A

PROJECT REPORT

ON

“Smart Lock”

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UNDER THE GUIDANCE OF:

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Finally, we pay our sincere thanks to all those who indirectly and directly helped us towards the successful completion of this project report.

Abstract:

In this paper, we propose a smart digital door lock system for home/bank automation. A digital door lock system is equipment that uses digital information such as a secret code, semi-conductors as the method for authentication instead of the legacy key system. In our proposed system, a module is embedded in digital door lock and the door lock acts as a central main controller of the overall home automation system. A door lock system proposed here consists of a motor module for opening and closing of the door, communication module, and control module for controlling other modules. Status of Lock module can be checked and controlled by the centralized controller (Blynk app), digital door lock. As the door lock is the first and last thing people come across in entering and leaving the home respectively, the home automation function in digital door lock system enables user to conveniently control and watch home environment and condition all at once before entering or leaving the house. Furthermore, it also allows users to remotely watch the condition inside the house through a local network. The biggest advantage of our proposed system over existing ones is that it can be easily installed when and where necessary without the requirement of any infrastructures and proper planning.

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INTRODUCTION

HOME automation system is a computerized, intelligent network of electronic devices, designed to watch and control the home appliances and lighting systems in a building. It allows users to remotely watch and control consumer electronics through a local network mobile device. Home automation is the emerging field that has attracted attention in both the commercial and research field. Although wired home networks were famous at the early developments of home automation systems, nowadays wireless communication is replacing the wired system which is very messy and difficult to setup wired system requires proper planning and construction works for efficient and clean design. It is the reason wireless communications are replacing wired ones. Furthermore, wireless systems supply more flexibility and extensibility. That is, its installation is free from construction works since it requires no wiring works. Although many wireless network solutions such as Bluetooth, Wireless local area network. A newly developing protocol for wireless sensor networks based on the IEEE 802.15.4 specification, has become the most attraction technique in the research and commercial domains because of open standard, low-cost, and low power characteristics.

STRUCTURE OF PROPOSED SMART DIGITAL DOOR LOCK SYSTEM:

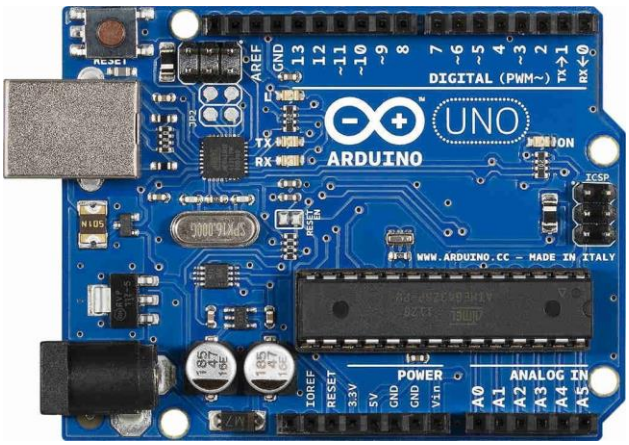
HARDWARE REQUIREMENTS:

The hardware components needed for the project are listed as follows:

S.NO.	COMPONENT TYPE	COMPONENT	DESCRIPTION
1.	IC	Arduino Uno	Microcontroller
3.	Switch	NPN TRANSISTOR	12V supply
4.	Motor	Servo motor	5V supply
5.	Display	16x 4 LCD	Display

Arduino Uno:

The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery.



16 x 4 LCD Display:

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

BLYNK:

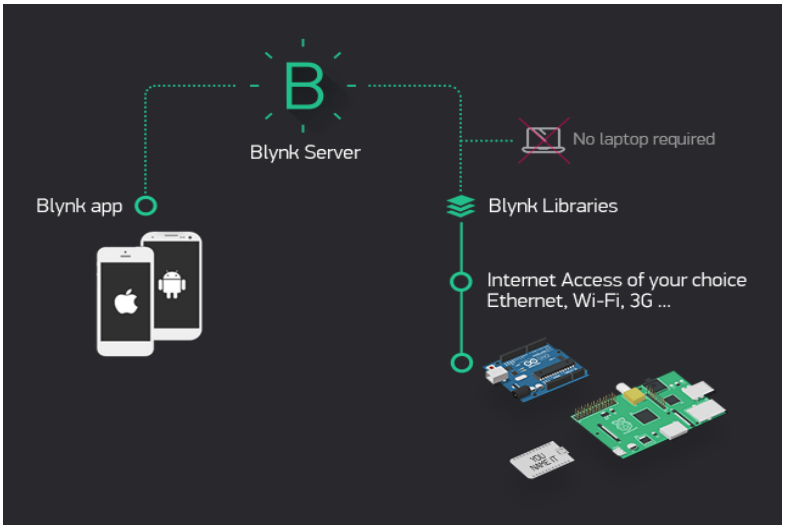
Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things

There are three major components in the platform:

App - it allows you to create amazing interfaces for your projects using various widgets we provide.

