EE4216 Hardware for Internet of Things
Lab3

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1. Introduction

- Background: Provide context about the ESP32-S3 and its networking capabilities.
- Objectives: Clearly state the objectives of the lab as listed:
    1. Program ESP32-S3 as a Wi-Fi station.
    2. Program ESP32-S3 as a client to connect to a web server.
    3. Program ESP32-S3 as a web server and sensor controller.

2. Materials

- List the materials and equipment used, as mentioned in the lab manual:
    - ESP32-S3 devkit board
    - Breadboard and Dupont wires
    - USB 2.0 cable
    - DHT22 temperature and humidity sensor
    - Computer

3. Procedure

- Task 1: Programming ESP32-S3 as a Wi-Fi Station

```
#include <WiFi.h>

const char* ssid = "ESP32Server3";

const char* password = "12345678";

void setup() {
```

```
  Serial.begin(115200);
  // Start connecting to Wi-Fi
  Serial.println("Connecting to Wi-Fi...");
  WiFi.begin(ssid, password);
  // Wait until connected to Wi-Fi
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println("Connecting...");
  }
  // When connected, print IP address
  Serial.println("Connected to Wi-Fi");
  Serial.print("IP Address: ");
  Serial.println(WiFi.localIP());
}
void loop() {
}
```

- Task 2: Programming ESP32-S3 as a HTTP Client

```
#include <WiFi.h>
#include <HTTPClient.h>
const char* ssid = "ESP32Server";
const char* password = "12345678";
const char* serverURL = "http://192.168.4.1";   // Base URL
int matricNumber = 239631;
```

```
void setup() {
  Serial.begin(115200);
  // Connect to Wi-Fi
  Serial.println("Connecting to Wi-Fi...");
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println("Connecting...");
  }
  Serial.println("Connected to Wi-Fi");
  // First HTTP request
  if(WiFi.status() == WL_CONNECTED) {
    HTTPClient http;
    http.begin(serverURL);
    int httpCode = http.GET();
    if(httpCode > 0) {
      String payload = http.getString();
      Serial.println("HTTP Response: " + payload);
      // Get the last digit of the matric number and perform modulo 3
      int lastDigit = matricNumber % 10;
      int k = lastDigit % 3;
      // Get the full message piece
      String endpoint = String(serverURL) + "/" + String(k);
      Serial.println("Fetching from endpoint: " + endpoint);
```

```
    http.begin(endpoint);
    int secondHttpCode = http.GET();
    if(secondHttpCode > 0) {
      String secondPayload = http.getString();
      Serial.println("Second HTTP Response: " + secondPayload);
    } else {
      Serial.println("Error in second HTTP request");
    }
  } else {
    Serial.println("Error in first HTTP request");
  }
  http.end();   }
}
void loop() {
}
```

- Task 3: Programming ESP32-S3 as a Webserver and Sensor Controller

```
#include <WiFi.h>
#include <WebServer.h>
#include <DHT.h>
#define DHTPIN 6          // Pin connected to DHT22 sensor
#define DHTTYPE DHT22     // DHT22 sensor type
#define LED_PIN 16        // external LED pin
const char* ssid = "notyouriphone";
const char* password = "hidejy123";
```

```
DHT dht(DHTPIN, DHTTYPE);

WebServer server(80);

void handleRoot() {
  float temp = dht.readTemperature();
  float hum = dht.readHumidity();
  String html = "<h1>ESP32 Web Server</h1>";
  html += "<p>Temperature: " + String(temp) + " °C</p>";
  html += "<p>Humidity: " + String(hum) + " %</p>";
  html += "<a href=\"/LED_ON\">Turn LED ON</a><br>";
  html += "<a href=\"/LED_OFF\">Turn LED OFF</a><br>";
  server.send(200, "text/html", html);
}

void handleLEDOn() {
  digitalWrite(LED_PIN, HIGH);
  server.send(200, "text/html", "LED is ON");
}

void handleLEDOff() {
  digitalWrite(LED_PIN, LOW);
  server.send(200, "text/html", "LED is OFF");
}

void setup() {
  Serial.begin(115200);
  dht.begin();
  pinMode(LED_PIN, OUTPUT);
  // Connect to Wi-Fi
```

```
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println("Connecting to Wi-Fi...");
  }
  Serial.println("Connected to Wi-Fi");
  Serial.println(WiFi.localIP());
  // Start Web Server
  server.on("/", handleRoot);
  server.on("/LED_ON", handleLEDOn);
  server.on("/LED_OFF", handleLEDOff);
  server.begin();
  Serial.println("Web server started.");
}
void loop() {
  server.handleClient();
}
```

- Lab test:

```
#include <WiFi.h>
#include <HTTPClient.h>
const char* ssid = "ESP32Server3";
const char* password = "12345678";
const char* serverURL = "http://192.168.4.1";  // Webserver IP
void setup() {
  Serial.begin(115200);
```

```
// Connect to the Wi-Fi Access Point (AP)
Serial.println("Connecting to Wi-Fi...");
WiFi.begin(ssid, password);
// Wait until the ESP32 is connected to Wi-Fi
while (WiFi.status() != WL_CONNECTED) {
  delay(500);
  Serial.print(".");
}
Serial.println("\nConnected to Wi-Fi");
// Print the IP address assigned to the ESP32
Serial.print("IP Address: ");
Serial.println(WiFi.localIP());
// Make sure the connection is active
if(WiFi.status() == WL_CONNECTED) {
  HTTPClient http;
  // Send an HTTP GET request to the root of the web server
  http.begin(serverURL);
  int httpCode = http.GET();
  // Check the response code
  if(httpCode > 0) {
    String payload = http.getString();
    Serial.println("HTTP Response: " + payload);
    String secretEndpoint = String(serverURL) + "/secret";
    Serial.println("Sending POST request to: " + secretEndpoint);
    http.begin(secretEndpoint);
```

```
      http.addHeader("Content-Type", "application/x-www-form-urlencoded");
      // Send the POST request
      int postHttpCode = http.POST("");
      if(postHttpCode > 0) {
        String secretMessage = http.getString();
        Serial.println("Secret Message: " + secretMessage);
      } else {
        Serial.println("Error in POST request to /secret");
      }
    } else {
      Serial.println("Error in HTTP request to the root");
    }
    http.end();
  } else {
    Serial.println("Wi-Fi connection failed");
  }
}
void loop() {
}
```

4. Results

- Task 1 Results:

```
Connected to Wi-Fi
IP Address: 192.168.4.10
```

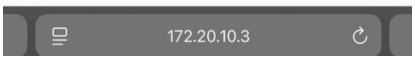
- Task 2 Results:

  The result is: Sinusoid

```
entry 0x403c98ac
Connecting to Wi-Fi...
Connecting...
Connected to Wi-Fi
HTTP Response: The firs part of the word is: Sin.
Next, use GET request to obtain the second half of the word from endpoint \k where k = the last digital of your matric number modulo 3.

Fetching from endpoint: http://192.168.4.1/1
Second HTTP Response: The second part of the word is: usoid
```

- Task 3 Results:



- Lab test Result:
  - The secret is EE4216