Introduction to Wokwi simulation

Lecture 4 : IoT courses

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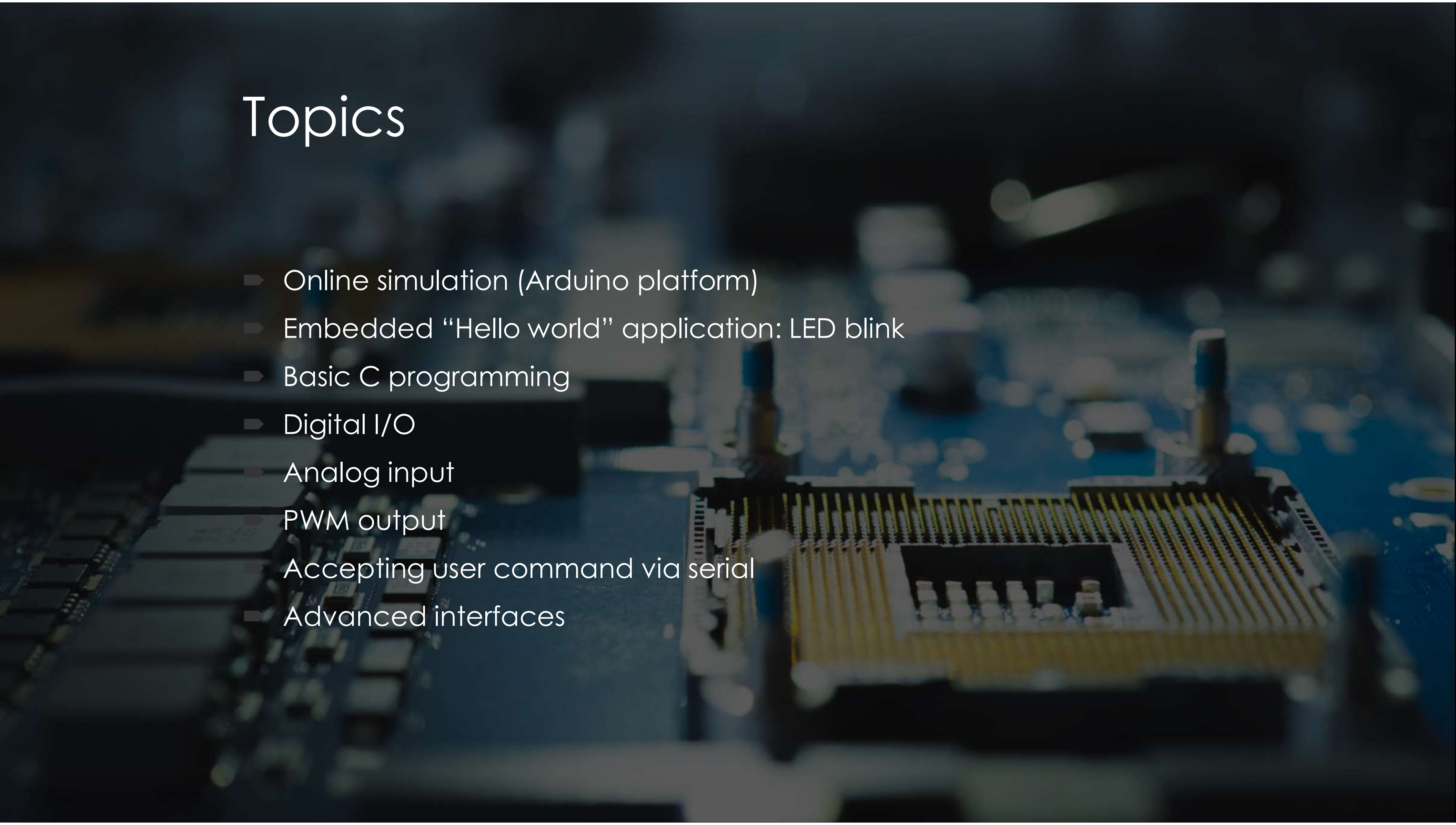
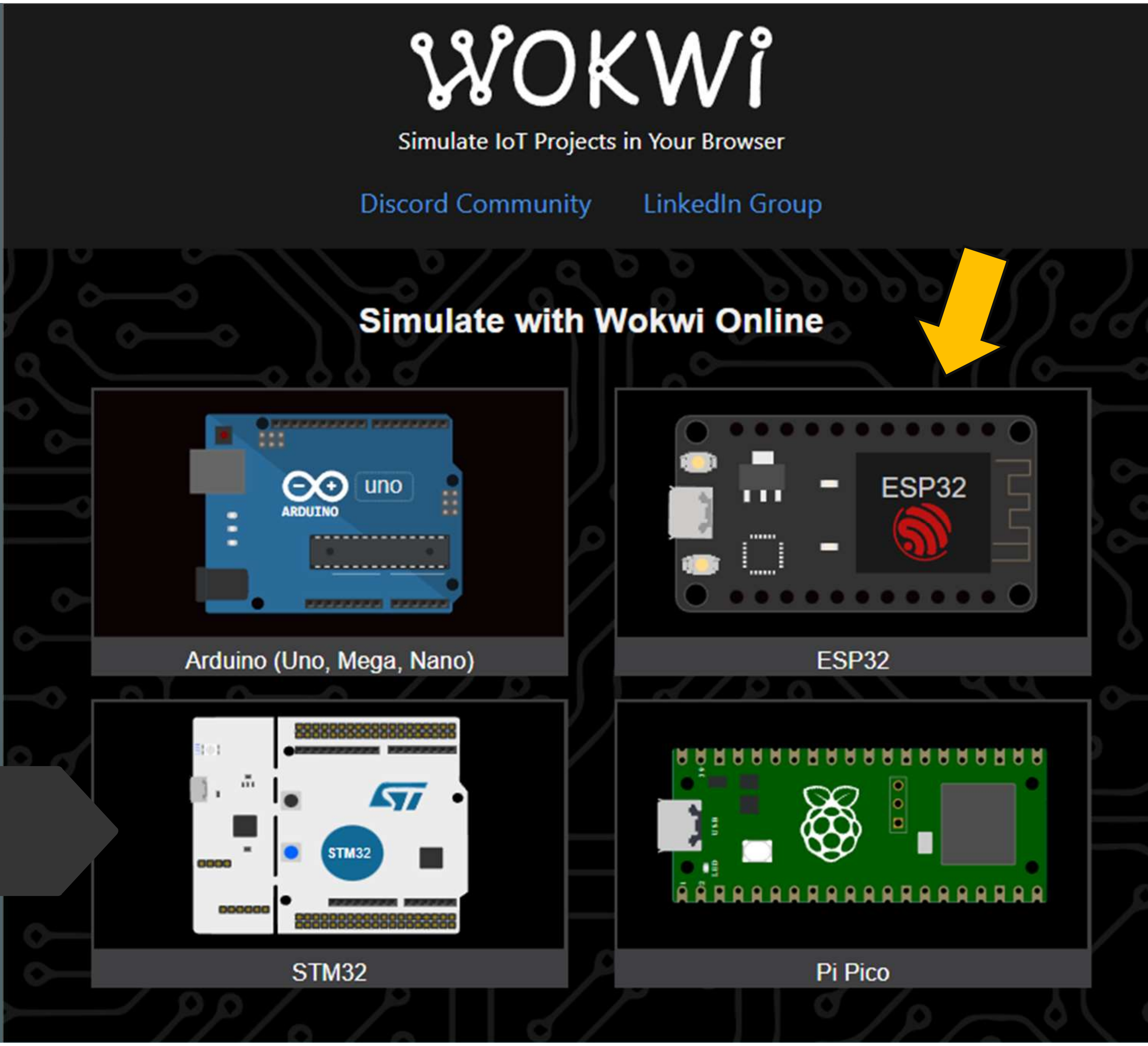


