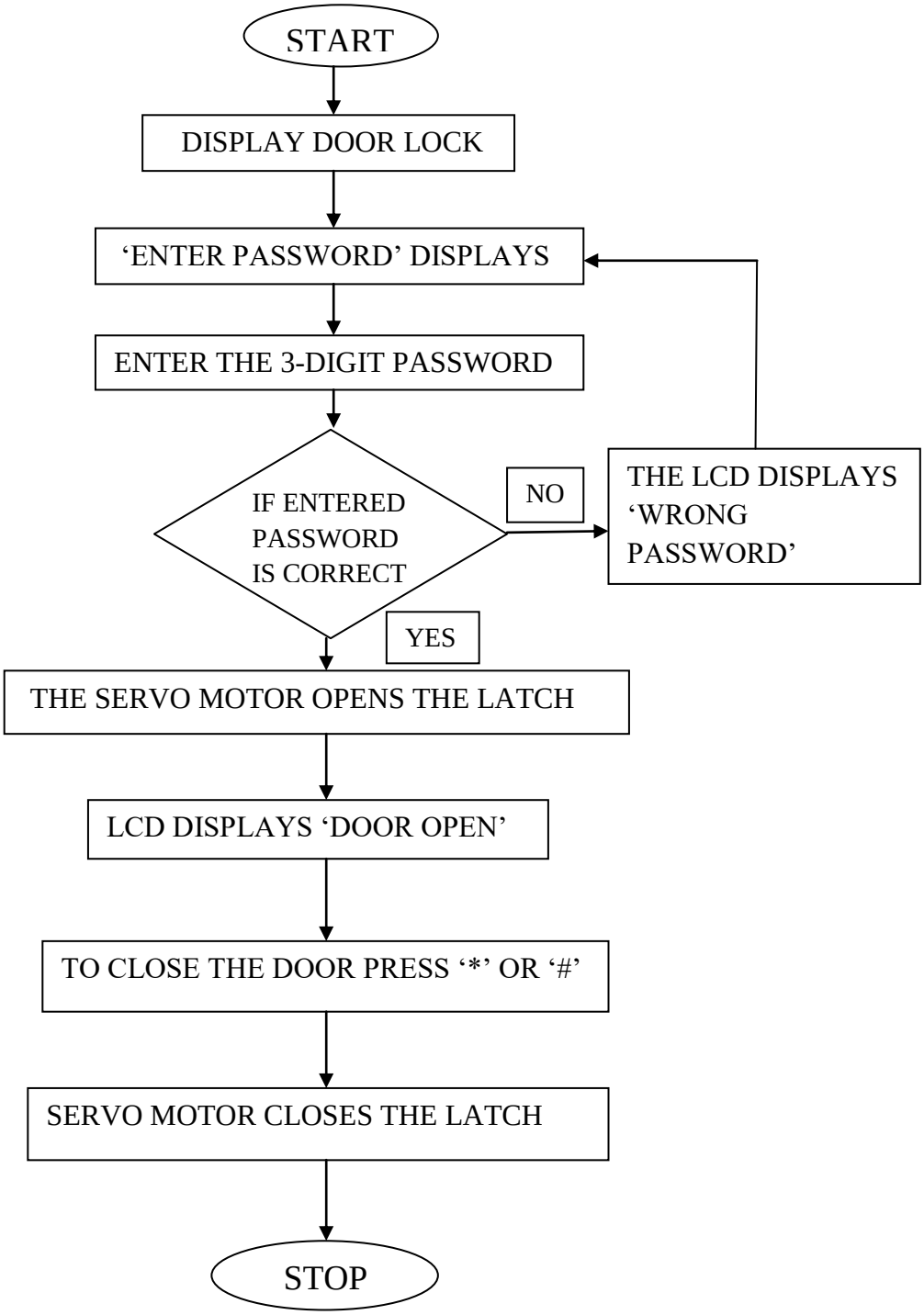

Fig 2.5: Flow Chart

3.3 Algorithm:

Step 1: Start

Step 2: The LCD displays the title of the project “Door Lock System”

Step 3: Then the LCD displays Enter Password

Step 4: The user should enter a 3-digit password

If the password is correct then the LCD displays “Password Accepted”

And the servo motor opens the door latch while the LCD displays “Door Open”

Step 5: If the entered password is wrong then the LCD displays wrong password and the door does not open

