A Report on

DOOR LOCK USING ARDUINO

for

Mini Project 1-B (REV- 2019 'C' Scheme) of Second Year, (SE Sem-IV)

in

Electronics & Telecommunication Engineering

by

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CERTIFICATE

This is to certify that the project entitled **DOOR LOCK USING ARDUINO**
is a bonafide work of

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submitted to the University of Mumbai in partial fulfillment of the requirement for the award
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& Telecommunication Engineering** as laid down by **University of Mumbai** during academic
year **2020-21**

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  Examiner/Reviewer-1   **Examiner/ Reviewer -2**

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1: INTRODUCTION

1.1 Need:

Often times, we need to secure a room at our home or office so that no one can access the room without our permission and ensure protection against theft or loss of our important accessories and assets. There are so many types of security systems present today but behind the scene, for authentication they all relay on fingerprint, retina scanner, iris scanner, face id, tongue scanner, RFID reader, password, pin, patterns, etc. Off all the solutions the low-cost one is to use a password or pin-based system. So, in this project, We have built an **Arduino Keypad Door Lock** which can be mounted to any of your existing doors to secure them with a digital password.

1.2 Definition:

To design arduino keypad door lock we start from the brain of this project which is the Arduino UNO board. The Arduino board is connected to an LCD and a servo motor. The servo motor is used to push (lock) or pull (unlock) the latch on the door. A 16 x 2 LCD is required to display the message by Arduino, 16 x 2 means it has 16 number of columns and 2 number of rows

We can use a 5v **Towerpro SG90** servo motor for making our customized door locker. It is a basic level servo motor and works fine with Arduino without any driving circuit or external module. In this project, we have used a 4 x 4 matrix keypad

We need a keypad for password input and manually lock our customized door locker. It consists of 16 keys (soft switch) 4 keys in Rows (R1, R2, R3, R4) and 4 keys in Columns (C1, C2, C3, C4) when a key pressed, it establishes a connection in between the corresponding rows and columns

Figure 1.diagram of door lock system using arduino

3. PROBLEM STATEMENT

Problem statement: To design a digital keypad security door lock system using Arduino.

4. MINI PROJECT DESIGN (PRINCIPLE AND WORKING)

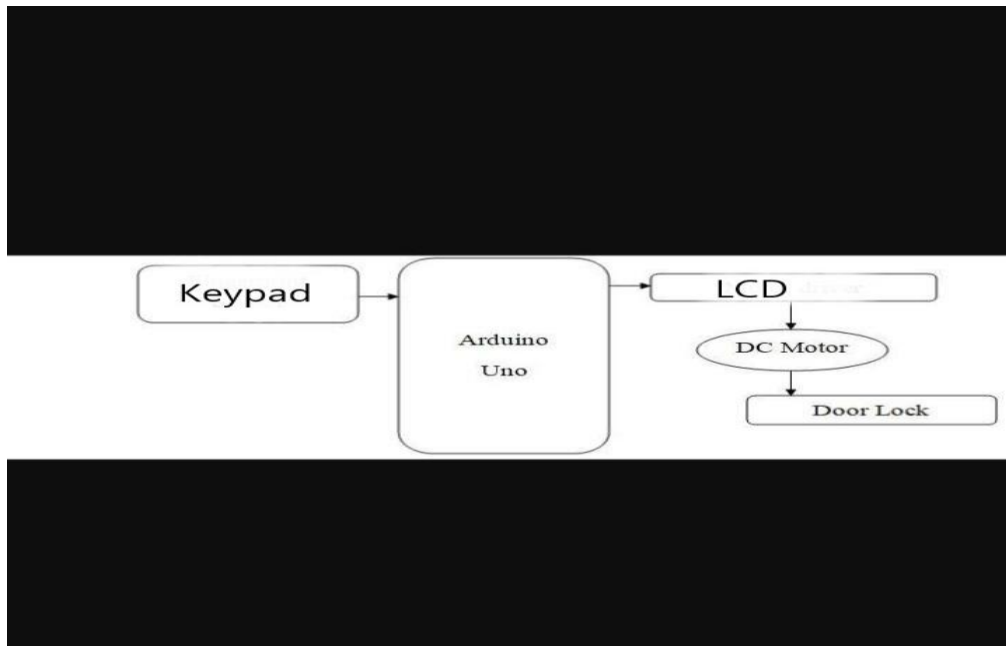**4.1Block diagram**

Figure 2.Block diagram of door lock system using Arduino

4.2   Block Diagram Description (principle)

The door lock system is designed using arduino coding. The below table shows how to connect your Arduino with Keypad.

