



Cyber Physical Systems

Hands-On with Arduino

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[GitHub Link](#)

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1. Smart Door Lock System



Smart_Doorlock_using_KeypadModule.ino diagram.json

```
1 #include <Keypad.h>
2 #include <Servo.h>
3 #include <LiquidCrystal_I2C.h>
4 #include <Wire.h>
5 LiquidCrystal_I2C lcd(0x27,16,2);
6 Servo s1;
7
8 const int Actual_Pin_size = 4;
9 const int Password_size = (Actual_Pin_size + 1);
10 char password[Password_size] = "12AB"; //set password
11 char Entered_pin[Password_size];
12
13 const char no_of_rows =4;
14 const char no_of_columns = 4;
15 byte row_pins[] = {2,3,4,5};
16 byte column_pins[] = {6,7,8,9};
17 char key_array[no_of_rows][no_of_columns] = {
18     {'1','2','3','A'},
19     {'4','5','6','B'},
20     {'7','8','9','C'},
21     {'*','0','#','D'}
22 };
23 Keypad k = Keypad(makeKeymap(key_array),row_pins,column_pins,no_of_rows,no_of_columns);
24
25 int Red = 12;
26 int Green = 13;
27 char key;
28 int i = 0;
29 int lock_status = 1; //initially locked
30
31 void setup() {
32   Serial.begin(9600);
33   lcd.begin(16,2);
34   lcd.backlight();
35   lcd.setBacklight(HIGH);
```

Smart_Doorlock_using_KeypadModule.ino diagram.json

```
37 pinMode(Red, OUTPUT);
38 pinMode(Green, OUTPUT);
39 digitalWrite(Red, HIGH);
40 digitalWrite(Green, LOW);
41 s1.attach(10);
42 s1.write(0);
43
44 lcd.setCursor(4,0);
45 lcd.print("Welcome!");
46 delay(2000);
47 lcd.setCursor(1,0);
48 lcd.print("Door: Locked");
49 delay(2000);
50 lcd.clear();
51 }
52
53 void loop() {
54   if (lock_status == 1){ //Trigger unlock if door locked
55     Unlock_activate();
56   }
57   if (lock_status == 0){ //Trigger lock if door unlocked
58     lcd.setCursor(0,0);
59     lcd.print("Enter * to lock:");
60
61   key = k.getKey();
62   if(key){
63     //Serial.println(key);
64     if (key == '*'){ //Use '' specifically ""
65       Lock_activate();
66       lcd.clear();
67       lcd.setCursor(0,0);
68       lcd.print("Door Locked");
69       delay(2000);
70       lcd.clear();
71       lock_status = 1;
```