Step 6: To close the door any of the special characters like ‘*’ and ‘#’ can be pressed

Step 7: Stop

CHAPTER 4

SOURCE CODE

```
#include<Keypad.h>

#include<LiquidCrystal.h>

#include<Servo.h>

//#include<String.h>

#define buzzer 13

LiquidCrystal lcd(A0,A1,A2,A3,A4,A5); // PINS FOR LCD

char keys[4][4]={

 {'1','2','3','A'},

 {'4','5','6', 'B'},

 {'7','8','9', 'C'},

 {'*','0','#', 'D'}};

byte rowPin[4]={8,7,6,5}; // ROW PINS OF KEYPAD

byte colPin[4]={4,3,2,1}; // COLUMN PINS OF KEYPAD

Servo servo_Motor;

String password = "912";       // SETTING DEFAULT PASSWORD.

int position = 0;              // VARIABLE FOR DETERMINING THE POSITION.

int wrong = 0;              // VARIABLE FOR CALCULATING THE WRONG INPUT.

int redPin = 10;          // DEFINING PIN FOR RED LED

int greenPin = 11;       // DEFINING PIN FOR GREEN LED

 Keypad keypad=Keypad(makeKeymap(keys),rowPin,colPin,4,4);

int total = 0; // VARIABLE TO DETERMINE THE NUMBER OF WRONG ATTEMPTS.
```

```
void setup()
{
 pinMode(redPin,OUTPUT);
 pinMode(greenPin,OUTPUT);
lcd.begin(16,2);
lcd.print("DOOR LOCK SYSTEM");
lcd.setCursor(0,2);
delay(1000);
lcd.clear();
servo_Motor.attach(9);
setLocked(true);
delay(1000);
pinMode(buzzer, OUTPUT);
}
void loop()
{
  lcd.clear();
  lcd.print("Enter Password:");
  delay(10);
 char pressed=keypad.getKey();   // TAKING THE INPUT FROM KEYPAD
 String key[3];
 if(pressed) {        // IF THE KEY IS PRESSED
  lcd.clear();
```

```
lcd.print("Enter Password:");
lcd.setCursor(position,2);
lcd.print(pressed);
delay(100);
  if(pressed == '*' || pressed == '#')
    {
       position = 0;
       setLocked(true);
       lcd.clear();
    }
  else if(pressed == password[position])
    {
       key[position]=pressed;
       position++;
    }
  else if (pressed != password[position] )
    {
       wrong++;
       position ++;
    }
  if(position == 3){
  if( wrong >0){
        total++;
```

```
  wrong = 0;
  position = 0;
  lcd.clear();
  lcd.print("WRONG");
  lcd.setCursor(5,2);
  lcd.print("PASSWORD");
  delay(1000);
  setLocked(true);
  }
else if(position == 3 && wrong == 0)
  {
     position = 0;
     wrong = 0;
     lcd.clear();
     lcd.print("PASSWORD");
     lcd.setCursor(6,2);
     lcd.print("ACCEPTED");
     delay(1000);
     lcd.clear();
     lcd.print("Door Open");
     delay(1000);
     setLocked(false);  }
if(total ==3)
```

```
          {
             total=0;
             buzzer_beep();
             delay(500);
          }
       }
   }
}
void setLocked(int locked)  // FUNCTION TO CHANGE STATUS OF SERVO MOTOR.
  {
    if (locked)
      {
         digitalWrite(redPin, HIGH);
         digitalWrite(greenPin, LOW);
         delay(1000);
         servo_Motor.attach(9);
         servo_Motor.write(10);
         delay(1000);
         servo_Motor.detach();
      }
    else
{
         digitalWrite(redPin, LOW);
```

```
        digitalWrite(greenPin, HIGH);
        delay(1000);
        servo_Motor.attach(9);
        servo_Motor.write(90);
        delay(1000);
        servo_Motor.detach();
      }
  }
void buzzer_beep()     // FUNCTION TO BEEP THE BUZZER.
{
   digitalWrite(buzzer,HIGH);
   delay(1000);
   digitalWrite(buzzer,LOW);
   delay(1000);
   lcd.clear();
}
```

CHAPTER 5

RESULT

Step 1: Give power supply less than 5v by using a battery or adapter to the arduino. Then, LCD displays “Enter Password”.

