Assignment IT4030

Internet of Things -Year 4 Semester 1/2, 2025

Assignment released on **:18th September 2025**

Due date **:19th October 2025**

Total Marks **:100**

This is a group assignment with a minimum of two and a maximum of four members in each group. However, your performance will be assessed individually.

AuraLink – Smart Agentic IoT Device with LLM Backend

Scenario

You have been recruited to design and develop a smart IoT system named AuraLink. This system combines sensor data, intelligent summarization, and AI-generated messages to support users in their daily lives. AuraLink integrates IoT hardware, MQTT communication, and an LLM-powered backend that connects with real user data.

Objectives

-Build a smart IoT device with ESP32 that senses indoor conditions.

- Use MQTT for communication between device and backend.

- Develop a backend using an LLM framework (e.g., LangChain with OpenAI API).

- Display both literature-style quotes and summarized emails on the IoT device.

- Indicate urgency using LEDs or display cues. - Encourage creativity through extensions.

Tasks

Part 1: IoT Device (ESP32)

1. Attach at least a temperature and humidity sensor (e.g., DHT22, BME280).

2. Program the ESP32 to read values and publish them via MQTT.

3. Subscribe to backend messages and display them on a small screen (OLED/TFT).

4. Implement a priority indicator (e.g., RGB LED or backlight).

Part 2: Backend with Agentic AI (LLM)

1. Subscribe to MQTT sensor data and log readings.

2. Use an LLM framework to: - Generate a literature-style quote or message inspired by indoor conditions. - Connect to the student's real email account (via Gmail API, Outlook API, or IMAP) and summarize actual emails.

3. Send both the quote and summarized emails back to the IoT device via MQTT.

Part 3: Optional Extensions (Extra Marks)

- Add predictions (e.g., forecast room temperature trend).

- Integrate extra sensors (air quality, motion, light, CO_2, etc.).

- Use a multi-agent design (separate agents for environment, emails, and priorities).

- Add creative outputs (e-paper display, voice alerts, smart lamp integration).

- Enable user interaction (e.g., 'AuraLink, do I have any urgent messages?').

Deliverables

1. Source Code: ESP32 firmware + backend code.
2. Demonstration: Live demo showing the full system.
3. Commercializing product video
4. Report (4–6 pages):
   - Architecture diagram.
   - Hardware/software details.
   - Explanation of LLM integration for quotes + email summarization.
   - Reflection on challenges and creative features.

Project Delivery Milestones

c	Item	Format	Due Date
1	Project Group registration (Group)	Through the Microsoft Form	19th Sept 2025
2	Proposal with the Progress Presentation	Proposal and Progress Presentation	30th September 2025
3	Prototype Completion, Project Report,	A video clip of 10 minutes presentation Prototype and report must be uploaded to the CourseWeb.*(video clip is not mandatory),*	19th October 2025
4	Project presentation and Viva	In-person project presentation & Commercialization video	22nd October 2025

AuraLink Project – Rubric-Style Marking Guide

Criteria	Poor	Fair	Good	Excellent	Marks
Part 1: IoT Device (30 marks)					
Sensor Integration (10)	No/incorrect data; unstable	Reads partially but unreliable	Stable readings from one sensor	Accurate, reliable readings from multiple sensors (DHT22/BME280)	/10
MQTT Communication (5)	No MQTT or fails	Works intermittently	Stable one-way communication	Reliable bidirectional publish/subscribe	/5
Display Functionality (10)	No display/irrelevant info	Basic text or sensor data only	Displays sensor or backend messages	Displays both sensor + backend messages clearly	/10
Priority Indicator (5)	No indicator	Limited LED feedback	Functional LED with basic urgency	Clear urgency mapping with RGB/backlight cues	/5
Part 2: Backend with Agentic AI (40 marks)					
Data Handling & Logging (5)	No backend logging	Limited data logging	Consistent data logging	Robust, well-structured logging with timestamps	/5
LLM Quote Generation (10)	No AI use	Basic text, low creativity	Context-aware quotes, somewhat literary	High-quality literature-style, creative outputs	/10
Email Summarization (15)	No/poor summarization	Limited clarity, inaccurate	Clear summaries, moderate accuracy	Accurate, concise, context-rich summaries	/15

Criteria	Poor	Fair	Good	Excellent	Marks
MQTT Response to Device (10)	No responses	Inconsistent responses	Mostly reliable	Fully stable bidirectional messaging	/10
Part 3: Optional Extensions (15 marks)					
Creative Extensions (predictions, extra sensors, agents, voice/e-paper, interaction)	None attempted	Attempted but minimal	Functional, adds value	Polished, highly creative, enhances system significantly	/15
Deliverables (15 marks)					
Source Code (5)	Incomplete/disorganized	Partially complete	Functional but minor issues	Clean, complete, well-documented	/5
Demonstration (5)	No/failed demo	Partial demo	Mostly functional demo	Smooth, clear, complete demo	/5
Report (5)	Missing/unclear	Basic coverage	Clear, structured, some analysis	Excellent detail, diagrams, reflection on challenges	/5