Topics

- Online simulation (Arduino platform)
- Embedded "Hello world" application: LED blink
- Basic C programming
- Digital I/O
- Analog input
- PWM output
- Accepting user command via serial
- Advanced interfaces

Introduction to online simulation on Wokwi



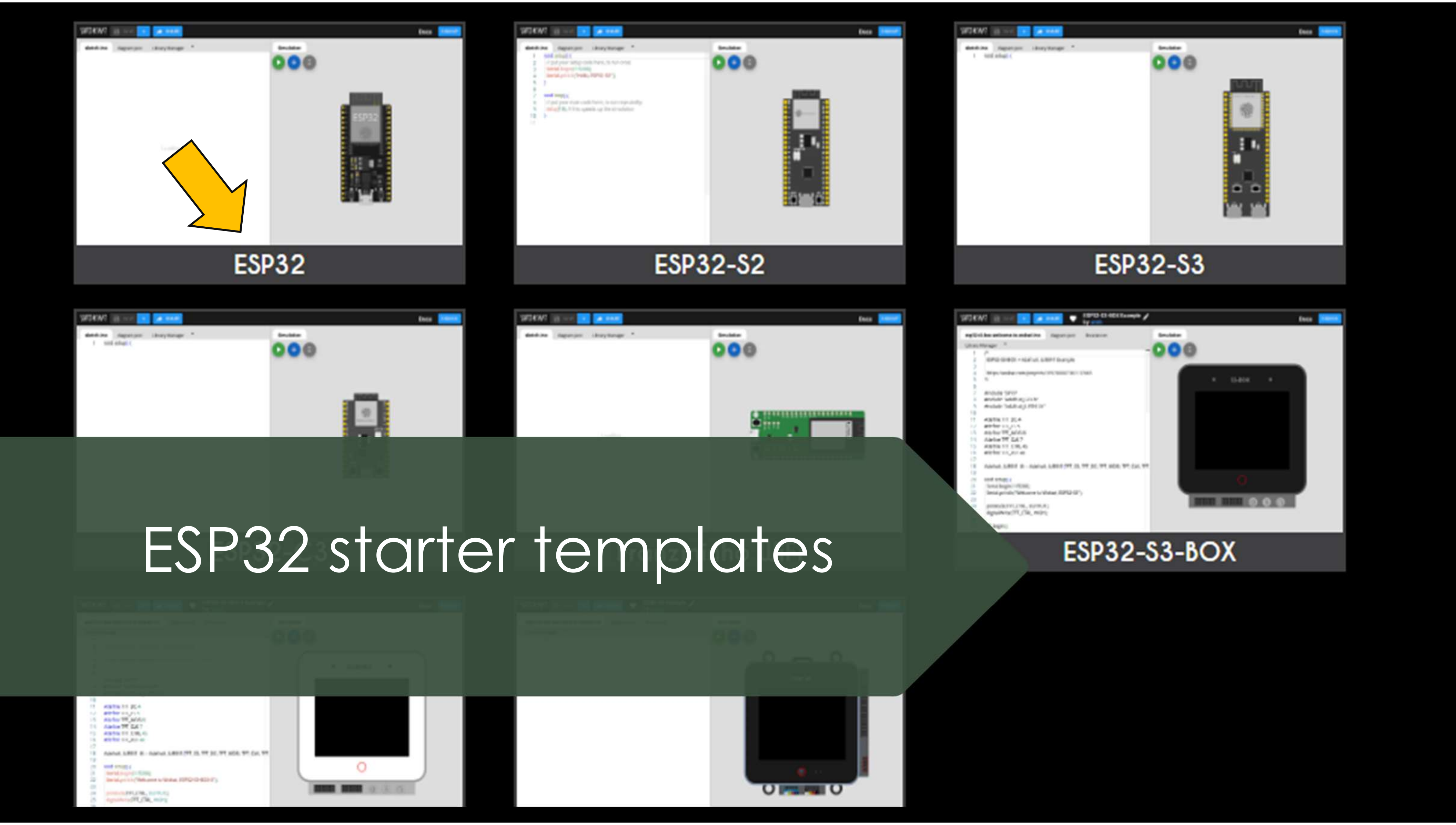
WOKWi

Simulate IoT Projects in Your Browser

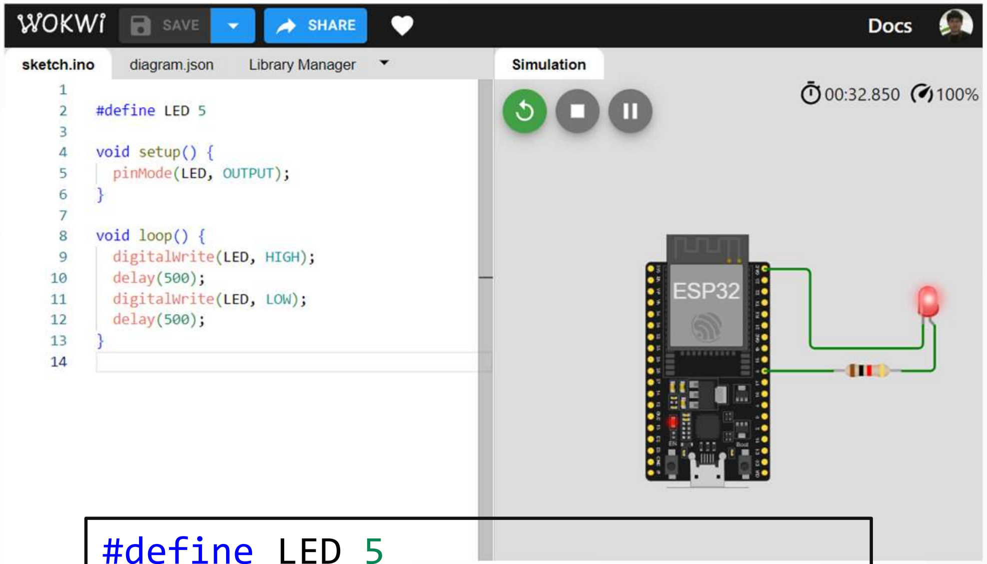
Discord Community LinkedIn Group

Simulate with Wokwi Online

ESP32 starter templates



Embedded "Hello World" : LED blink

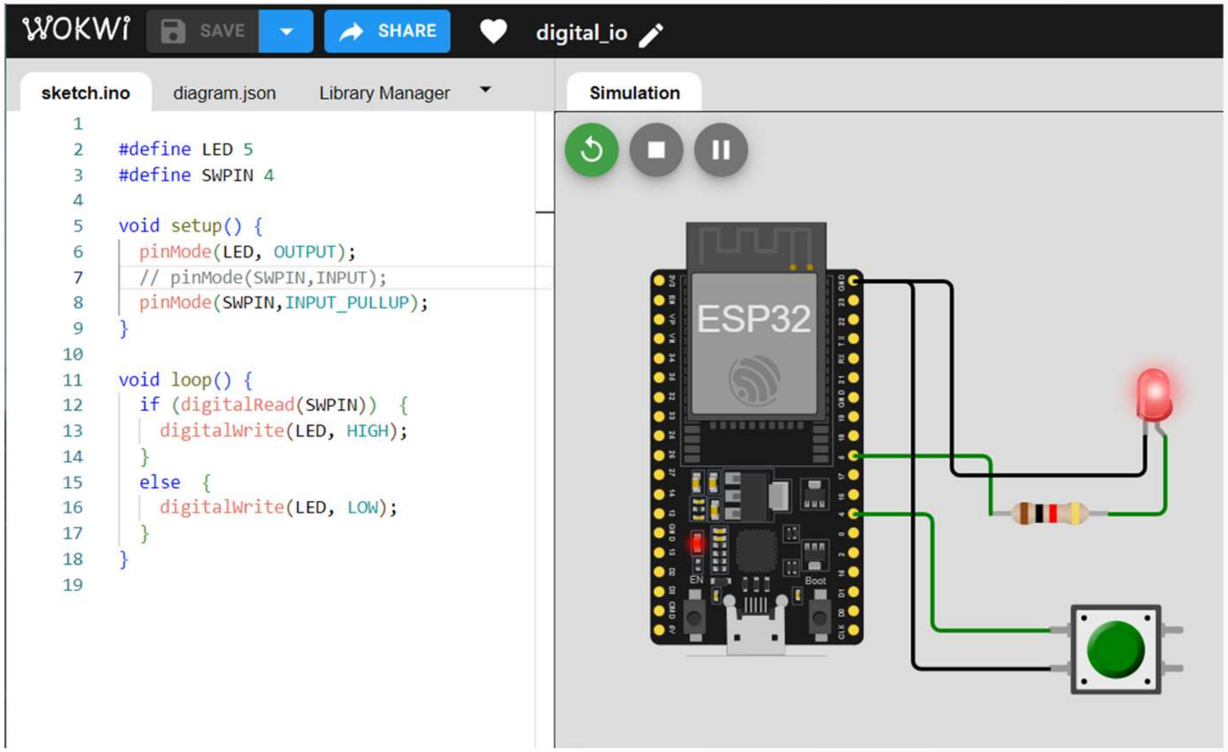


```

#define LED 5

void setup() {
  pinMode(LED, OUTPUT);
}

void loop() {
  digitalWrite(LED, HIGH);
  delay(500);
  digitalWrite(LED, LOW);
  delay(500);
}

```

```
#define LED 5

void setup() {
  pinMode(LED, OUTPUT);
}

void loop() {
  digitalWrite(LED, HIGH);
  delay(500);
  digitalWrite(LED, LOW);
  delay(500);
}
```

Digital I/O

```
#define LED 5
#define SWPIN 4

void setup() {
  pinMode(LED, OUTPUT);
  // pinMode(SWPIN,INPUT);
  pinMode(SWPIN,INPUT_PULLUP);
}

void loop() {
  if (digitalRead(SWPIN))  {
    digitalWrite(LED, HIGH);
  }
  else  {
    digitalWrite(LED, LOW);
  }
}
```



```
1
2   #define LED 5
3   #define SWPIN 4
4
5   void setup() {
6     pinMode(LED, OUTPUT);
7     // pinMode(SWPIN,INPUT);
8     pinMode(SWPIN,INPUT_PULLUP);
9   }
10
11  void loop() {
12    if (digitalRead(SWPIN))  {
13      digitalWrite(LED, HIGH);
14    }
15    else  {
16      digitalWrite(LED, LOW);
17    }
18  }
19
```