Fig 2.6: Door Lock System Display

Fig 2.7: Enter Password

Fig 2.8: Closed Door

Step 2: Enter the pre-defined password with the help of 4*4 keypad . If the password entered matches with the pre-defined password LCD displays “Password Accepted”. Then, the servo motor gets unlocked and LCD displays “Door open”.

Fig 2.9: Entering Password (a)

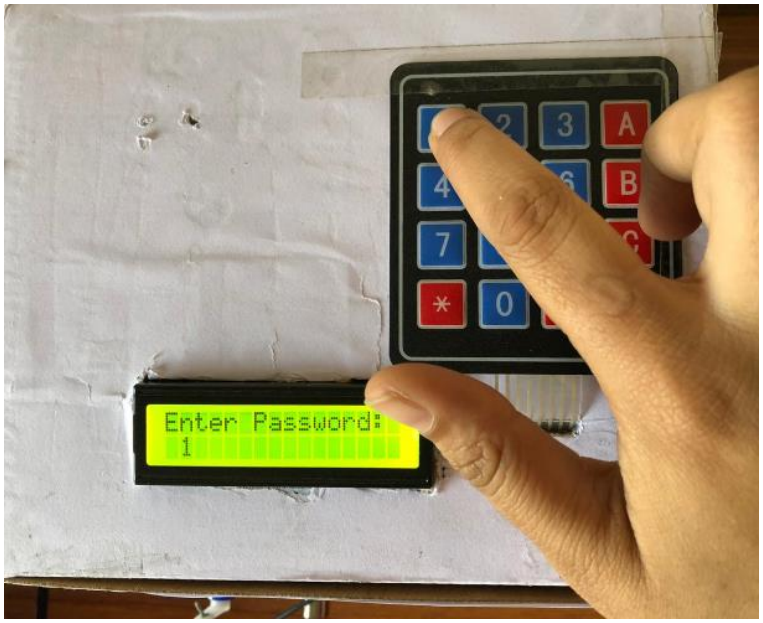

Fig 3.0: Entering Password (b)

Fig 3.1: Password Accepted

Fig 3.2: Door Open Displayed

Fig 3.3: Door Opens

Step 3: If the password entered doesn't match with the predefined password LCD displays "Wrong Password".

Fig 3.4: Wrong Password

CHAPTER 6

MERITS AND DEMERITS

6.1 Advantages of Password Based Door Lock System

- This project provides security where in a person does not need to carry a key to unlock the door instead it can be done by using a password which is easy to remember.
- Power consumption is less.
- Used commonly available components and even less cost of making the system.
- Project is simple and easy.

6.2 Limitations of Password Based Door Lock System

- It is a low range circuit, i.e. it is not possible to operate the circuit remotely.
- If you forget the password it is not possible to open the door.
- To change the password it is a big process and not all people can do it very easy.
- As it is driven by electricity or power supply, in case of power failure the circuit might not function.

6.3 Applications of Password Based Door Lock System

- This simple circuit can be used at residential places to ensure better safety.
- It can be used at organizations to ensure authorized access to highly secured places.
- With a slight modification this Project can be used to control the switching of loads through password.

CHAPTER 7

FUTURESCOPE AND CONCLUSION

7.1 FUTURE SCOPE:

The security level can be increased by adding a biometric fingerprint scanner so that only authorized personnel can enter into the room. Also we can interface sensors like Fire, LPG, PIR motion detector to micro-controller in case of any accident so that door will open automatically. We can interface camera to the micro-controller so that it could capture the picture of the thief who is trying to breach the security.

This simple circuit can be used at places like home to ensure better safety. With a slight modification, this project can also be used to control the switching of loads through password. It can also be used at organizations to ensure authorized access to highly secured places.The project can be interfaced with a GSM modem so that any unauthorized entry or breached can be easily known to the desired person through an SMS.

7.2 CONCLUSION:

The door locks or unlocks system using GSM module was implemented successfully. The design can be used for security based systems and procedures. It is a safe and secure system. The system can be used in residential and commercial development. The following improvements can be suggested for further improvements of system:-

1) Face recognition

2) Designing based on the individual need

3) Integrating with thumb impression

4) Integrating with CCTV network

This project is productive in providing enough security as long as the password is not shared. In future this “Password based Door Lock 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 buy such locking system in minimal cost to keep his valuables safely without any worries.

CHAPTER 8

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