Blynk Server - responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. It's open source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and outcoming commands.



Servo Motor:

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor, although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system.

Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

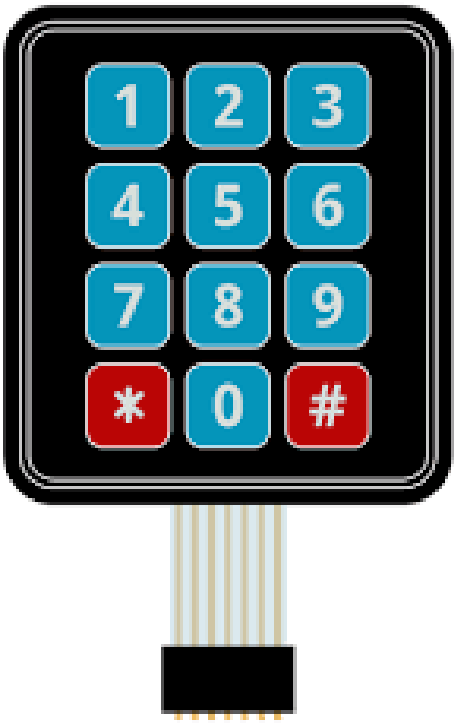
Buzzer:

The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices. The buzzer consists of an outside case with two pins to attach it to power and ground. When current is applied to the buzzer it causes the ceramic disk to contract or expand. Changing the This then causes the surrounding disc to vibrate. That's the sound that you hear.

Keypad:

A keypad is a set of buttons arranged in a block or "pad" which bear digits, symbols or alphabetical letters. Pads mostly holding numbers are called a numeric keypad.

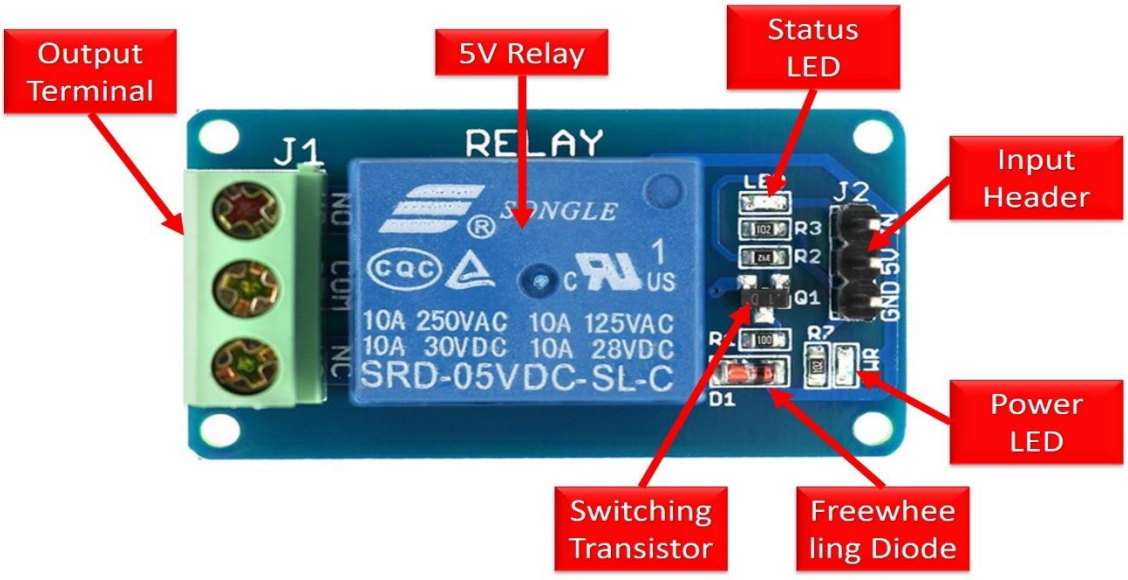
The keypad allows an individual to quickly input numbers into a computer. For example, the keypad is often used for anyone who deals with numbers often or must perform calculations with a software calculator. To switch between the number and the directional functions of the keypad, press the Num Lock key.



