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|  | | **ITER, SIKSHA ‘O’ ANUSANDHAN (Deemed to be**  **University)** | | | | | **Assignment** | |
| Branch | | **Computer Science and Engineering,** | | Programme | | | **B.Tech** | |
| Course Name | | **Practical Robotics Projects with Arduino** | | Semester | | | **7th** | |
| Course Code | | **CSE-4571** | | Academic Year | | | **2025/Odd** | |
| **Assignment-1** | | **Topic- WiFi-Communication** | |  | | | | |
| Learning Level (LL) | | **L1**: Remembering | **L3:** Applying | | **L5**: Evaluating | | | |
| **L2**: Understanding | **L4**: Analyzing | | **L6**: Creating | | | |
| To interface an ESP01 Wi-Fi module with an Arduino Uno to establish wireless communication for transmitting real-time sensor data to a remote server or monitoring system. This involves utilizing serial communication between Arduino and ESP01, configuring Wi-Fi connectivity using AT commands, and implementing TCP/IP protocols to enable accurate and reliable wireless data transmission for IoT-based applications. | | | | | | | | |
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| Q’s | Questions | | | | | COs | | LL |
| **1** | What is the primary purpose of the ESP8266 ESP-01 module when interfaced with an Arduino UNO?  Ans: | | | | | **CO1** | | **L1 &L2** |
| **2** | Why does the ESP-01 module operate at 3.3V instead of 5V, and what could happen if connected directly to 5V?  Ans: | | | | | **CO1** | | **L1 &L2** |
| **3** | List all 8 pins of the ESP-01 module and briefly describe the function of each.  Ans: | | | | | **CO1** | | **L1 &L2** |
| **4** | What is the default baud rate of the ESP-01 module, and why is it important to match it with the Arduino serial communication settings?  Ans: | | | | | **CO1** | | **L1 &L2** |
| **5** | Differentiate between Station (STA) and Access Point (AP) Wi-Fi modes, as well as both (STA+AP) Wi-Fi modes, supported by the ESP-01.  Ans: | | | | | **CO2** | | **L2 & L3** |
| **6** | Explain the function of the AT commands AT, AT+RST, and AT+CWJAP.  Ans: | | | | | **CO2** | | **L2 & L3** |