Exercise 1 : change line 8 to

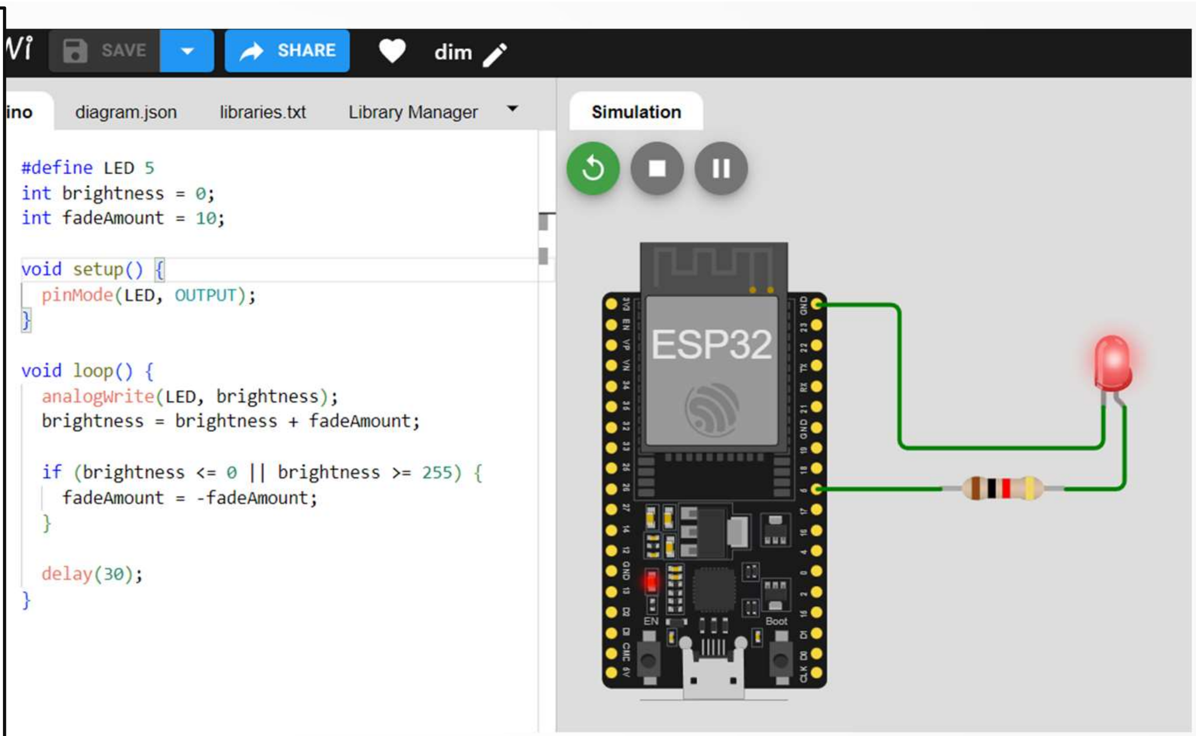
```
     pinMode(SWPIN,INPUT);
```

Why doesn’t it work well?

What must be added to the circuit to make it work?

LED dim

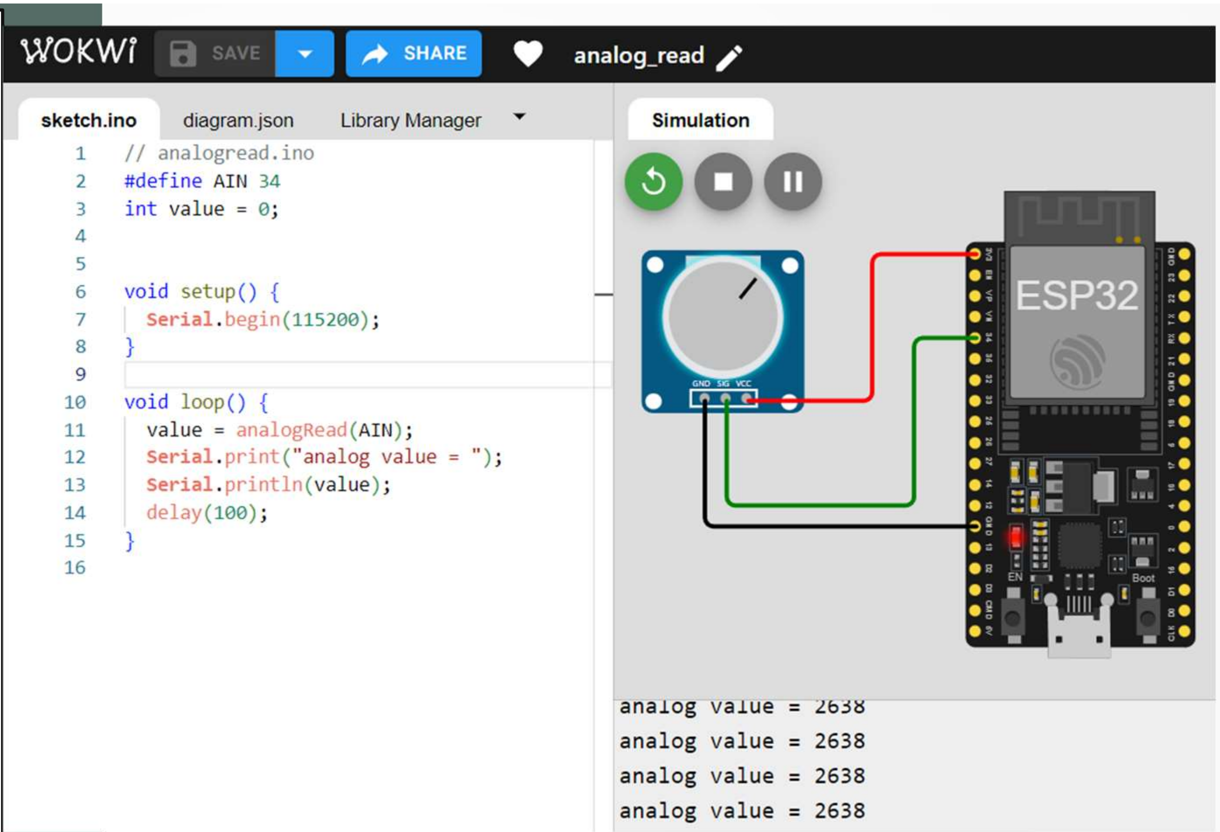
```
#define LED 5
int brightness = 0;
int fadeAmount = 10;

void setup() {
  pinMode(LED, OUTPUT);
}

void loop() {
  analogWrite(LED, brightness);
  brightness = brightness + fadeAmount;

  if (brightness <= 0 || brightness >= 255) {
    fadeAmount = -fadeAmount;
  }

  delay(30);
}
```



```
#define LED 5
int brightness = 0;
int fadeAmount = 10;

void setup() {
  pinMode(LED, OUTPUT);
}

void loop() {
  analogWrite(LED, brightness);
  brightness = brightness + fadeAmount;

  if (brightness <= 0 || brightness >= 255) {
    fadeAmount = -fadeAmount;
  }

  delay(30);
}
```

analog_read

```
#define AIN 34
int value = 0;


void setup() {
  Serial.begin(115200);
}

void loop() {
  value = analogRead(AIN);
  Serial.print("analog value = ");
  Serial.println(value);
  delay(100);
}
```