RELAY BOARD:

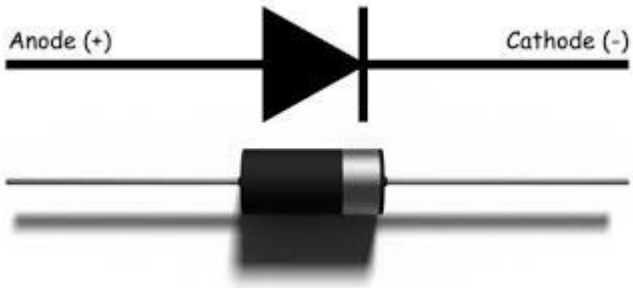
A relay is an electrically operated switch. Many relays use an electromagnet to mechanically run a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it to another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Electromagnetic relays are those relays which are run by electromagnetic action. Modern electrical protection relays are mainly micro-processor based, but still electromagnetic relay holds its place. It will take a much longer time to replace all electromagnetic relays by micro-processor based static relays.



Diode:

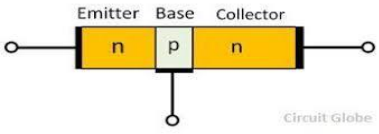
A **diode** is a semiconductor device that essentially acts as a one-way switch for current. It allows current to flow easily in one direction, but severely restricts current from flowing in the opposite direction.



N-P-N Transistor:

In an NPN transistor, a positive voltage is given to the collector terminal to produce a current flow from the collector to the emitter. In a PNP transistor, a positive voltage is given to the emitter terminal to produce current flow from the emitter to collector.

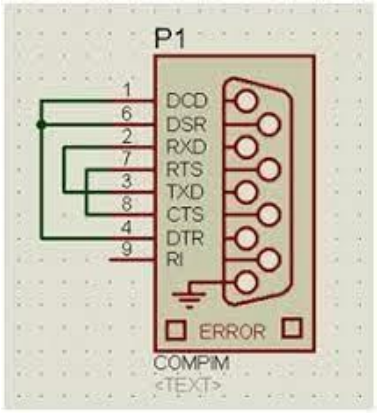
With a zero-signal applied to the Base of the transistor it turns “OFF” acting like an open switch and zero collector current flows. With a positive signal applied to the Base of the transistor it turns “ON” acting like a closed switch and maximum circuit current flows through the device.



VIRTUAL COM port:

Virtual COM Port Driver is a powerful technology designed specifically for those who develop, test, or debug serial port software and hardware. This solution will provide your system with as many virtual COM interfaces as you need.

A serial port typically can only be checked or transmitted to by one device at a time under the constraints of most operating systems, but a virtual serial port program can create two virtual ports, allowing two separate applications to check the same data.



Working Principle:

The Smart Lock Device's working is straightforward. In simple words, the user must enter the correct pin to unlock the device. If the entered pin is incorrect, a buzzer ring. In both cases the user is notified about the actions taken by the device. It also has a built-in L.C.D to display various messages.

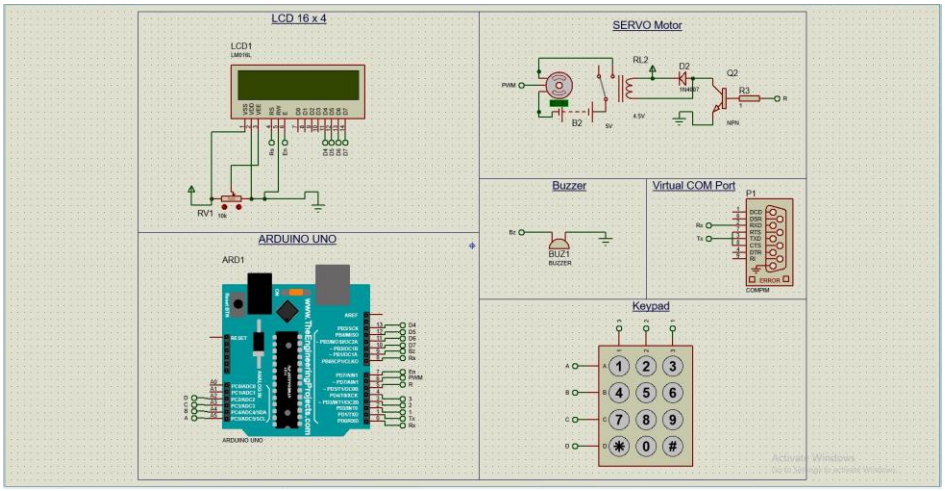
We used the Arduino Uno as it is most simple and easy to use and used a 4 x 3 Keypad and used the * button as 'backspace' and the # symbol as 'Submit' button.