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| **7** | Explain the role of the ESP01 Wi-Fi module in an IoT-based Arduino system.  Ans: | **CO2** | **L2 & L3** |
| **8** | Describe how serial communication occurs between the Arduino UNO and the ESP01 module.  Ans: | **CO2** | **L2 & L3** |
| **9.** | Why is a voltage divider circuit or logic level converter required when connecting Arduino TX (5V) to ESP-01 RX (3.3V)?  Ans: | **CO2** | **L2 & L3** |
| **10** | What is the purpose of using the AT+CWJAP="SSID","PASSWORD" command during ESP01 configuration.  Ans: | **CO2** | **L2 & L3** |
| **11.** | Using the ESP8266 ESP-01 Wi-Fi module and Arduino UNO, demonstrate how to configure the module in Station (STA) mode to connect to an existing Wi-Fi network.     1. Draw the circuit diagram showing the connection between Arduino UNO and ESP-01 module for Station mode configuration.   Ans:  circuit_image   1. Perform a Simulation-based Configuration to connect ESP-01 to a Wi-Fi network and record your observations.   Ans:  circuit_image Screenshot 2025-11-30 at 9.11.42 AM   1. Perform Hardware-based Configuration to connect ESP-01 to a Wi-Fi network and capture the serial monitor output.   Ans:  PXL_20251130_044305627  Screenshot 2025-11-30 at 9.11.42 AM | **CO3** | **L3 & L4** |
| **12** | Using the ESP8266 ESP-01 Wi-Fi module and Arduino Uno, demonstrate how to wirelessly transmit sensor data from Arduino to a remote server or monitor through both simulation and hardware implementation.   1. Draw the circuit diagram showing the connection between Arduino UNO, ESP-01 module, and a sensor for wireless data transmission.   Ans:  circuit_image   1. Write a short Arduino code snippet to send temperature or humidity data from a DHT11/LM35 sensor through ESP-01 to a remote server.   Ans:  *#include <SoftwareSerial.h>*  *#include <DHT.h>*  *#define DHTPIN 4*  *#define DHTTYPE DHT11*  *DHT dht(DHTPIN, DHTTYPE);*  *SoftwareSerial esp(2,3); // RX, TX*  *const char ssid[] = "YOUR\_SSID";*  *const char pass[] = "YOUR\_PASS";*  *const char host[] = "example.com"; // remote server (IP or domain)*  *const int port = 80;*  *unsigned long lastSend = 0;*  *void setup(){*  *Serial.begin(9600);*  *esp.begin(9600);*  *dht.begin();*  *delay(1000);*  *sendAT("AT");*  *sendAT("AT+CWMODE=1");*  *connectWiFi();*  *}*  *void loop(){*  *if (millis() - lastSend >= 15000){*  *float t = dht.readTemperature();*  *if (isnan(t)){ lastSend = millis(); return; }*  *sendHTTP(t);*  *lastSend = millis();*  *}*  *while(esp.available()){ Serial.write(esp.read()); }*  *while(Serial.available()){ esp.write(Serial.read()); }*  *}*  *void sendAT(const char \*cmd){*  *esp.println(cmd);*  *waitFor("OK",3000);*  *}*  *void connectWiFi(){*  *String cmd = String("AT+CWJAP=\"") + ssid + "\",\"" + pass + "\"";*  *esp.println(cmd);*  *waitFor("WIFI GOT IP",15000);*  *}*  *void sendHTTP(float temp){*  *String payload = String("GET /update?temp=") + String((int)temp) + " HTTP/1.1\r\nHost: " + host + "\r\nConnection: close\r\n\r\n";*  *String cipstart = String("AT+CIPSTART=\"TCP\",\"") + host + "\"," + port;*  *esp.println(cipstart);*  *if (!waitFor("CONNECT",5000)) return;*  *String cipsend = String("AT+CIPSEND=") + payload.length();*  *esp.println(cipsend);*  *if (!waitFor(">",3000)) return;*  *esp.print(payload);*  *waitFor("CLOSED",5000);*  *esp.println("AT+CIPCLOSE");*  *waitFor("OK",2000);*  *}*  *bool waitFor(const char \*pat, unsigned long timeout){*  *unsigned long t0 = millis();*  *String r;*  *while(millis()-t0 < timeout){*  *while(esp.available()) r += (char)esp.read();*  *if (r.indexOf(pat) != -1) return true;*  *}*  *return false;*  *}*   1. Perform Simulation-based implementation to wirelessly transmit sensor data and record your observations.   circuit_image Screenshot 2025-12-01 at 6.55.55 PM   1. Perform Hardware-based implementation to demonstrate actual data transmission and capture the serial monitor output or server response.   Ans: PXL_20251201_111742138 Screenshot 2025-12-01 at 6.55.55 PM   1. Conclude your observations by discussing how reliable data transmission can be achieved using ESP-01 in IoT applications.   Ans: | **CO4** | **L4 & L5** |
| **13** | Using the ESP8266 ESP-01 Wi-Fi module and Arduino UNO, demonstrate how to implement TCP/IP protocols for client-server communication through hardware-based development   1. How can you configure the ESP-01 module as a TCP client to connect with a remote server?   Ans:   1. Write the AT commands sequence for establishing a TCP connection and transmitting data.   Ans:   1. Draw the circuit diagram showing the setup for client-server communication between Arduino UNO and ESP-01.   Ans:  circuit_image   1. Perform Hardware-based development to implement TCP/IP communication and record the serial monitor output.   Ans:  PXL_20251130_044305627Gemini_Generated_Image_xmwypjxmwypjxmwy | **CO5** | **L4 & L5** |
| **14** | Explain how ESP-01 Wi-Fi communication contributes to the development of smart IoT systems with an example.  Ans: | **CO6** | **L5 & L6** |

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| **Assignment 1** | **Topic: WiFi-Communication** | **Date of Assignment1: 08.11.2025** | **Date of Submission: ---.11.2025** |

**Note:**

1. Assignment carries a weightage of **20 marks out of 100**
2. Course outcome CO1 to CO2 was covered.

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| Course Outcomes | CO1 | Understand the fundamentals of Arduino hardware and software. |
| CO2 | Interface various sensors and actuators with Arduino. |
| CO3 | Apply programming logic to control robotic systems. |
| CO4 | Design and build basic to intermediate level robotics projects. |
| CO5 | CO5 Demonstrate problem-solving and debugging skills in robotics. |
| CO6 | Collaborate in teams to plan, execute, and present robotics projects |