



MCTE 2332: Digital System and Microprocessor  
Semester 1 2020/2021

## Digital Logic Design Project: **Automatic Passcode Door Lock**

Instructor's Name : Assoc. Prof. Dr. Hazlina binti Md.Yusof

Prepared by:  
Eva Nazira binti Nazry Syah (1917904)  
Section: 1

## 1.0 Goal of Project

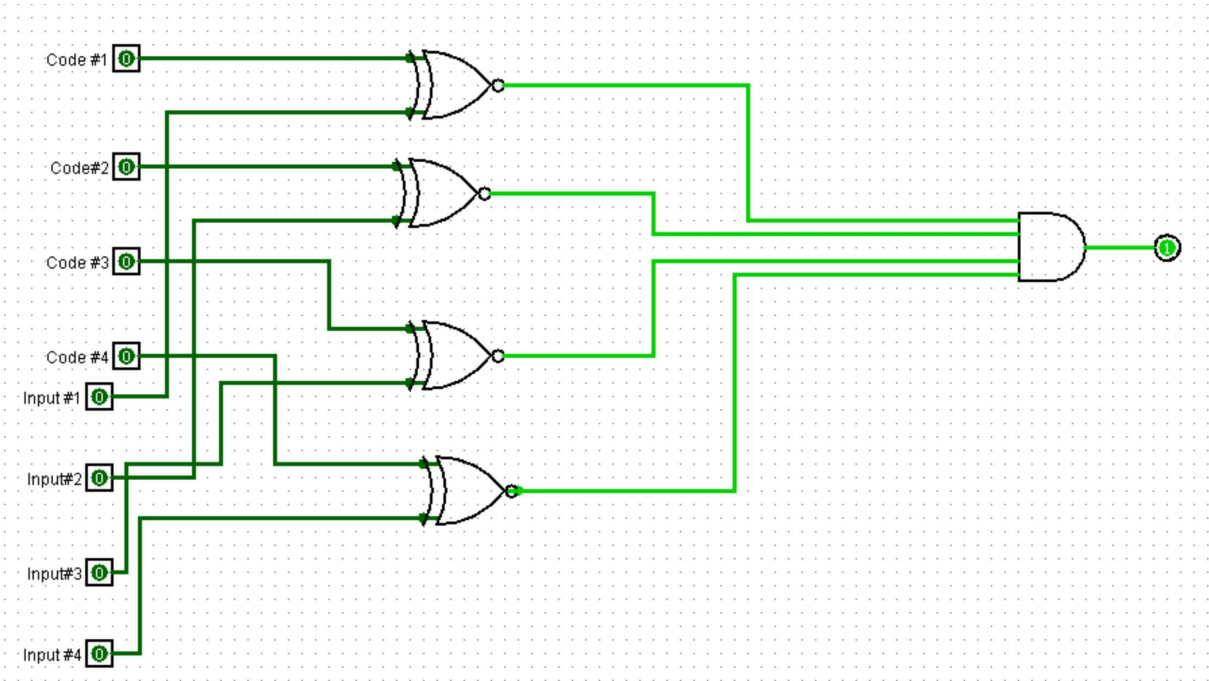
The Automatic Password Door Lock is door lock that use a keypad that can increase resistance to compromise as it provide more security to the property. These lock use certain designs or characteristics that improve their ability to resist manipulation and forced entry for a given amount of time. Hence, the aim of this project is to:

1. Increase the security around the property to avoid attempts to break into the house easily.
2. Reduce the duplication of keys that can be dangerous if the key is found by bandits.
3. Prevent situation where owner lost their key.

## 2.0 Design Process

1. The system will take inputs from user by pressing button 'A' for entering the code.
2. The input will be compare with the set password.
3. If the password is correct, the keypad will light up green LED and buzzer will make a sound and the servo will rotate 90°. This will turn the lock 90° to unlock the door. After some time, the door will locked again when the door is closed.
4. If the password is incorrect, the keypad will light up red LED and the buzzer will make a sound to signal the user that the code inserted is incorrect.However, the servo will no rotate.
5. This system also can change the password to renew the password by pressing the 'B' button to avoid outsider to remember the password code.
6. To renew the password, owner need to insert the old passcode to have the access to change the password.If the old passcode inserted is correct, the owner can change the password with a new 4-digit of passcode.Owner also need to confirm the new passcode so that the passcode inserted is correct.If the new code is same with confirm passcode, the green LED will light up and buzzer will make a sound that signal the owner the passcode has been changed.
7. To make sure the door is locked, the owner can press button 'C'.This will make sure that the door will always be locked.