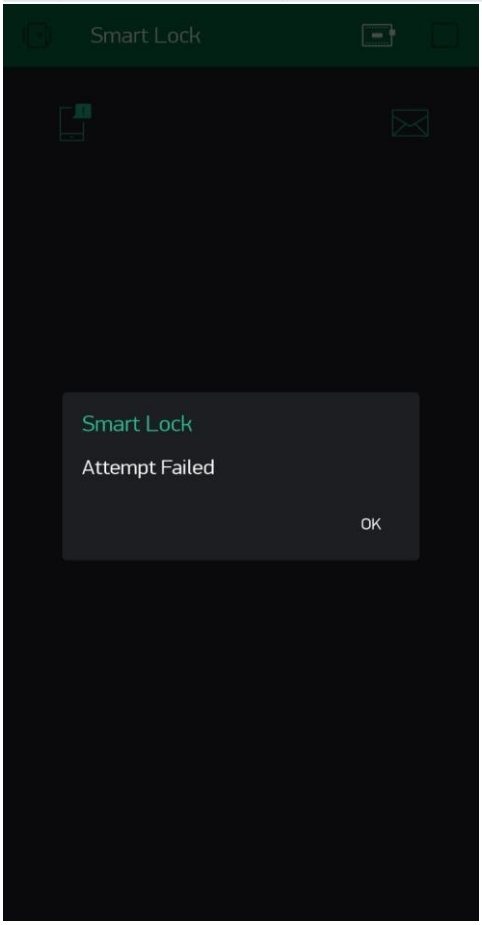
The L.C.D display is connected in 4-bit mode and connected to a 10k potentiometer to control its contrast.

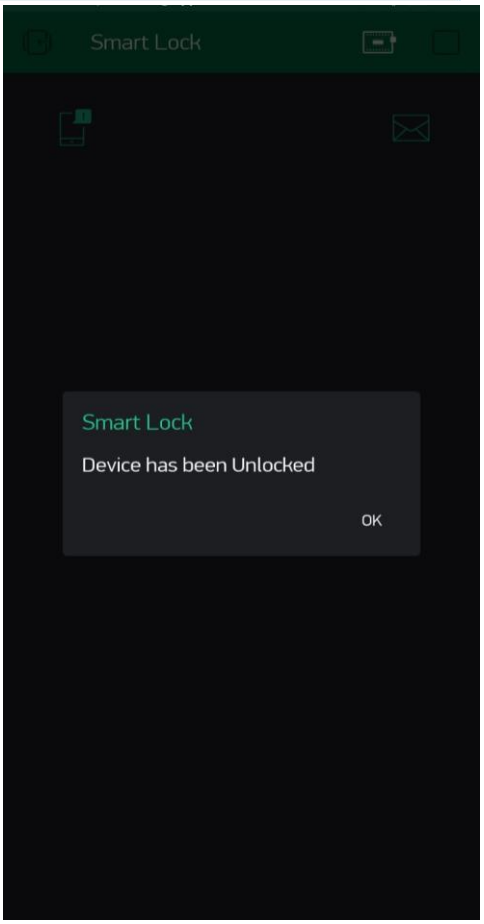
While unlocking the servo motor is activated by a Relay and to add reverse current protection for the relay, we also added a diode in series with the relay.

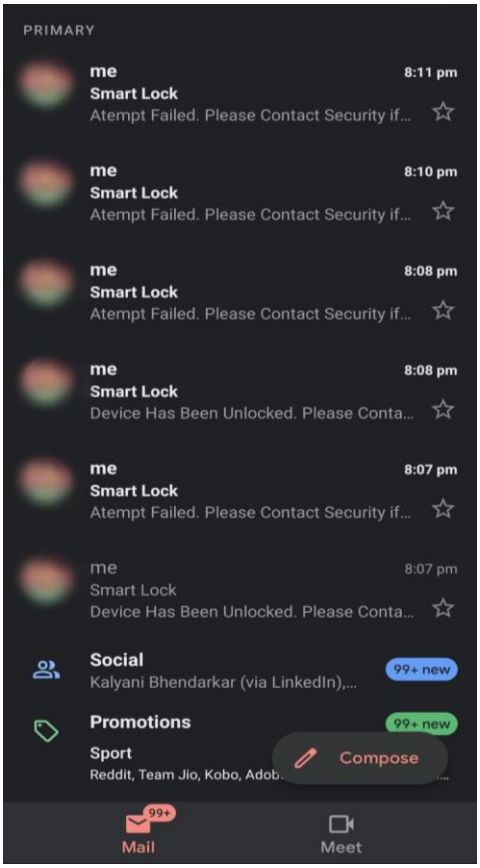
The Buzzer is simply connected to digital pin of Arduino and the Virtual COM port is connected to the TX and RX pins of the Arduino board.

Circuit Diagram:








PRIMARY
me
8:11 pm
Smart Lock
Atempt Failed. Please Contact Security if...
me
8:10 pm
Smart Lock
Atempt Failed. Please Contact Security if...
me
8:08 pm
Smart Lock
Atempt Failed. Please Contact Security if...
me
8:08 pm
Smart Lock
Device Has Been Unlocked. Please Conta...
me
8:07 pm
Smart Lock
Atempt Failed. Please Contact Security if...
me
8:07 pm
Smart Lock
Device Has Been Unlocked. Please Conta...
Social
99+ new
Kalyani Bhendarkar (via LinkedIn),...
Promotions
99+ new
Sport
Reddit, Team Jio, Kobo, Adob...
Compose
99+
Mail
Meet

Code:

```
#include <LiquidCrystal.h>
#include <Keypad.h>
#include <Servo.h>
void backspace();
void Match();
void noMatch();
Servo myservo;
int pos = 0;
/*      BLYNK App Integration     */
#include <BlynkSimpleStream.h>
char auth[] = "xdHkD3q_9nnjGXau3mDyDR6NZlK0V4NR";
LiquidCrystal lcd(8, 7, 13, 12, 11, 10);
/*      CODE FOR CUSTOM CHARECTERS     */
byte Block[8] = {
    0b11111,
    0b11111,
    0b11111,
    0b11111,
    0b11111,
    0b11111,
    0b11111,
    0b11111};
byte keyRing[8] = {
    0b01110,
    0b11011,
    0b10001,
```

```
    0b10001,
    0b11011,
    0b01110,
    0b00000,
    0b00000};
byte keyrod[8] = {
    0b00000,
    0b11111,
    0b00000,
    0b11111,
    0b11111,
    0b00000,
    0b00000,
    0b00000};
byte key_main[8] = {
    0b00000,
    0b11111,
    0b00000,
    0b11111,
    0b11111,
    0b11011,
    0b11001,
};
/*     CODE FOR KEYPAD    */
const int ROW_NUM = 4;    //four rows
const int COLUMN_NUM = 3; //three columns
char keys[ROW_NUM][COLUMN_NUM] = {
```

```
 {'1', '2', '3'},
    {'4', '5', '6'},
    {'7', '8', '9'},
    {'*', '0', '#'}};
byte pin_rows[ROW_NUM] = {A5, A4, A3, A2}; //connect to the row pinouts of the keypad
byte pin_column[COLUMN_NUM] = {4, 3, 2};   //connect to the column pinouts of the keypad
Keypad keypad = Keypad(makeKeymap(keys), pin_rows, pin_column, ROW_NUM, COLUMN_NUM);
const String password = "1234"; // change your password here
String input_password;
int i = 0;
int inp = 0;
void setup()
{
    myservo.attach(6);
    myservo.write(0);
    lcd.createChar(0, Block);
    lcd.createChar(1, keyRing);
    lcd.createChar(2, keyrod);
    lcd.createChar(3, key_main);
    pinMode(6, OUTPUT);
    pinMode(5, OUTPUT);
    pinMode(9, OUTPUT);
    digitalWrite(9, LOW);
    digitalWrite(5, LOW);
```

```
lcd.begin(16, 2);
    lcd.setCursor(5, 0);
    lcd.print("HELLO!");
    delay(200);
    while (i <= 15)
    {
        lcd.setCursor(i, 0);
        lcd.write((uint8_t)0);
        lcd.setCursor(15 - i, 1);
        lcd.write((uint8_t)0);
        delay(50);
        i++;
    }
    delay(200);
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Enter Key!");
    int k = 1;
    for (int j = 13; j < 16; j++)
    {
        lcd.setCursor(j, 0);
        lcd.write((uint8_t)k);
        k++;
    }
    lcd.setCursor(0, 1);
    /*     BLYNK App Integration    */
    Serial.begin(9600);
```

```
Blynk.begin(auth, Serial);
}
void loop()
{
    Blynk.run();
    lcd.blink();
    char key = keypad.getKey();
    if (key)
    {
        if (inp == 0)
        {
            lcd.setCursor(0, 1);
        }
        inp++;
        if (key == '*')
        {
            backspace();
        }
        else if (key == '#')
        {
            lcd.noBlink();
            if (password == input_password)
            {
                Match();
            }
            else
```

```
{
                noMatch();
            }
            input_password = ""; // clear input password
            lcd.setCursor(0, 0);
            lcd.print("Enter Key!");
            int k = 1;
            for (int j = 13; j < 16; j++)
            {
                lcd.setCursor(j, 0);
                lcd.write((uint8_t)k);
                k++;
            }
            lcd.setCursor(0, 1);
        }
        else
        {
            input_password += key; // append new character to input password
string
            lcd.print("*");
        }
    }
}
void backspace()
{
    lcd.noBlink();
```

```
  lcd.setCursor(0, 1);


  lcd.print("       ");
     lcd.setCursor(0, 1);
     input_password.remove(input_password.length() - 1);
     for (int z = 0; z < input_password.length(); z++)
     {
          lcd.setCursor(z, 1);
          lcd.print("*");
     }
}
void Match()
{
     lcd.clear();
     digitalWrite(5, HIGH);
     lcd.print("Unlocking. . . ");
     for (pos = 0; pos <= 180; pos += 1)
     {
          myservo.write(pos);
          delay(10);
     }
     inp = 0;
     lcd.clear();
     Blynk.notify("Device has been Unlocked"); // BLYNK App Integration
     Blynk.email("shaileshdeshmukh25204@gmail.com", "Smart Lock", "Device Has Been
Unlocked. Please Contact Security if you did not do this.");
     lcd.setCursor(0, 0);
     delay(3000);
```

```
    myservo.write(0);



  digitalWrite(5, LOW);
    lcd.print("Enter Key!");
    int k = 1;
    for (int j = 13; j < 16; j++)
    {
        lcd.setCursor(j, 0);
        lcd.write((uint8_t)k);
        k++;
    }
    lcd.setCursor(0, 1);
}
void noMatch()
{
    lcd.clear();
    lcd.print("Try again...");
    for (int i = 0; i < 4; i++)
    {
        digitalWrite(9, HIGH);
        delay(500);
        digitalWrite(9, LOW);
        delay(500);
    }
    lcd.clear();
    inp = 0;
    Blynk.notify("Attempt Failed"); //BLYNK App Integration
    Blynk.email("shaileshdeshmukh25204@gmail.com", "Smart Lock", "Atempt Failed.
```

```
Please Contact Security if you did not do this.");
    lcd.print("Enter Key!");
    int k = 1;
    for (int j = 13; j < 16; j++)
    {
        lcd.setCursor(j, 0);
        lcd.write((uint8_t)k);
        k++;
    }
    lcd.setCursor(0, 1);
}
```

Application and Future scope:

The above proposed system can have many applications due to its practicality and its security aspect. Some of them are:

- Can be used for doors at Home and Offices Industrial doors high security Bank vault doors.
- Immediately Alerts the user via LAN as well as E-mail alerts.
- Sounds the buzzer to get the users attention for failed attempts

Future Scope:

- We can add Two-step verification to the device to increase security.
- We can use Geo-location triggers with the device so that if the user is outside of a given radius, the device will be disabled.
- We can add the function of changing passwords from the user's smartphone and add memory to the device so that it can store the passwords even after restart! It can also be used to store the logs of device usage.

Conclusion:

The proposed system allows remote access to lock or unlock the door without physical user interaction. The system fulfils the requirements of supporting autonomous locking device and easy key distribution compared to physical keys. The system has smallest requirements for hardware and supports customization of keys. The intrusion alert enhances the security of the system. The prototype-built shows that the design consumes minimal power and the locking/unlocking of the door happens in 4 seconds on an average. Thus, the system proposed is possible.

References:

Arduino Library for Proteus

Blynk Software

Information about virtual COM port

GITHUB link for Blynk Local server

Arduino IDE

Proteus Official Website

Reference for Virtual IoT

Reference Research Paper

Youtube Tutorial for Blynk Local server

https://www.ijert.org/research/smart-door-locking-system-IJERTV2IS110725.pdf