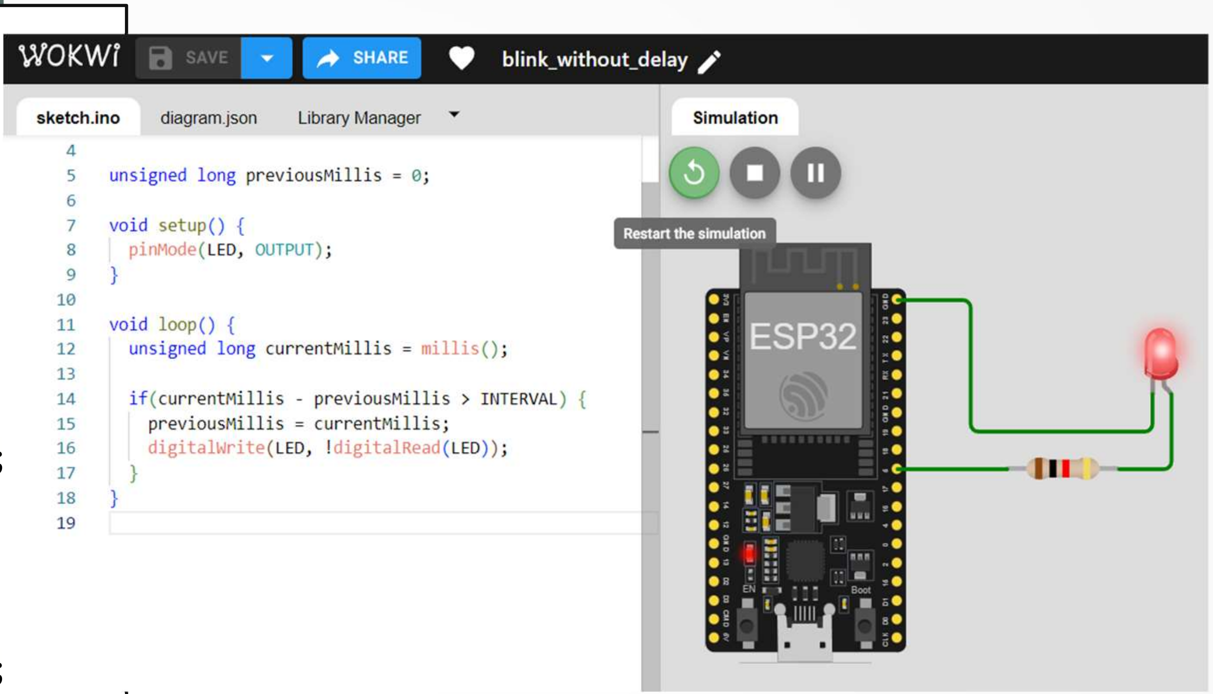
```
// analogread.ino
#define AIN 34
int value = 0;


void setup() {
  Serial.begin(115200);
}

void loop() {
  value = analogRead(AIN);
  Serial.print("analog value = ");
  Serial.println(value);
  delay(100);
}

```

```
analog value = 2638
analog value = 2638
analog value = 2638
analog value = 2638
```

Exercise 2 : combine dim.ino and analog_input.ino such that the potentiometer can be used to adjust LED brightness.

Blink w/o delay

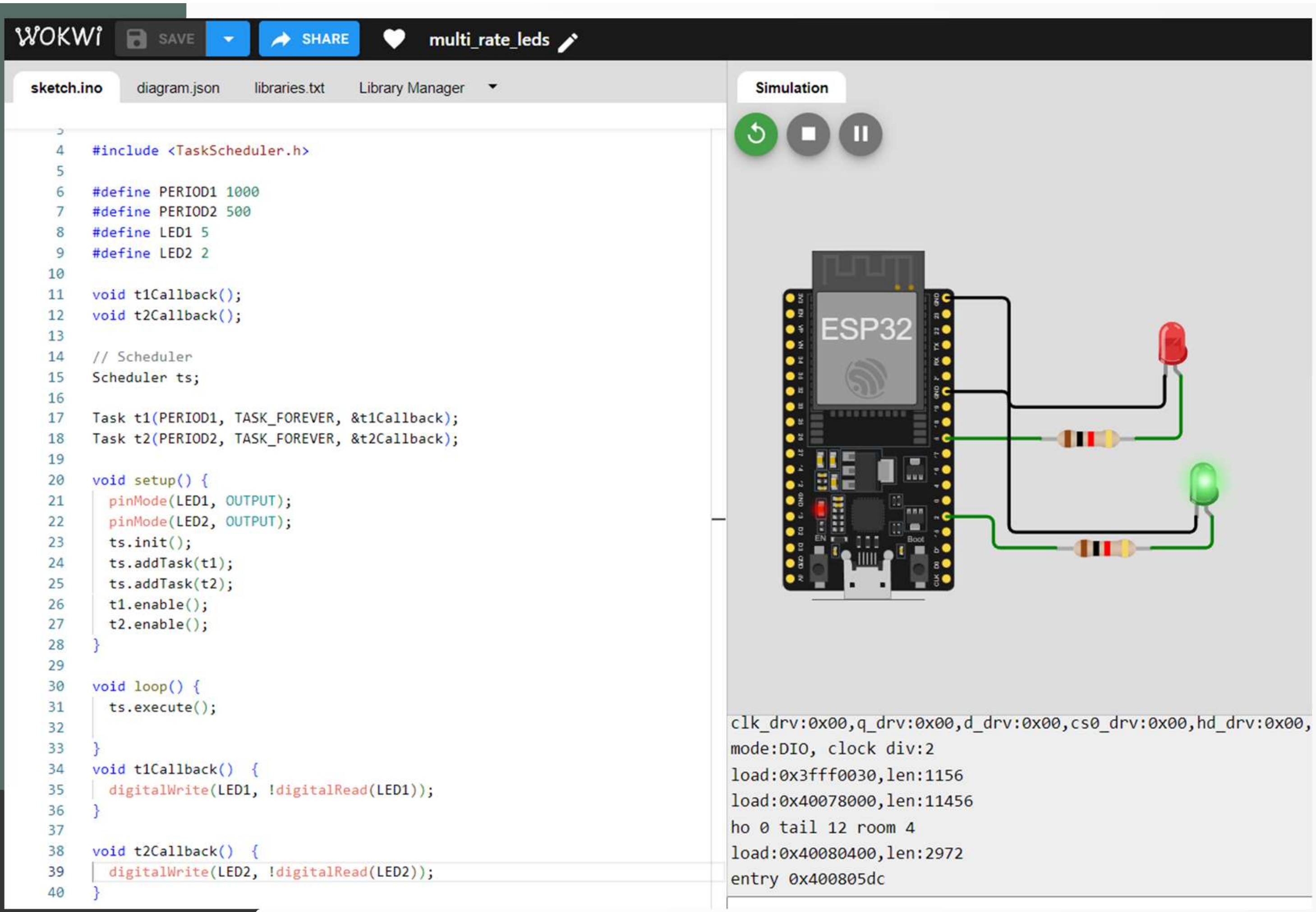
```
#define LED 5
#define INTERVAL 1000

unsigned long previousMillis = 0;

void setup() {
  pinMode(LED, OUTPUT);
}

void loop() {
  unsigned long currentMillis = millis();

  if(currentMillis - previousMillis >
INTERVAL) {
    previousMillis = currentMillis;
    digitalWrite(LED, !digitalRead(LED));
  }
}
```



```

unsigned long previousMillis = 0;

void setup() {
  pinMode(LED, OUTPUT);
}

void loop() {
  unsigned long currentMillis = millis();

  if(currentMillis - previousMillis > INTERVAL) {
    previousMillis = currentMillis;
    digitalWrite(LED, !digitalRead(LED));
  }
}

```

Exercise 3 : Use this method to blink two LEDs at Different rate.