Keypad	Arduino
Pin 1 (row 1)	Digital Pin1
Pin 2 (row 2)	Digital Pin2
Pin 3 (row 3)	Digital Pin3
Pin 4 (row 4)	Digital Pin4
Pin 5 (columns 5)	Digital Pin5
Pin 6 (columns 6)	Digital Pin6
Pin 7 (columns 7)	Digital Pin7

Table 1 Arduino with keypad description

Since the door lock system is based on arduino coding the steps to be followed for its implementation are as follow

1. After inserting all the header and library files, assign all the pin for LCD and define the password length and set the initial position of the servo to 0. After that, take a "char" datatype for declaring the number that can hold it including the null character.

2. With this piece of code (char Master[Password_Lenght] = "123456";) -- under the Char Master, declare the password of the door lock, then assign the number of rows and columns in the keyboard and also declare keyMaps and connect with rows and columns. Under the void setup, initialize the servo signal pin D9, servo status closed and print the name of the project/device/company with 3 seconds of delay on LCD time of starting the device.

3. Under the loop function, the simple if-else condition is there. According to status (it's locked automatically), print "Door is close" with 3 seconds of delay and servo rotate to close position, door data count as 1 otherwise door locker remains open and data count 0, servo open rotate to the position goes 0 degrees to 180 degrees and to close it goes from 180 to 0.

4. Write the position of the servo with 15 seconds of delay to reach the servo position. Under the void open function, print on LCD "Enter Password" then the condition specifies that the entered password should be same with custom key, within this body data counted and stores char into the data array, incremented and input password printed on LCD if the data length (number of key) and input password matches with Data Master (where the pre-defined keys are present). Then as an action LCD clear, servo drive, print on LCD "Door is open" and the data counter is reset to 0.
If the input key does not match with Data Master, as an action on LCD clear print on LCD "Wrong Password " to notify with 1 second of delay and remains in its lock position with data counter sets to 1 and continue this process in a loop.

The complete coding is as shown below

```
#include <Keypad.h>
#include <LiquidCrystal.h>
#include <Servo.h>

#define Password_Length 5

Servo myservo;
LiquidCrystal lcd(A0, A1, A2, A3, A4, A5);

int pos = 0;

char Data[Password_Length];
char Master[Password_Length] = "7854";
byte data_count = 0, master_count = 0;

bool Pass_is_good;
bool door = false;
char customKey;


/---preparing keypad---/

const byte ROWS = 4;
const byte COLS = 4;
char keys[ROWS][COLS] = {
  {'1', '2', '3', 'A'},
  {'4', '5', '6', 'B'},
  {'7', '8', '9', 'C'},
  {'*', '0', '#', 'D'}
};
```

```
byte rowPins[ROWS] = {0, 1, 2, 3};
byte colPins[COLS] = {4, 5, 6, 7};

Keypad customKeypad( makeKeymap(keys), rowPins, colPins, ROWS, COLS);


/--- Main Action ---/
void setup()
{
 myservo.attach(9, 2000, 2400);
 ServoClose();
 lcd.begin(16, 2);
 lcd.print("Protected Door");
 loading("Loading");
 lcd.clear();
}


void loop()
{
 if (door == true)
 {
  customKey = customKeypad.getKey();
  if (customKey == '#')
  {
   lcd.clear();
   ServoClose();
   lcd.print("Door is closed");
   delay(3000);
   door = false;
  }
 }
 else
  Open();

}

void loading (char msg[]) {
 lcd.setCursor(0, 1);
 lcd.print(msg);

 for (int i = 0; i < 9; i++) {
  delay(1000);
  lcd.print(".");
 }
}

void clearData()
{
 while (data_count != 0)
 {
  Data[data_count--] = 0;
 }
```

```
    return;
  }

  void ServoClose()
  {
   for (pos = 90; pos >= 0; pos -= 10) {
     myservo.write(pos);
   }
  }

  void ServoOpen()
  {
   for (pos = 0; pos <= 90; pos += 10) {
     myservo.write(pos);
   }
  }

  void Open()
  {
   lcd.setCursor(0, 0);
   lcd.print("Enter Password");

   customKey = customKeypad.getKey();
   if (customKey)
   {
     Data[data_count] = customKey;
     lcd.setCursor(data_count, 1);
     lcd.print(Data[data_count]);
     data_count++;
   }

   if (data_count == Password_Length - 1)
   {
     if (!strcmp(Data, Master))
     {
       lcd.clear();
       ServoOpen();
       lcd.print(" Door is Open ");
       door = true;
       delay(5000);
       loading("Waiting");
       lcd.clear();
       lcd.print(" Time is up! ");
       delay(1000);
       ServoClose();
       door = false;
     }
     else
     {
       lcd.clear();
       lcd.print(" Wrong Password ");
       door = false;
     }
     delay(1000);
     lcd.clear();
```

```
  clearData();
 }
}
```