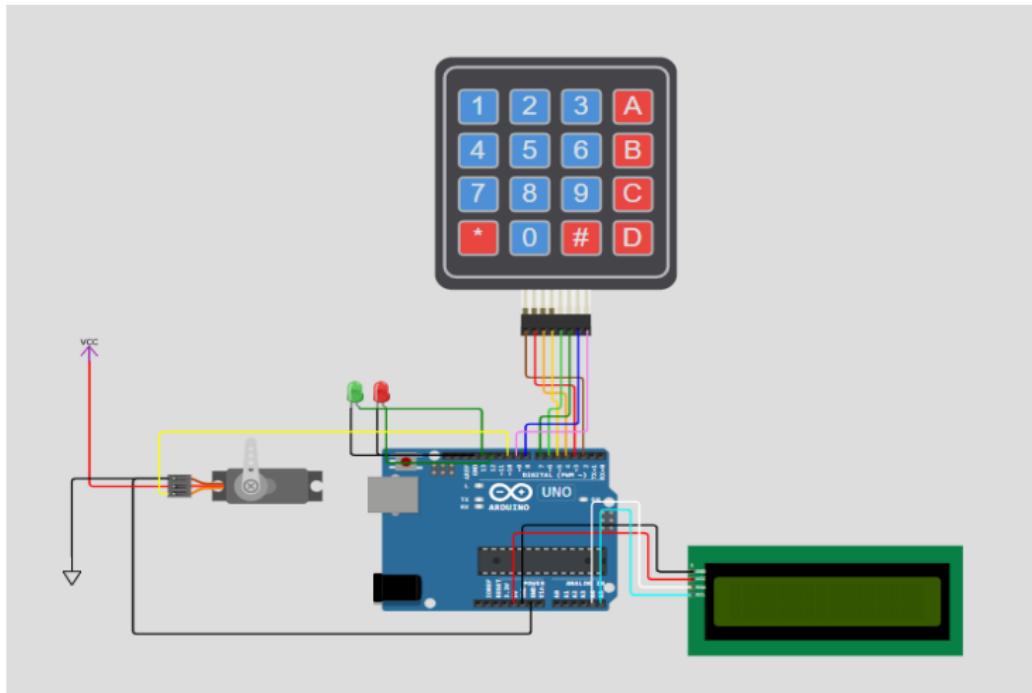
1. Smart Door Lock System



Smart_Doorlock_using_KeypadModule.ino diagram.json

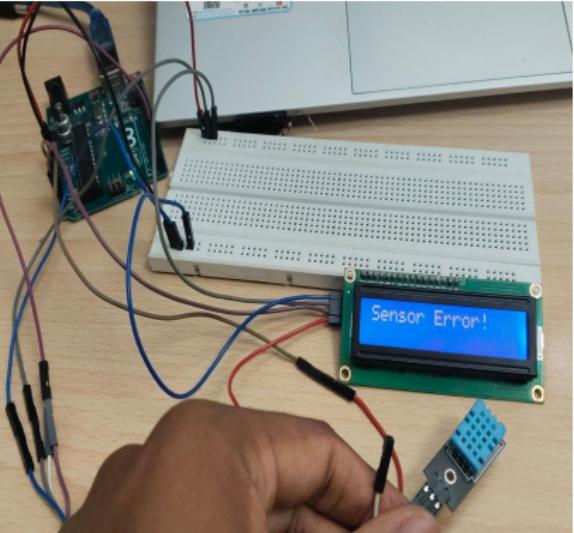
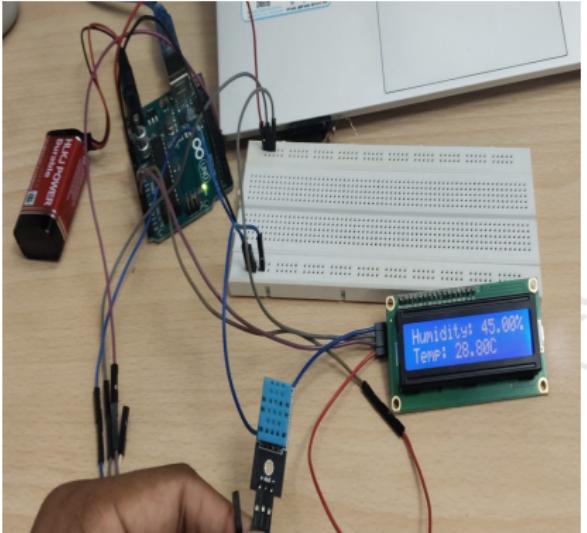
```
77 void Unlock_activate(){
78     lcd.setCursor(0,0);
79     lcd.print("Enter Pin:");
80
81     key = k.getKey();
82     if(key){
83         Entered_pin[i] = key;
84         lcd.setCursor(i,1);
85         lcd.print("*");
86         i++;
87
88         if(i == (Password_size - 1)){
89             // Serial.println(Entered_pin);
90             Entered_pin[i] = '\0';
91             delay(1000);
92             if(strcmp(Entered_pin,password)== 0){
93                 digitalWrite(Green, HIGH);
94                 digitalWrite(Red, LOW);
95                 s1.write(90);
96
97                 lcd.clear();
98                 lcd.setCursor(0,0);
99                 lcd.print("Door: Unlocked");
100
101                 i = 0;
102                 delay(1000);
103                 lock_status = 0;
104             }
105         }
106     }
107
108     else{
109         lcd.clear();
110         lcd.setCursor(0,0);
111         lcd.print("Wrong Pin");
112         delay(2000);
113         lcd.clear();
114         i = 0;
115         lock_status = 1; // Setting the lock to 1
116     }
117 }
118
119
120 void Lock_activate(){
121     digitalWrite(Red, HIGH);
122     digitalWrite(Green, LOW);
123     s1.write(0);
124     delay(1000);
125 }
```