Simple multitasking with TaskScheduler



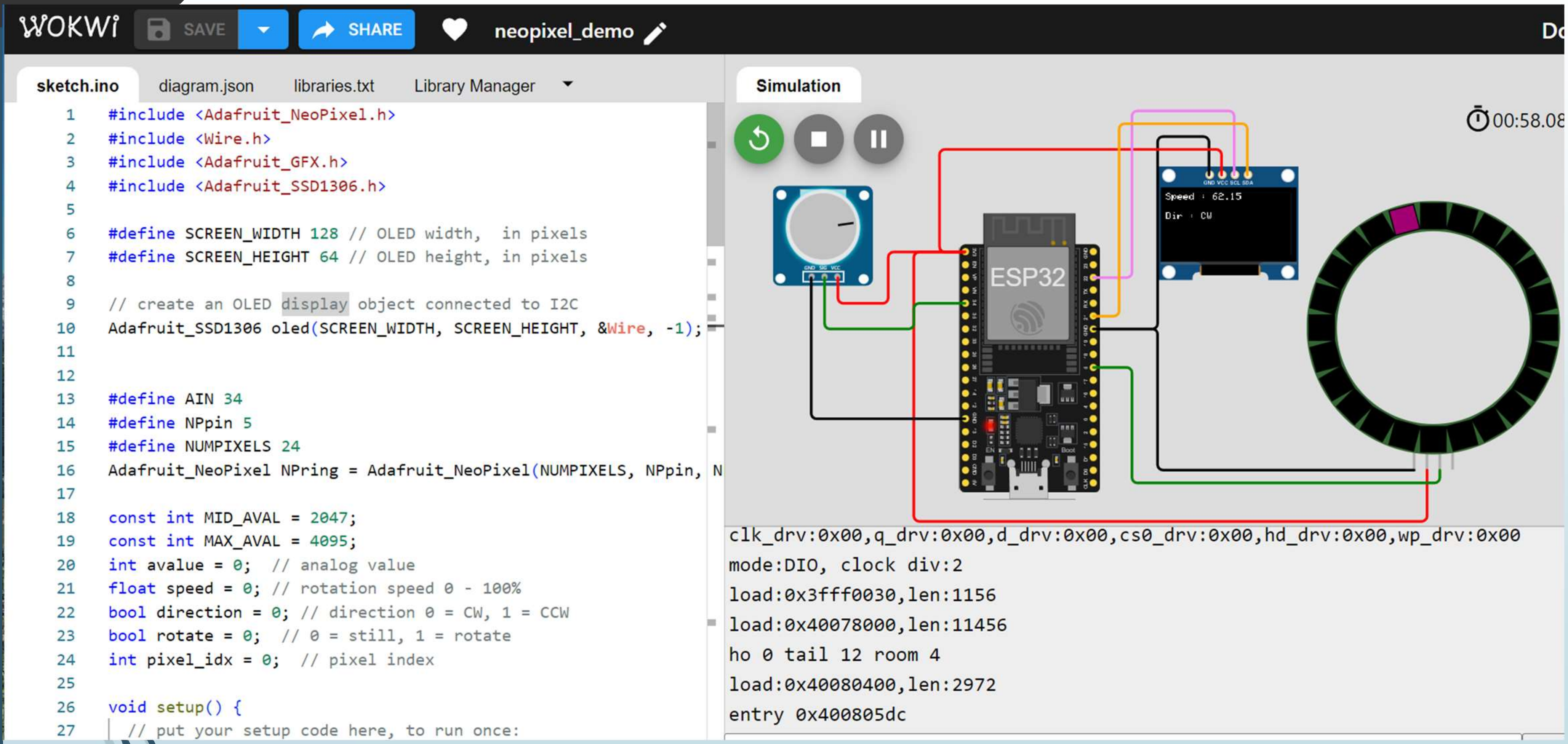
```
#include <TaskScheduler.h>

#define PERIOD1 1000
#define PERIOD2 500
#define LED1 5
#define LED2 2

void t1Callback();
void t2Callback();

// Scheduler
Scheduler ts;

Task t1(PERIOD1, TASK_FOREVER, &t1Callback);
Task t2(PERIOD2, TASK_FOREVER, &t2Callback);

void setup() {
  pinMode(LED1, OUTPUT);
  pinMode(LED2, OUTPUT);
  ts.init();
  ts.addTask(t1);
  ts.addTask(t2);
  t1.enable();
  t2.enable();
}

void loop() {
  ts.execute();

}
void t1Callback()  {
  digitalWrite(LED1, !digitalRead(LED1));
}

void t2Callback()  {
  digitalWrite(LED2, !digitalRead(LED2));
}
```

```
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,
mode:DIO, clock div:2
load:0x3fff0030,len:1156
load:0x40078000,len:11456
ho 0 tail 12 room 4
load:0x40080400,len:2972
entry 0x400805dc
```