Figure 3.Door lock system using arduino preview

4.3: Working

-We can show the working of door lock using arduino the following way

1-We set up the door lock system by connecting the digital keypad with the arduino board (arduino uno R3) after setting it with the arduino code listed above in its principle and with the lock latch or positional micro servo with wires as shown
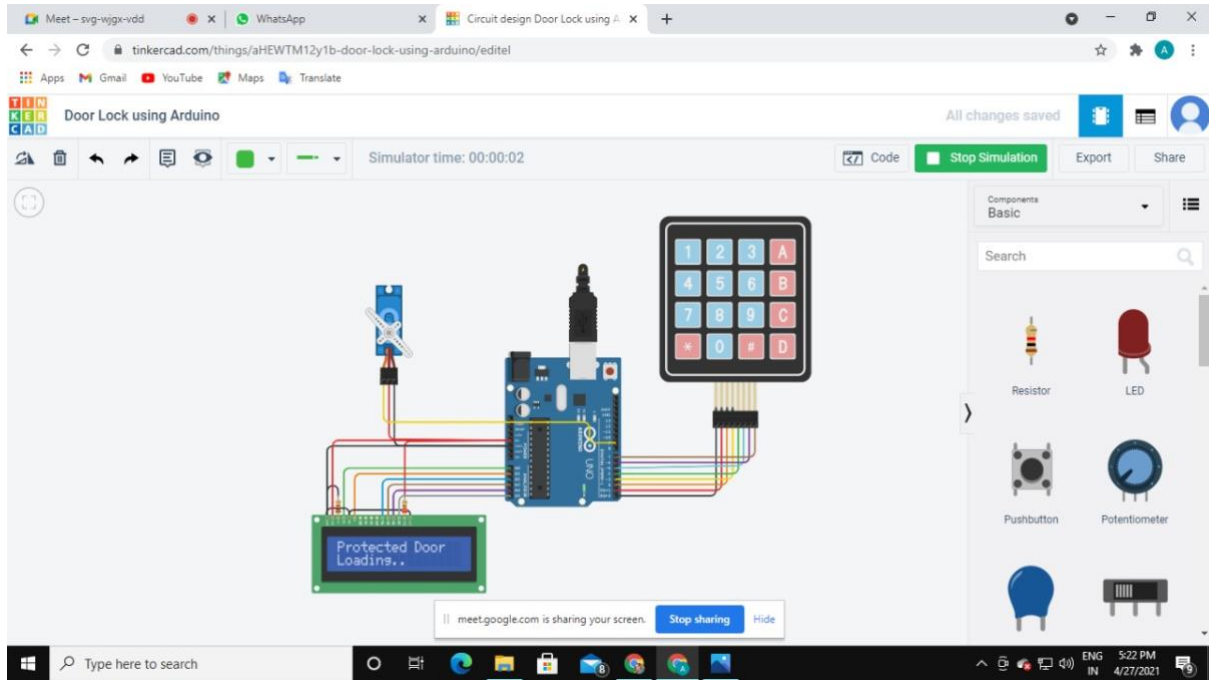