1. Smart Door Lock System



- ❑ Link for Simulation Video in GitHub

2. DHT Values in LCD

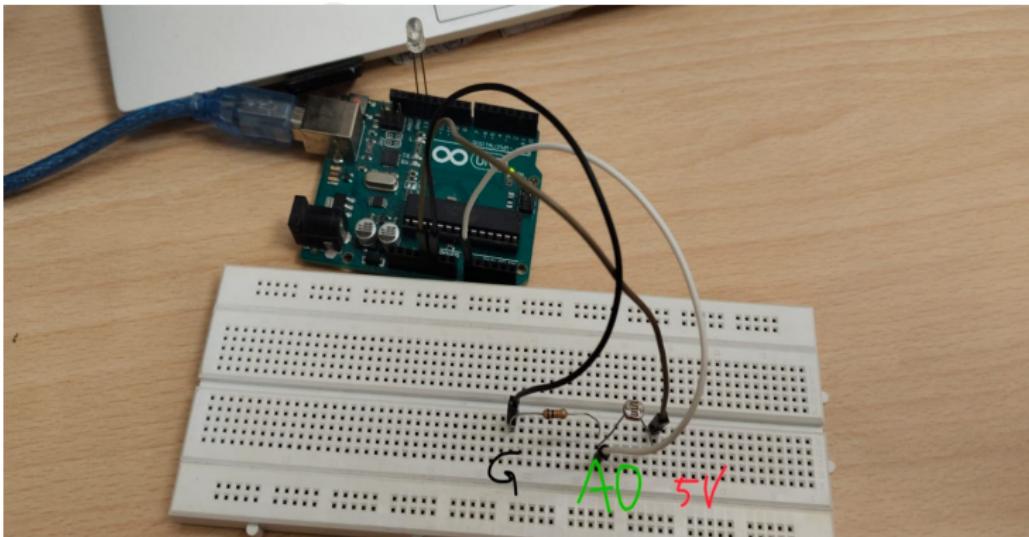


- ❑ Some sensors failed to sense the temperature and humidity as shown in fig 2. Hence LCD showed "Sensor Error!".
- ❑ Sometimes we have to provide external power as the power supply was not sufficient lead to garbage values in LCD.

3. Automatic Street Lamps using LDR

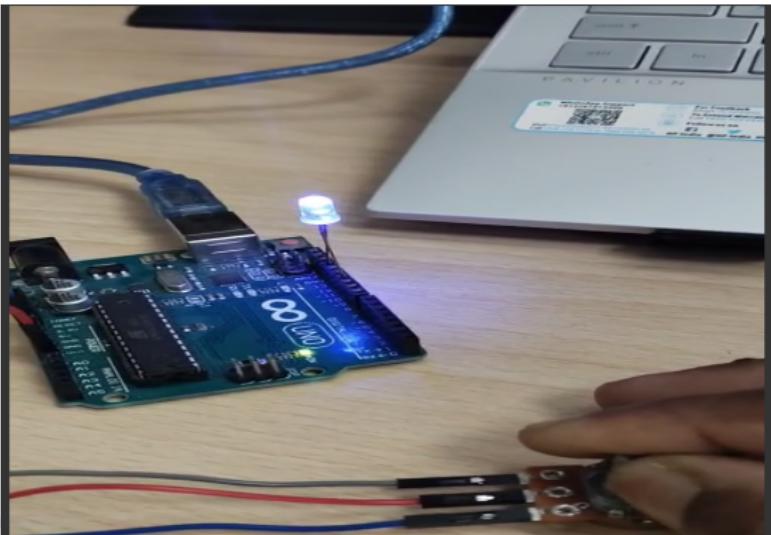


In this project, we built smart street lamps that during the day (when detecting sunlight) are switched off and switched on during the night.