The importance of this design is that it use XNOR gate and AND gate to identify the input from the user and to compare it with the passcode of the door lock.



Here, the XNOR gate is used to compare the code from the passcode with the digit that the user insert. If all the code and input share the number, the AND gate will have an output of ‘1’ which will make the door lock open. However, if one of the input is not same with the passcode, the lock will not open.

3.0 Detailed Design

Code #1	Code #3	Code #4	Code#2	Input #1	Input #4	Input#2	Input#3	Output(930,260)
0	0	0	0	0	0	0	0	x
0	0	0	0	0	0	0	0	1

Output:

Code1 ^ Input1

Code2 ^ Input2

Code3 ^ Input3

Code4 ^ Input4

~(Code1 ^ Input1)

~(Code2 ^ Input2)

~(Code3 ^ Input3)

~(Code4 ^ Input4)

Product of sums:

[illegible]

$$(\text{Code4} + \overline{\text{Input4}})(\text{Code3} + \overline{\text{Input3}})(\text{Code2} + \overline{\text{Input2}})(\text{Code1} + \overline{\text{Input1}})(\overline{\text{Code4}} + \text{Input4})(\overline{\text{Code3}} + \text{Input3})(\overline{\text{Code2}} + \text{Input2})(\overline{\text{Code1}} + \text{Input1})$$

1. Arduino UNO R3 - 1x
2. LCD - 1x
3. LED - 2x
4. Buzzer - 1x

5. Servo - 1x
6. Keypad - 1x
7. Potentiometer - 1x
8. Breadboard -1x

### Inputs

Keypress - input from user

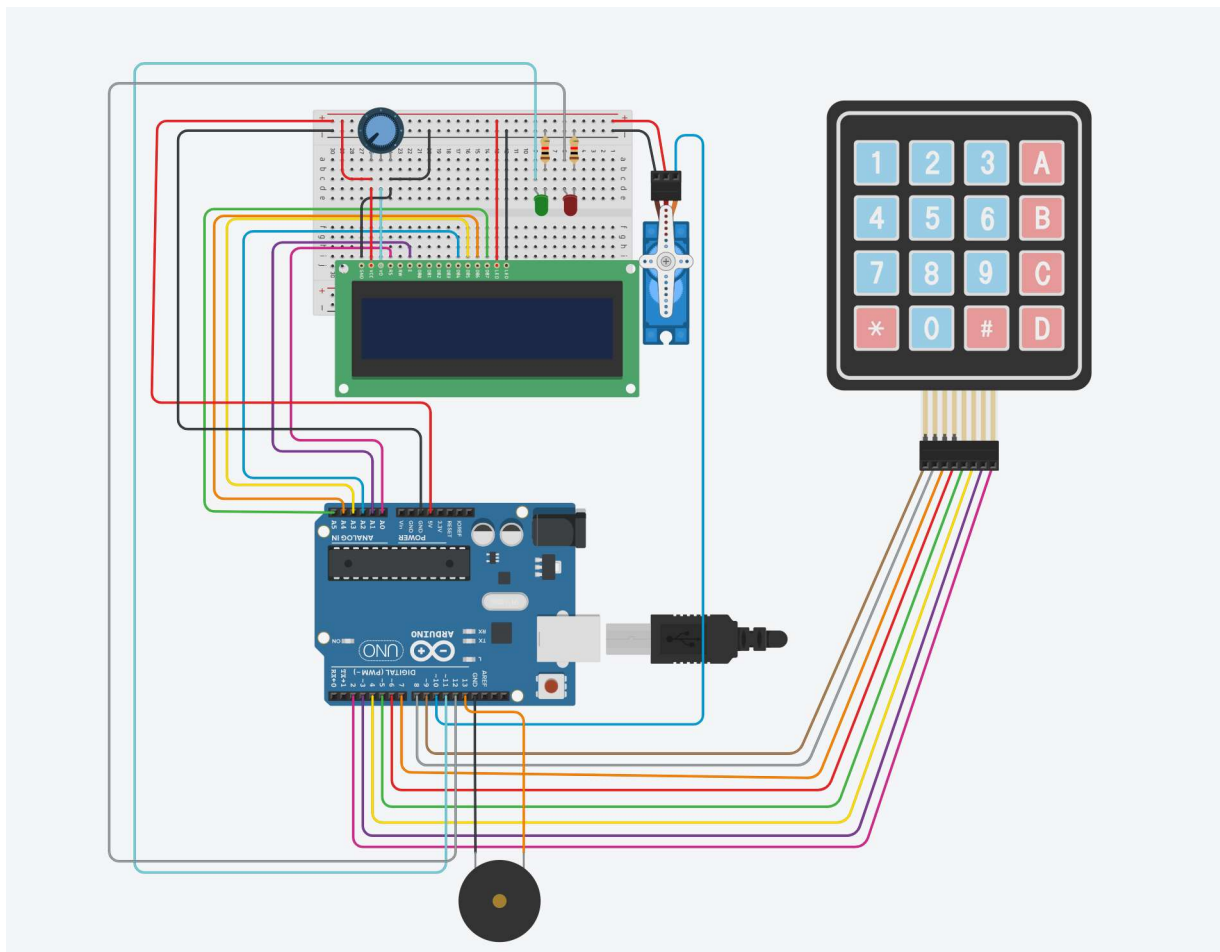
### Output

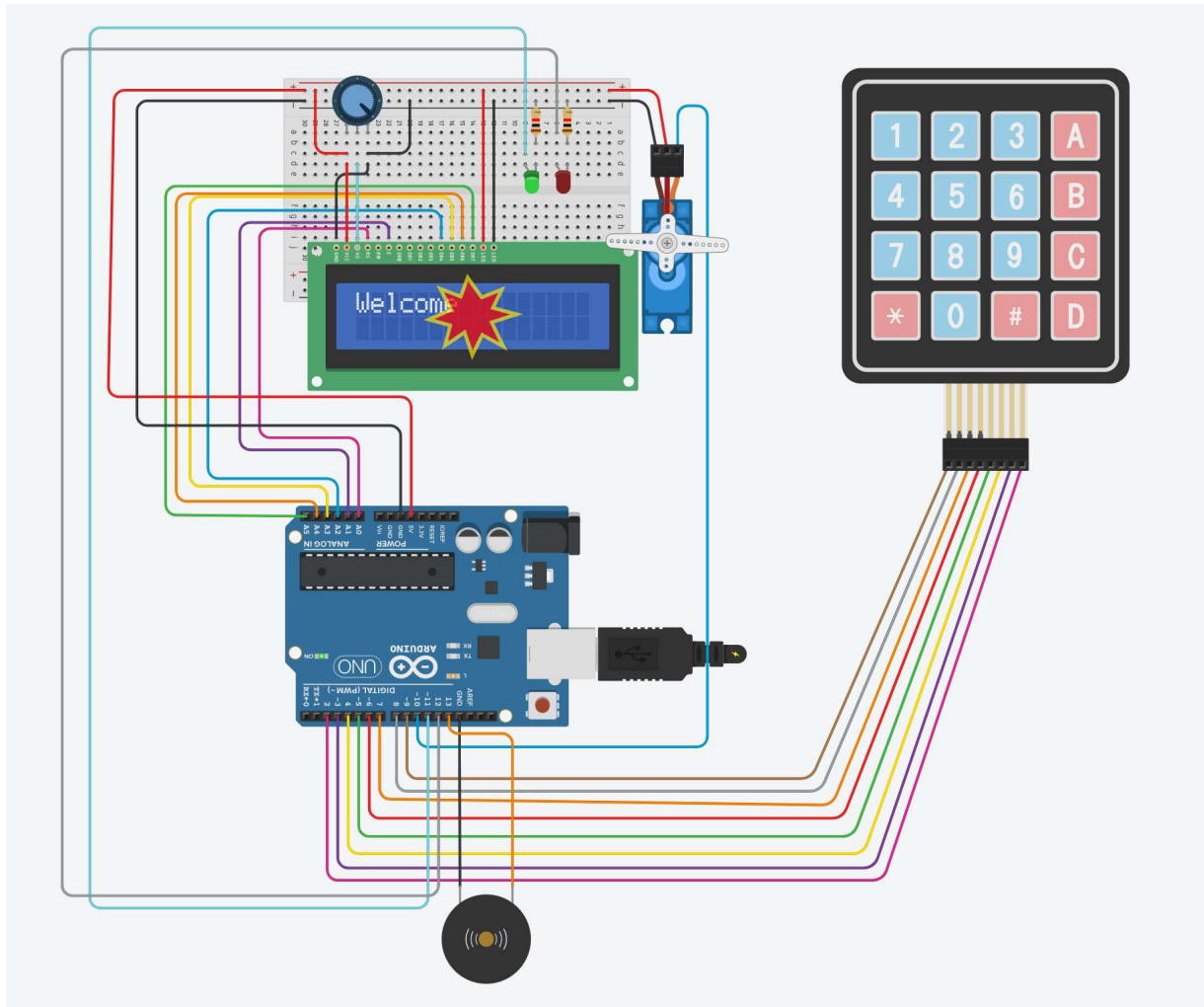
LED1 - green LED that shows a correct inputs from user

LED2 - red LED that shows an incorrect inputs from user

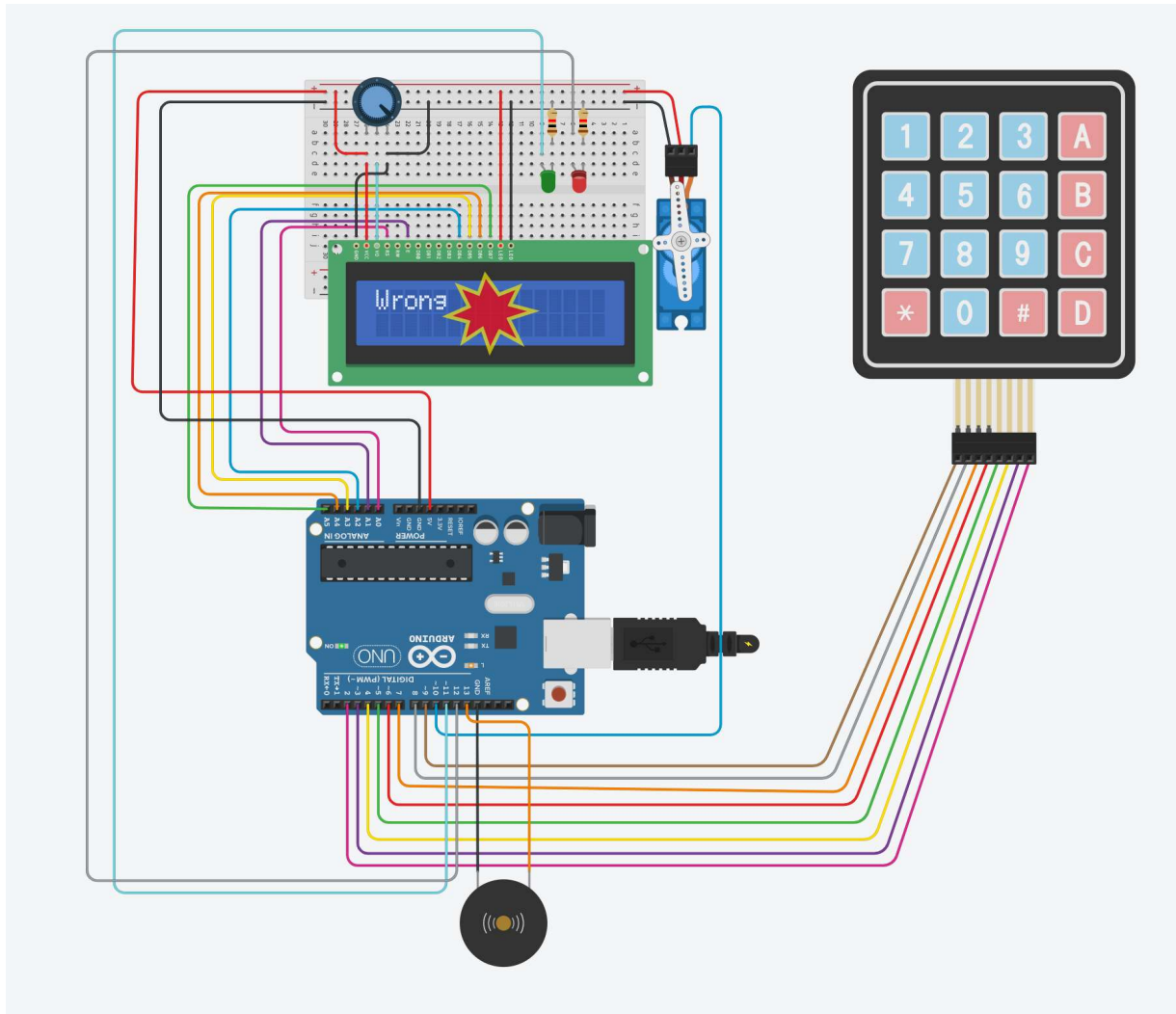
Buzzer - a device that will make a sound that indicates correct or incorrect inputs

## 4.0 Design Verification





The system will take inputs from user by pressing button 'A' for entering the code. The input will be compared with the set password. If the password is correct, the keypad will light up green LED and buzzer will make a sound and the servo will rotate 90°. This will turn the lock 90° to unlock the door. After some time, the door will be locked again when the door is closed.



If the password is incorrect, the keypad will light up red LED and the buzzer will make a sound to signal the user that the code inserted is incorrect. However, the servo will not rotate. To make sure the door is locked, the owner can press button 'C'. This will make sure that the door will always be locked.

```

#include <Keypad.h>
#include <Servo.h>
#include <EEPROM.h>
#include <LiquidCrystal.h>
const int LED1 = 11;
const int LED2 = 12;
int const numRows= 4;
int const numCols= 4;

char keymap[numRows][numCols]=
{
  {'1', '2', '3', 'A'},
  {'4', '5', '6', 'B'},
  {'7', '8', '9', 'C'},
  {'*', '0', '#', 'D'}
};

char keypressed;
char password[] = {'1', '2', '3', '4'};

LiquidCrystal lcd(A0, A1, A2, A3, A4, A5);
byte rowPins[numRows] = {9,8,7,6};
byte colPins[numCols] = {5,4,3,2};

char check1[sizeof(password)];
char check2[sizeof(password)];
short a=0,i=0,s=0,j=0;
Keypad myKeypad= Keypad(makeKeymap(keymap), rowPins, colPins, numRows, numCols);
Servo myservo;

void setup()
{
  lcd.begin (16,2);
  lcd.print("Standby"); //when no key is pressed
  myservo.attach(10);
  myservo.write(0);
  pinMode (LED1,OUTPUT);

```



```

pinMode (LED2,OUTPUT);
pinMode (13,OUTPUT);
}

void loop()
{
  keypressed = myKeypad.getKey();
  if(keypressed == 'A')// A to open the lock keypad
  {
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("Enter code");           //Message to show
    Readpassword();                     //Getting code function

    if(a==sizeof(password)) //The ReadCode function assign a value to a (it's correct when it has the size of the code array)
    {
      OpenDoor(); //Open lock function if code is correct
      digitalWrite(LED1, HIGH);
      tone (13,550,1000);
      delay(2000);
      CloseDoor();
      digitalWrite(LED1, LOW);
    }

    else
    {
      lcd.clear();
      lcd.print("Wrong"); //Message to print when the code is wrong
      digitalWrite(LED2, HIGH);
      tone (13,450,1000);
      delay(2000);
      digitalWrite(LED2, LOW);
    }

    delay(2000);
    lcd.clear();
    lcd.print("Standby");           //Return to standby mode it's the message do display when waiting
  }

  else if(keypressed == 'B') //'B' is to change the password
  {
    CloseDoor();
    Changepassword();
    lcd.clear();
    lcd.print("Standby");//When done it returns to standby mode
  }
  else if(keypressed == 'C')
  {
    lcd.clear();
    CloseDoor();
    lcd.clear();
    lcd.print("Standby");
  }
}

void Readpassword()
{
  //Getting code sequence
  i=0;           //All variables set to 0
  a=0;
  j=0;

  while(keypressed != '*'){
    keypressed = myKeypad.getKey();
    if(keypressed != NO_KEY && keypressed != '*'){
      lcd.setCursor(j,1);
      lcd.print("*");
      j++;
      if(keypressed == password[i]&& i<sizeof(password)){
        a++;
        i++;
      }
    }
    else
      a--;
  }
  //if the character typed is wrong a decrements and cannot equal the size of code []
}

```

```

        }
    }
    keypressed = NO_KEY;
}

void Changepassword()
{
    //Change code sequence
    lcd.clear();
    lcd.print("Changing code");
    lcd.clear();
    lcd.print("Enter old code");
    Readpassword(); //verify the old code first so you can change it

    if(a==sizeof(password))//again verifying the a value
    {
        lcd.clear();
        lcd.print("Changing code");
        GetNewCode1(); //Get the new code
        GetNewCode2(); //Get the new code again to confirm it
        s=0;

        for(i=0 ; i<sizeof(password) ; i++)//Compare codes in array 1 and array 2 from two previous functions
        {
            if(check1[i]==check2[i])
                s++; //again this how we verify, increment s whenever codes are matching
        }
        if(s==sizeof(password))//Correct is always the size of the array
        {
            for(i=0 ; i<sizeof(password) ; i++)
            {
                password[i]=check2[i]; //the code array now receives the new code
                EEPROM.put(i, password[i]); //And stores it in the EEPROM
            }
            lcd.clear();
            lcd.print("Password Changed");
            digitalWrite(LED1, HIGH);
        }
    }
}

```

```

        tone (13,550,1000);
        delay(500);
        digitalWrite(LED1, LOW);
    }
    else
    {
        //In case the new codes aren't matching
        lcd.clear();
        lcd.print("Password are not");
        lcd.setCursor(0,1);
        lcd.print("matching !!");
        digitalWrite(LED2, HIGH);
        tone (13,450,1000);
        delay(500);
        digitalWrite(LED2, LOW);
    }
}
else
{
    //In case the old code is wrong you can't change it
    lcd.clear();
    lcd.print("Wrong");
    delay(1000);
}
}

void GetNewCode1() {
    i=0;
    j=0;
    lcd.clear();
    lcd.print("Enter new code"); //tell the user to enter the new code and press A
    lcd.setCursor(0,1);
    lcd.print("and press *");
    delay(2000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("and press *"); //Press A keep showing while the top row print ***

    while(keypressed != '*') { //to confirm and quits the loop
        keypressed = myKeypad.getKey();
    }
}

```

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```

        if(keypressed != NO_KEY && keypressed != '*' ){
            lcd.setCursor(j,0);
            lcd.print("*");
            check1[i]=keypressed;    //Store characters in the array
            i++;
            j++;
        }
    }
    keypressed = NO_KEY;
}

void GetNewCode2() {
    i=0;
    j=0;

    lcd.clear();
    lcd.print("Confirm password");
    lcd.setCursor(0,1);
    lcd.print("and press *");
    delay(3000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("and press *");
    while(keypressed != '*')
    {
        keypressed = myKeypad.getKey();
        if(keypressed != NO_KEY && keypressed != '*' )
        {
            lcd.setCursor(j,0);
            lcd.print("*");
            check2[i]=keypressed;
            i++;
            j++;
        }
    }
    keypressed = NO_KEY;
}

void OpenDoor() {
    //Lock opening function open for 3s
    lcd.clear();
    lcd.print("Welcome");
    myservo.write(90);
}

void CloseDoor()
{
    lcd.clear();
    lcd.print("Door is Locked!");
    myservo.write(0);
}

```

Link of tinkercad of this project:

[https://www.tinkercad.com/things/jAd9LZWGqZe-project-dld/editel?sharecode=zp-S\\_N-wVGwiEyj4xwLeJbZtyh0m4fBIcZD3xr3umXE](https://www.tinkercad.com/things/jAd9LZWGqZe-project-dld/editel?sharecode=zp-S_N-wVGwiEyj4xwLeJbZtyh0m4fBIcZD3xr3umXE)

## 5.0 Conclusion

The automatic passcode door lock has upgrade the door lock system to a higher security level that can avoid the attempt of burglary and maintain the safety of user's property. As an upgrade version, there also a door lock that can connect with mobile phone online so that owner can monitor their property even when they are not in there,