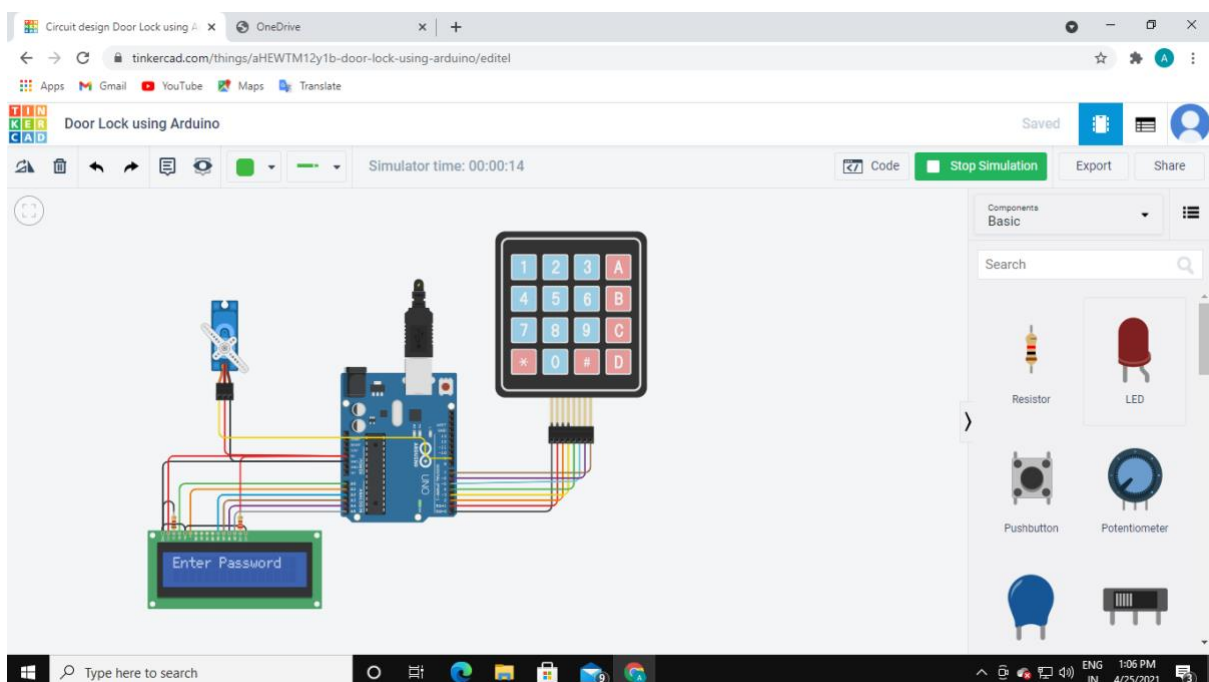**Figure 4. Setup of door lock system using arduino/Enter password**

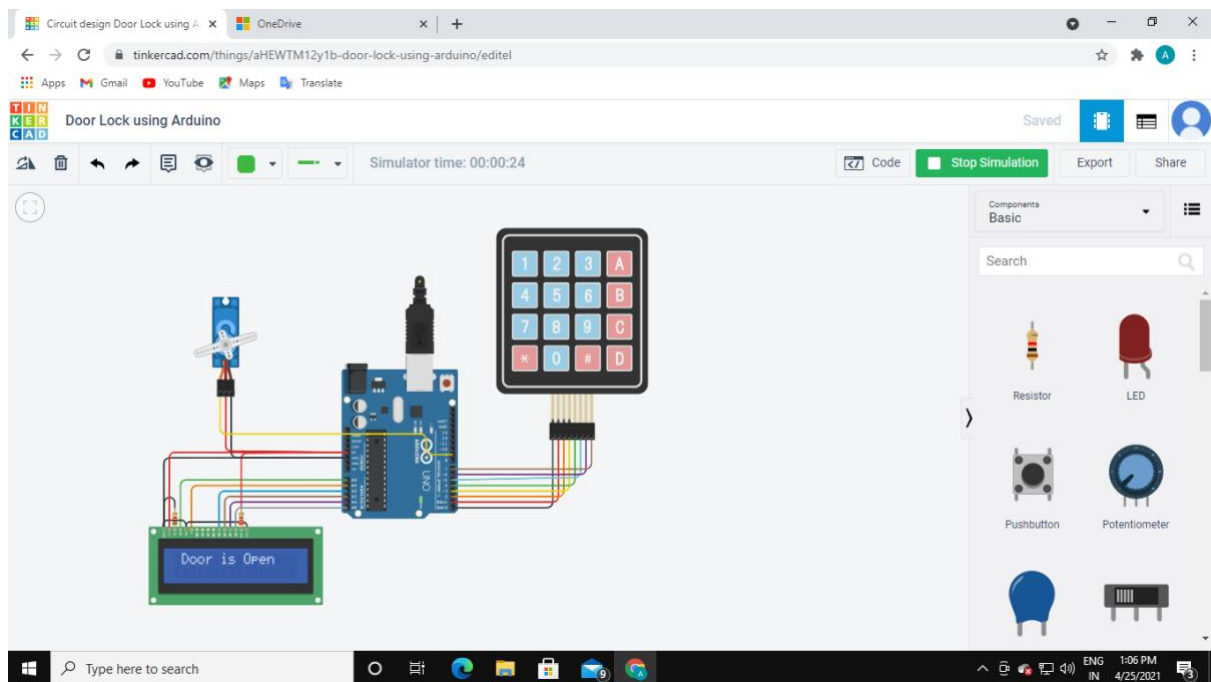**Figure 5: Working of door lock system when enter password is shown after setup**