https://wokwi.com/projects/404089151037188097

Demo : control speed of LED ring

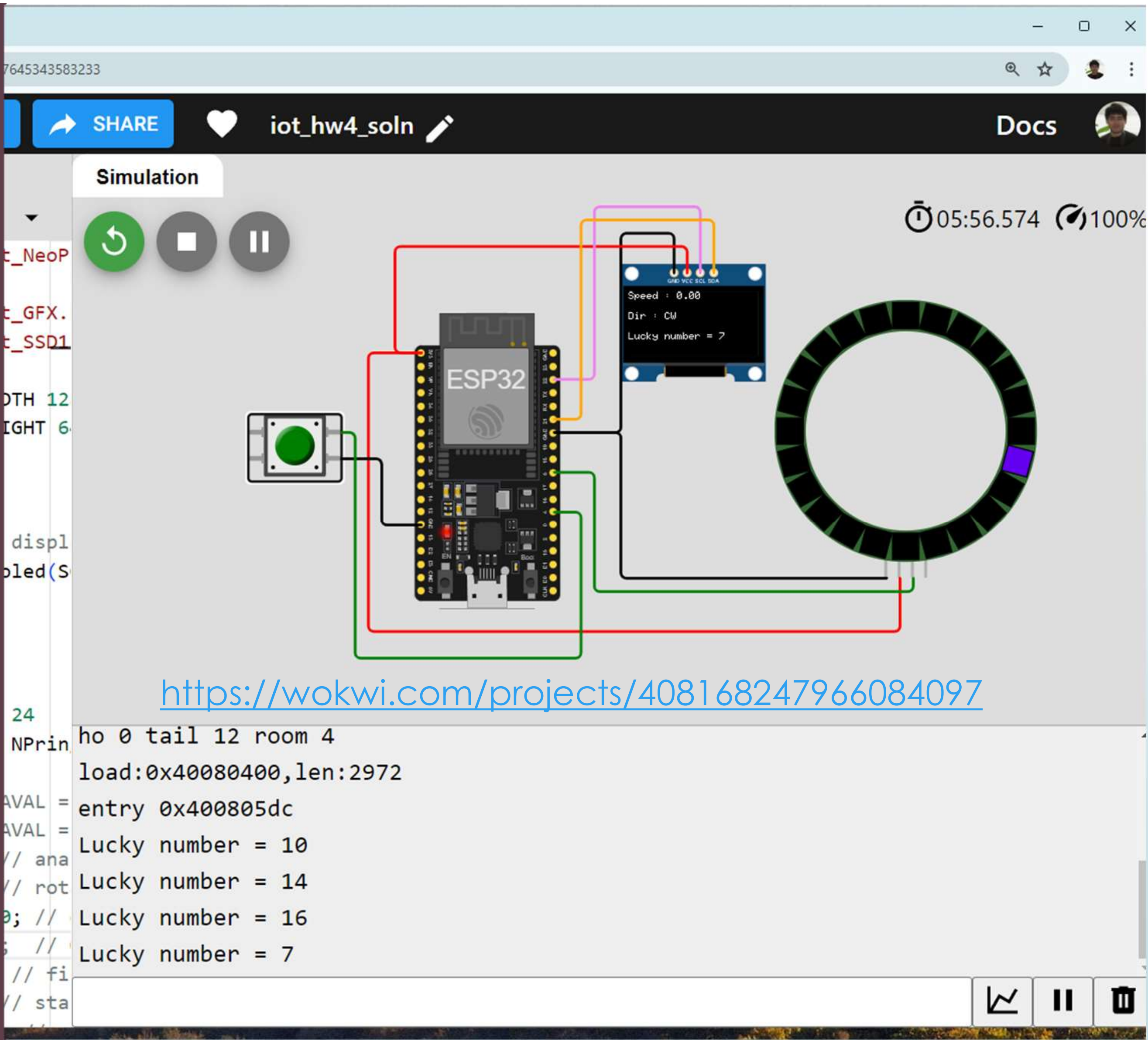
https://wokwi.com/projects/404090408270626817



```
#include <Adafruit_NeoPixel.h>
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>

#define SCREEN_WIDTH 128 // OLED width,  in pixels
#define SCREEN_HEIGHT 64 // OLED height, in pixels

// create an OLED display object connected to I2C
Adafruit_SSD1306 oled(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, -1);


#define AIN 34
#define NPpin 5
#define NUMPIXELS 24
Adafruit_NeoPixel NPring = Adafruit_NeoPixel(NUMPIXELS, NPpin, N

const int MID_AVAL = 2047;
const int MAX_AVAL = 4095;
int avalue = 0;   // analog value
float speed = 0; // rotation speed 0 - 100%
bool direction = 0; // direction 0 = CW, 1 = CCW
bool rotate = 0;  // 0 = still, 1 = rotate
int pixel_idx = 0;  // pixel index

void setup() {
  // put your setup code here, to run once:
```

```
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:2
load:0x3fff0030,len:1156
load:0x40078000,len:11456
ho 0 tail 12 room 4
load:0x40080400,len:2972
entry 0x400805dc
```

Ex1 (optional): implement a roulette game



https://wokwi.com/projects/408168247966084097

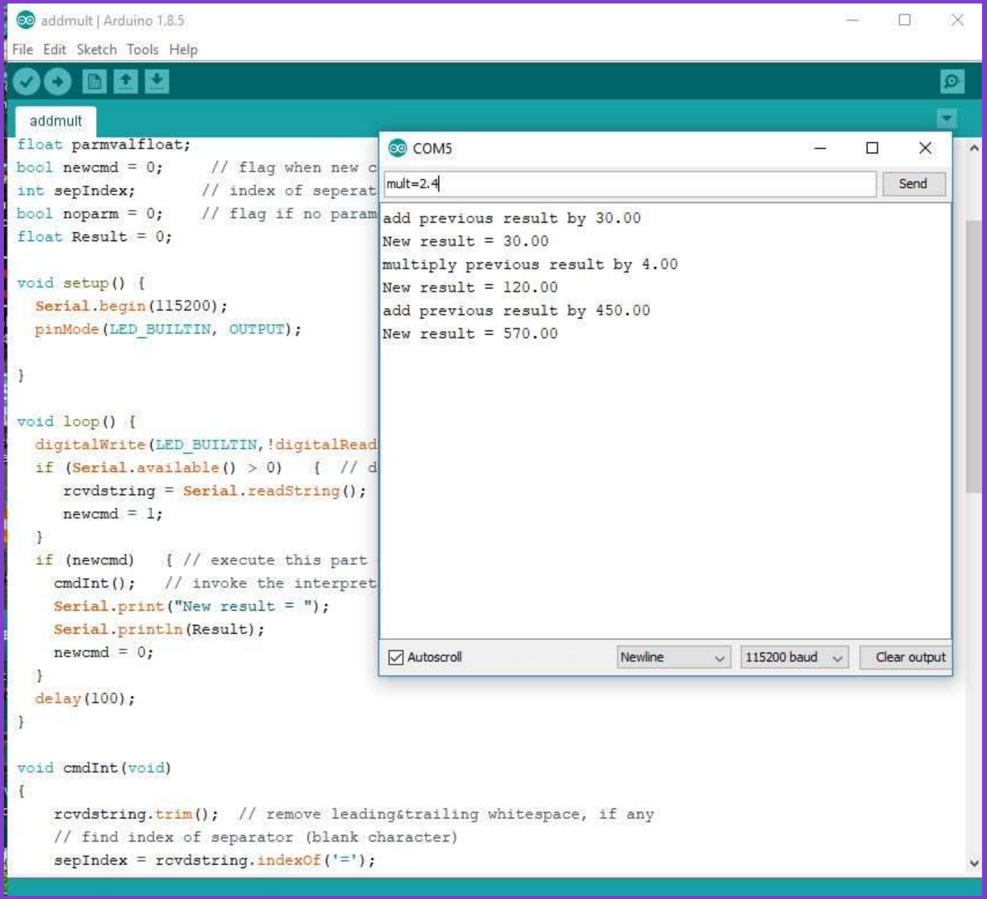
```
ho 0 tail 12 room 4
load:0x40080400,len:2972
entry 0x400805dc
Lucky number = 10
Lucky number = 14
Lucky number = 16
Lucky number = 7
```