- ❑ Link for Video Demonstration in GitHub

4. LED Brightness Control with Potentiometer



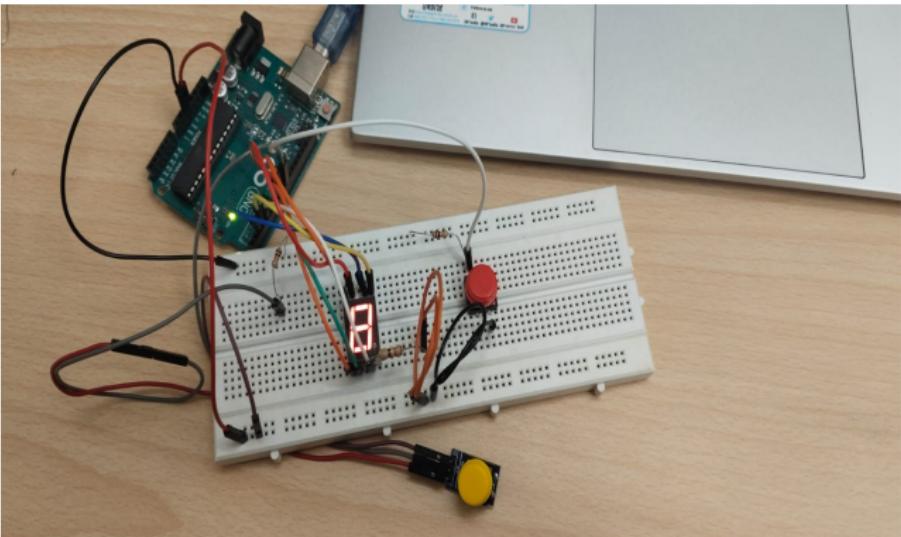
- ❑ Link for Video Demonstration in GitHub

5. ++ and -- Counter using Pushbuttons



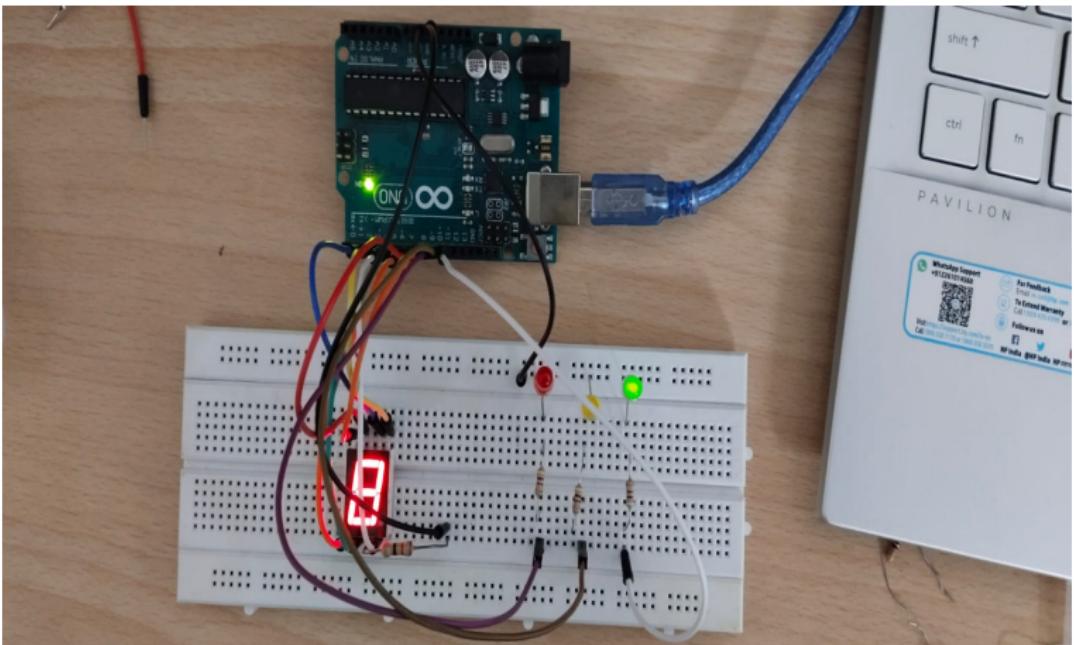
```
1 #include "SevSeg.h"
2 SevSeg S;
3 byte CommonPins[] = {}; // common pin numb
4 byte SegPins[] = {2,3,4,5,6,7,8}; // 7-segment displ
5
6 int btn1=9; //button for increment
7 int btn2=10; //button for decrement
8 int cnt=0;
9 int incPrev, decPrev;
10
11 void setup() {
12     S.begin(COMMON_ANODE, 1, CommonPins, SegPins, 1);
13     pinMode(btn1, INPUT_PULLUP); // assumes active LOW
14     pinMode(btn2, INPUT_PULLUP);
15 }
16
17 void loop(){
18     int inc = digitalRead(9);
19     int dec = digitalRead(10);
20
21     //Increment
22     if((inc == HIGH) && (cnt < 9) && (inc != incPrev )){ //if button 1 is pressed
23         delay(100);
24         cnt++;
25     }
26
27     //Decrement
28     if((dec == HIGH) && (cnt >0) && (dec != decPrev)){ //if button 2 is pressed
29         delay(100);
30         cnt--;
31     }
32
33     //Logic to print digit/character on 7 segment display
34     S.setNumber(cnt);
35     S.refreshDisplay();
36     delay(100);
37
38     //storing the button states
39     incPrev = inc;
40     decPrev = dec;
41 }
42 }
```

5. ++ and -- Counter using Pushbuttons



- ❑ Link for Video Demonstration in GitHub

6. Traffic Light Control and 7 Segment Display



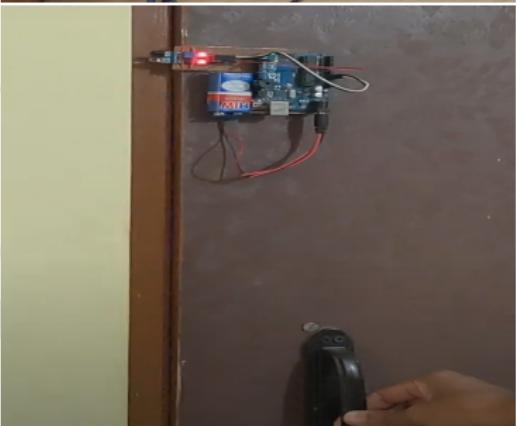
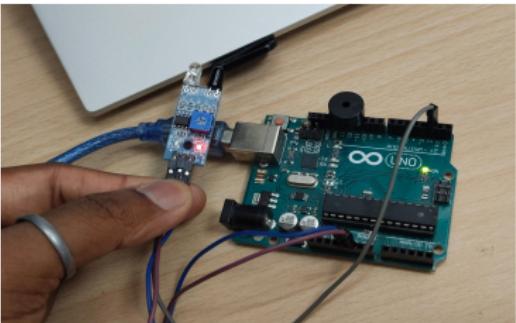
- ❑ Link for Simulation and Video Demonstration in GitHub

7. Arduino Door Security System using IR Sensor



Arduino_Door_Security_System_using_IRSensor.ino

```
1 byte buzzer = 11;
2 byte ir_sensor = 2;
3
4 void setup() {
5     Serial.begin(9600);
6     // put your setup code here, to run once:
7     pinMode(ir_sensor, INPUT);
8     pinMode(buzzer, OUTPUT);
9 }
10
11 void loop() {
12     // put your main code here, to run repeatedly:
13     int sensor_state = digitalRead(ir_sensor);
14     Serial.println(sensor_state);
15     if (sensor_state == LOW){
16         analogWrite(buzzer, 200);
17         delay(110);
18         analogWrite(buzzer, 100);
19         delay(110);
20     }
21
22     else{
23         digitalWrite(buzzer, HIGH);
24         delay(110);
25     }
26 }
```



Link for Video Demonstration in GitHub

References



- ❑ **YouTube:** Arduino Projects
- ❑ **Book:** Simon Monk, "30 Arduino Projects for the Evil Genius"
- ❑ **Simulations:** Wokwi,Tinkercad

Thanks.