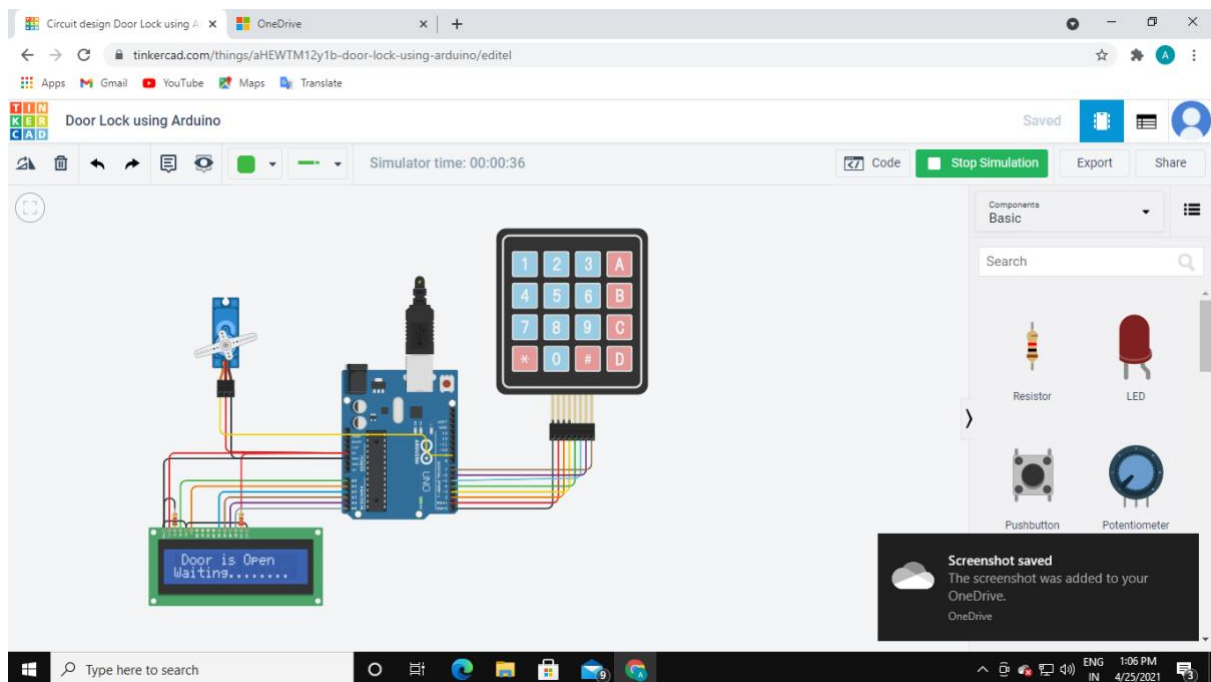**Figure6: Working of Door lock system after the password is entered**

