جامعة الحسين التقنية
Al Hussein Technical University

ASSIGNMENT BRIEF

HTU Course No: 10204470	**HTU Course Name:** Special Topics
BTEC Unit Code:	**BTEC UNIT Name:**

Student Name/ID Number/Section	
HTU Course Number and Title	10204470 Special Topics
BTEC Unit Code and Title	
Academic Year	2024-2025 1
Assignment Author	Malek Allouzi
Course Tutor	Murad Yaghi - Malek Allouzi
Assignment Title	Smart Greenhouse System
Assignment Ref No	1
Issue Date	17/12/2024
Formative Assessment dates	From 26/12/2024 to 09/01/2025
Submission Date	27/01/2025
IV Name & Date	Mohammad Yahia 16/12/2024

Submission Format

The assignment is divided into parts, and each part should be submitted on the specific date that is shown in the assignment brief and guidance section.**Part 1:**

In class closed book and open notes examination.

Part 2:

The submission of this part consists of Four parts:

- An individual written report that has a solution for tasks that ends with the word (**Report**).
- A full working one Python code for tasks that require code implementation, these tasks will end with the word (**Code**).
- **Discussion** with your instructor (and any other witness) about the submitted work.
- Fully functional Hardware that represents the tasks, you should bring it with you to your oral discussion.

You need to follow the following guidelines, failing to follow them may result an 'unclassified' grade.

Assignment Guidelines

- You are required to submit a well-formatted **Word version** report that provides a complete answer for all required tasks.
- The Hardware and code are group work, the group consists of two students, but the report is an individual report.
- The submission deadline of this part will be on Monday 27/1/2025 at 11:59 PM.
- Full and clear answers for all required tasks, mention the task number and the subtask number before each answer**.**
- Don't compress your work, you should submit your report and your code as separate files.
- Soft-copy submissions are only allowed, you are required to upload your submission files to the university's eLearning platform through (https://elearning.htu.edu.jo/) within the submission date and time stated above. **NO SUBMISSION by EMAIL and NO LATE SUBMISSIONS WILL BE ACCEPTED.**
- If you commit any kind of plagiarism, HTU policies and regulations will be applied.
- The Discussion will be one to one oral discussion between you and your instructor, which includes debugging, analyzing, and evaluating tasks and the code.

- Attendance of the oral discussion is mandatory in the date and time determined by your instructor; the exact discussion schedule will be announced after your submission.

Unit Learning Outcomes

LO1 Hardware Assembly and Configuration

LO2 Setting Up Raspberry Pi and Python Programming for IoT

LO3 Understand and Apply Communication Protocols in IoT Systems

Assignment Brief and Guidance

Part 1:

In class closed book and open notes examination, you are allowed to bring one A4 page only contains your necessary notes. This part will be held on Tuesday 17/12/2024.

Your answer should be clear, and providing a final answer without showing detailed steps is not acceptable.

Part 2:

Scenario

You are working in a well-known IoT company as a junior IoT engineer. Your company assigned you to a new project to build a smart greenhouse system, The goal of this project is to automate environmental monitoring and control to ensure optimal growing conditions for plants. You are requested to design and implement this system by doing the following tasks:

Task 1:

In this task, you will use the **DHT11 sensor** to measure temperature and humidity for monitoring greenhouse conditions, **LED** to simulate grow lights that can be controlled manually, a **keypad** to serve as a user interface for operating the system, and a **motor** to simulate a water pump for regulating the environment.

- You need to **design** a schematic diagram to show how you will connect these components to your Raspberry Pi, you need to show the used GPIOs (Pin numbers). **(Report)**
- Based on your schematic diagram, write a Python code to do the following**: (Code)**
  1. **Read Sensor Data (DHT11 Sensor)**:
     - Write a Python code to read and display temperature and humidity data from the DHT11 sensor.
     - Display the readings on the console with timestamps to monitor the environment.
  2. **Control LED (Simulating Grow Lights)**:
     - Update your Python code to turn an LED on or off based on keypad input:
       - Press key **1** to turn the LED **on**.
       - Press key **0** to turn the LED **off.**
  3. **Control Motor (Simulating Water Pump)**:
     - Update your Python code to start and stop the motor using keypad input or Humidity value:
       - Press key **8** or humidity value less than 20% to **start** the motor.
       - Press key **9** or humidity value higher than 40% to **stop** the motor

Task 2: (Code)

We want to enable remote monitoring and data storage for data collected from the smart greenhouse using IoT cloud platform; to do this, you need to send the collected data (temperature and humidity) continuously every 10 seconds to the ThingSpeak channel using HTTP protocol, update your Python code to implement this task.

Task 3:

The smart greenhouse that you are developing is one of many smart greenhouses, they are all connected through an MQTT network for data sharing; update your Python code to add the following features:

1. There is a secret keypad code to power off all LEDs and Motors in all green houses. The secret code is ***999#,** once you received this code you should turn off the LED in your smart greenhouse, the secret code can be entered form any keypad in any greenhouse. **(Code)**
2. Sometimes there is no internet connection to communicate between Greenhouses through MQTT protocol, what we should do to overcome this issue and enable data communication using MQTT protocol between the greenhouses without internet. **(Report)**
3. You are requested to turn on and off the LED based on humidity value in the ThingSpeak channel using MQTT protocol, clearly write the steps to enable this functionality and reflect these steps on your previous work. **(Report and Code)**

Learning Outcomes and Assessment Criteria			
Learning Outcome	**Pass**	**Merit**	**Distinction**
LO1 Hardware Assembly and Configuration	**P1** Understand how to connect basic input components (e.g., sensors, switches) using GPIO pins. **P2** Understand how to connect output components (e.g., LEDs, buzzers, motors) to GPIO pins.	**M1** Design a schematic diagram for a functional hardware system integrating multiple sensors and actuators.	**D1** Demonstrate the Ability to Develop and Implement a Fully Functional IoT Project Using MQTT Protocol for data sharing between devices and IoT cloud platform.
LO2 Setting Up Raspberry Pi and Python Programming for IoT	**P3** Write Python scripts to interact with basic input and output devices (e.g., read sensor data, keypad, control LEDs). **P4** Differentiate between polling and event-driven programming in GPIO operations. **P5** Configure network settings and enable remote access (e.g., SSH, VNC) for headless operation. **P6** Identify and describe the function of Raspberry Pi GPIO pins.	**M2** Develop a Python program that varies PWM signals dynamically to control device (e.g., LEDs or motors).	
LO3 Understand and Apply Communication Protocols in IoT Systems	**P7** Identify and understand at least one key IoT communication protocol (e.g., MQTT, HTTP, CoAP, WebSocket).	**M3** Design and implement a custom IoT project utilizing one IoT communication protocol for data sharing between an IoT device and an IoT cloud platform (e.g., AWS IoT, Google Cloud IoT, or ThingSpeak).	