Creating Command Intepreter

- Can aceept user commands via serial port as well as NETPIE (later)
- Chosen format
  - Command = parameter
  - For example,
    - led = 1 (turn on LED)
    - period = 250 (change loop period to 250 millisecs)

Example : addmult.ino

- Use Serial Monitor to accept input and print output
- Commands
  - add=x : add x to result
  - mult=y : mult y to result



```
float parmvalfloat;
bool newcmd = 0;      // flag when new c
int sepIndex;        // index of seperat
bool noparm = 0;     // flag if no param
float Result = 0;

void setup() {
  Serial.begin(115200);
  pinMode(LED_BUILTIN, OUTPUT);

}

void loop() {
  digitalWrite(LED_BUILTIN,!digitalRead
  if (Serial.available() > 0)   {  // d
     rcvdstring = Serial.readString();
     newcmd = 1;
  }
  if (newcmd)   { // execute this part
    cmdInt();   // invoke the interpret
    Serial.print("New result = ");
    Serial.println(Result);
    newcmd = 0;
  }
  delay(100);
}

void cmdInt(void)
{
    rcvdstring.trim();  // remove leading&trailing whitespace, if any
    // find index of separator (blank character)
    sepIndex = rcvdstring.indexOf('=');
```

mult=2.4

```
add previous result by 30.00
New result = 30.00
multiply previous result by 4.00
New result = 120.00
add previous result by 450.00
New result = 570.00
```

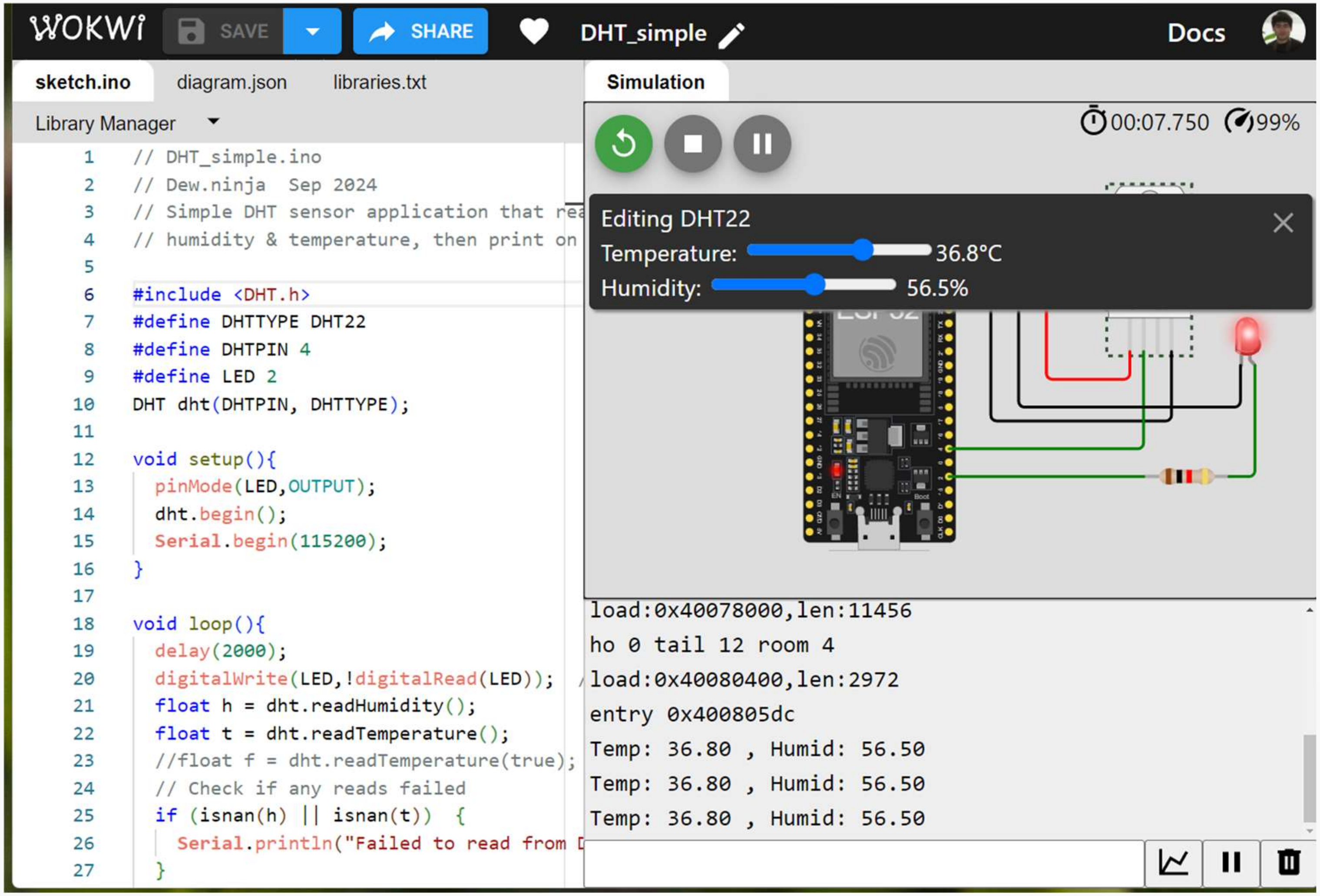
☑ Autoscroll   Newline   115200 baud

Note: appearance changes slightly in newer versions

Wokwi diagram : https://wokwi.com/projects/404633623147534337

Ex. Simple DHT

https://wokwi.com/projects/408171741929910273



```
// DHT_simple.ino
// Dew.ninja  Sep 2024
// Simple DHT sensor application that rea
// humidity & temperature, then print on

#include <DHT.h>
#define DHTTYPE DHT22
#define DHTPIN 4
#define LED 2
DHT dht(DHTPIN, DHTTYPE);

void setup(){
  pinMode(LED,OUTPUT);
  dht.begin();
  Serial.begin(115200);
}

void loop(){
  delay(2000);
  digitalWrite(LED,!digitalRead(LED));  /
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  //float f = dht.readTemperature(true);
  // Check if any reads failed
  if (isnan(h) || isnan(t))  {
    Serial.println("Failed to read from D
  }
```

Editing DHT22

Temperature: 36.8°C

Humidity: 56.5%

```
load:0x40078000,len:11456
ho 0 tail 12 room 4
load:0x40080400,len:2972
entry 0x400805dc
Temp: 36.80 , Humid: 56.50
Temp: 36.80 , Humid: 56.50
Temp: 36.80 , Humid: 56.50
```