Figure7.When the door is waiting for action after after entering the password
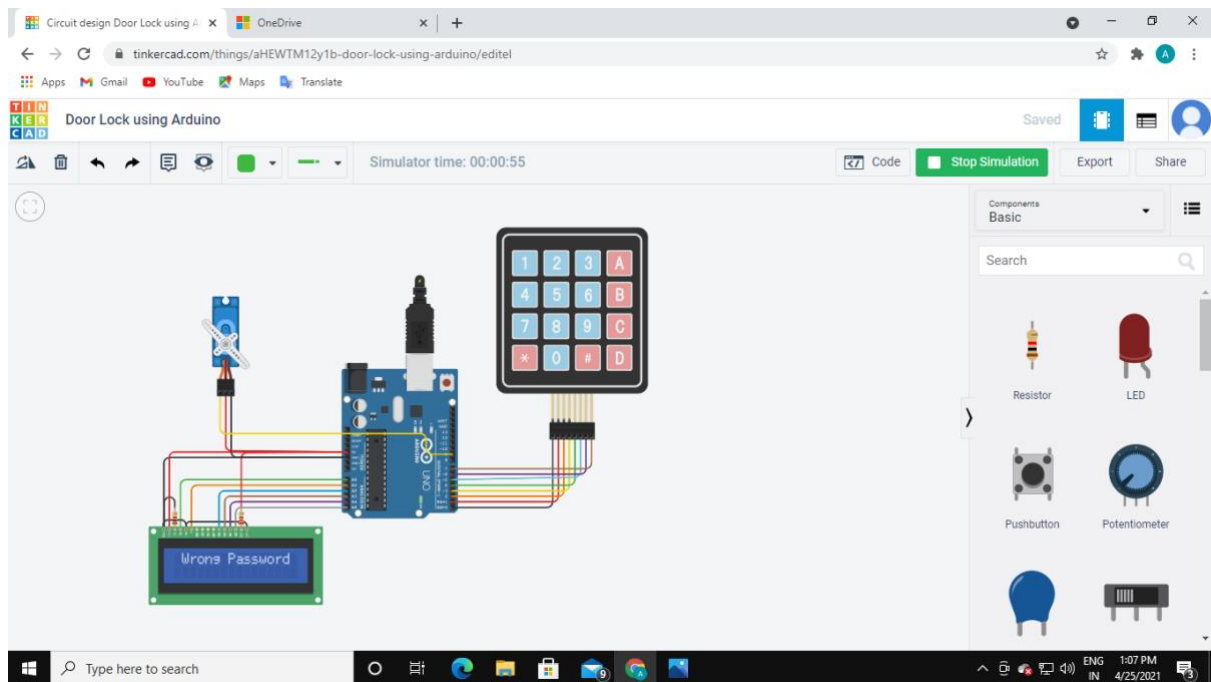
Figure 8.Working of Door lock system when wrong password is entered

5. COMPONENTS/ TOOLS TO BE USED

5.1.1 Components (model)

1. Arduino Uno/Pro/Mini or Custom board using Atmega 328p Microcontroller
2. 16 x 2 LCD (Liquid Crystal Display)
3. 4 x 3 or 4 x 4 matrix keypad for Arduino
4. Servo motor
5. 3D printed door locker/customized door locker
6. Additional components for power supply of 1 Amp 5 Volt mobile charger
7. 4'' / 6''plastics boxes, jumper wires, nuts bolts, plastic casing, etc.

5.1.2 Components (simulation)

1. Arduino uno r3
2. LCD 16*2
3. 1k ohm Resistor
4. 220 ohm Resistor
5. Keypad 4*4
6. Positional Micro Servo

5.2 Software

Tinker cad online website

https://www.tinkercad.com/

6. PROPOSED EXECUTION STEPS

6.1: Implemented steps for PCB

- Firstly for designing the PCB we have to open any simulation website, we have used tikercad.com for the simulation

- Now to design the PCB of Door lock system using arduino we have to enter the complete logical coding in its PCB board/Arduino board and set up the board

- We attach the arduino board with a digital keypad according to table 1 I sequence

- We attach a doorlock latch on the other side as show along with a digital LCD which displays the results

- We can also use breadboard instead of a LCD display but it will get complicated so we have used the LCD display

- Then implant the circuit on the PCB for its design

6.2: PCB layout

Figure9.PCB layout of Door lock system

7. TROUBLESHOOTING

7.1: Problems/Faults in the Project

1. The LCD displays an error code(ERROR or ---------)
2. The Board does not accept the entered password to be correct

7.2: Steps to solve the Problems/Faults

-To solve the first problems we have to follow the following steps:

1. Check if the LCD is connected to all the points on the arduino board sequentialy as stated in table1
2. Check if the wire has been damaged/broken
3. Replace or repair the LCD screen with new one as it might be damaged

-To solve the second problem we have to follow the following steps

1. Check if all the outputs are connected to a bulb separately
2. Check if the entered password is correct
3. Recheck the arduino logic coding and make sure there is no logical error in it like the loop missing or missarranged

REFERANCES

For Books:-

J.S Katre, "Micro Controllers", Tech Knowledge, 2019 Edition,2019,

  Page no 78.

For websites

https://circuitdigest.com/microcontroller-projects/digital-keypad-security-door-lock-using-arduino

https://create.arduino.cc/projecthub/projects/tags/lock

https://electrosome.com/door-lock-arduino/

https://www.tinkercad.com/

APPENDIX

Data sheet of components

1. Introduction

The automated door lock system is widely deployed in several spheres of life such as in the banks as well as home and office environments. It could be employed as a traffic regulator for controlling the inflow and outflow of individuals to and from an environment (as seen in banks) or could be used to restrict unwanted access to an environment (access control).
The motivation behind this paper stems from the unavoidable distractions which occur during academic lectures in tertiary institutions owing to the arbitrary entrance and exit of students into and from the lecture halls. Hence, the aim of this project is to assist the lecturer in establishing some form of control over the lecture hall throughout the duration ofa lecture period. As a result, the lecturer gets to allow students into and out of the lecture hall at his / her own discretion

1. Related works

Ibencos discussed that the major drivers of the Arduino door lock with password are the Arduino Uno microcontroller and a servo motor to represent the opening and closing of door [1].
Staff, in a project stated that the major drivers of Arduino door lock using 4x4 Keypad and Servo Motor are the Arduino mega and a servo motor representing the opening and closing of the door [2].
Ali Hamza in the Digital Door Lock project using Arduino stated that the major drivers are the Arduino uno, Liquid Crystal Display, push pull solenoid representing the door and the TIP 120 NPN Transistor [3]. Again, Ali Hamza, in a project, Arduino Keyless Door Lock System with Keypad and LCD says that the major components include the Arduino Uno, a DC Lock, Relay and Liquid Crystal Display [4].
Hence, from previous works, there has been no attempt to employ the use of L293D motor driver and a DC motor in conjunction with a 4x4 matrix keypad and the Arduino Uno. This is a fresh concept, hence, making the setup unique.

2. Methodology

The system is composed of three major modules. The microcontroller module consists basically of the Arduino Uno R3 microcontroller. The keypad module serves as the input to the microcontroller, as the password required to open the door must be entered into the system via the module. The keypad module was designed from scratch for this system, using 16 push button switches and 4 resistors, since a ready-made module was not available in the market at the moment of design. The Motor driver module controls the mechanical action of the door (opening and closing). It comprises a 12Vdc motor and the L293D motor driver IC. Since the Arduino is limited to a maximum output current of 500mA on each of its output pins, driving the DC motor directly from these pins would damage them. Hence, the motor driver IC is employed to act as an interface between the Arduino and the DC motor.
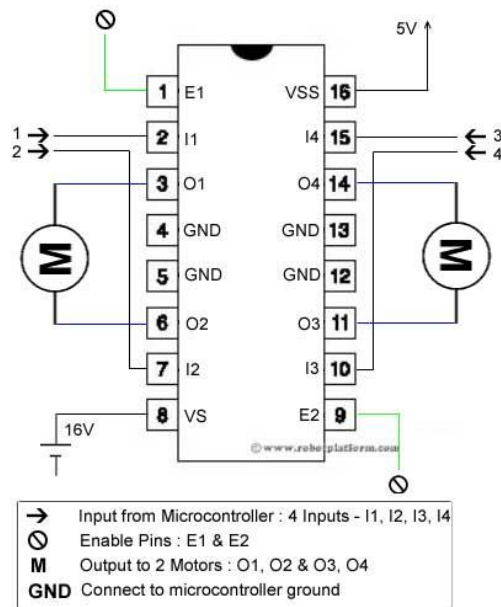
Figure 10: L293D Motor driver IC and operational circuitry

In addition, an indicator circuit comprised of two LEDs is added to indicate the opening and closing of the mechanical door.
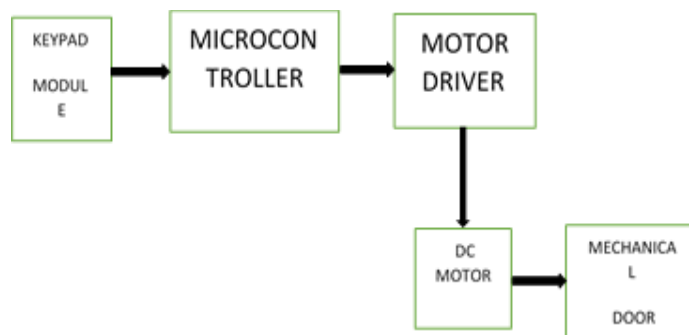

Figure 11: Block diagram for the automated door lock system using Arduino Uno
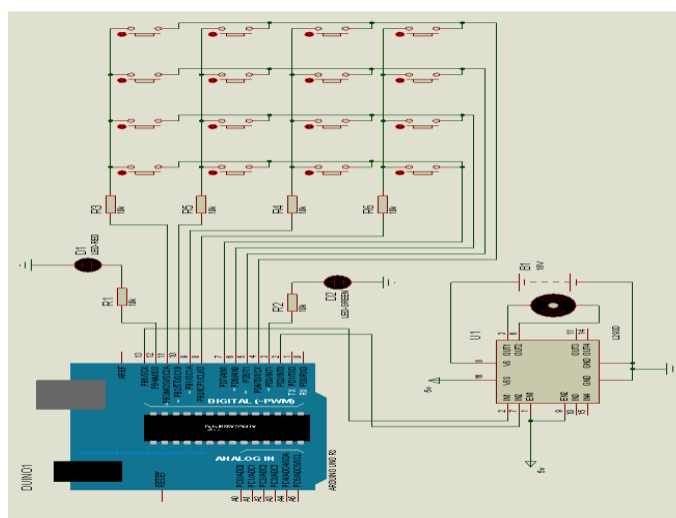

Figure12. Circuit diagram for the automated door lock system

After powering up the circuit, the door remains closed until the correct password is entered. When the password is entered, the door opens and remains opened for 30s (or as desired by the programmer), after which the door is closed again.

The automated door lock system specifications are as follows:

NAME	QUANTITY
Arduino Uno R3 microcontroller	1 pc
L293B H-Bridge IC	1 pc
9v Battery	3 pcs
9v Battery connector	3 pc
Resistors (1kΩ & 10kΩ)	6 pc
Jumper wires	5 yards
IC connector	1 pc
Switches	16 pcs
Glue	6 pcs
Veroboard	1 pc
Wood	1 pc
LED	2 pcs
Top Bond (Adhesive bond)	1 pc
DC Motor	1 pc

Table 2: Specifications

Figure 13: A 4x4 Keypad Module

3. Limitations

The major limitation of this system is its inability to automatically detect the presence of students outside the lecture hall when the door is closed.

As an improvement, motion sensors could be employed to implement this functionality.

Based on the motivation behind this project, this system could be applied as an access control mechanism in tertiary institutions like universities, polytechnics and the likes.

4. Conclusion

The use of the Arduino uno microcontroller in this project allows for design simplicity, hence, the project can be achieved in lesser time compared to other techniques previously employed.

5. References

Ibenko   [1] Ibenkos, "Arduino door lock with password." Internet: http://www.instructables.com/id/Arduino-door-lock-with-password/, 2017 [July 17, 2017].

[2]   [2] Staff, "Arduino Door lock using 4*4 keypad and servo motor." Internet:

https://www.open-electronics.org/arduino-door-lock-using-4x4-keypad-and-servo-motor/, Oct. 11, 2015[July 17, 2017].

[3]   [3] Ali Hamza. "Digital Door lock using Arduino." Internet: https://electrosome.com/door-lock-arduino/ , Dec. 10th, 2016 [July 17, 2017].

[4]   [4] Ali Hamza. "Arduino keyless door lock system with keypad and LCD." Internet: