Department of Electronic & Telecommunications Engineering

University of Moratuwa

EN3251 Internet of Things

Lab Assignment 1 : Implementing an end-to-end IoT system with JSON and MQTT

2020 Batch   **Semester 5**

Overview:

In this exercise you will use JSON Objects to transfer information via MQTT. You will work in groups.

Objective:

To become familiar with hardware implementation of an MQTT client and efficient data transfer with JSON Objects.

Learning outcomes covered:

All Learning outcomes will be covered in this assignment.

What you require:

- Python installed and running on your computer with the necessary libraries and IDE.
- Node-RED installed on your computer
- Two of either NodeMCU or ESP-32 devices
- Two protoboards
- Potentiometer, LDR, three LEDs (Red, Green, Blue)

Assignment Part A:

Task 1:

- Create an IoT node (Node A) consisting of an LDR and a Potentiometer as sensors as inputs.
- Create an IoT node (Node B) consisting of three LEDs as outputs (Physical LED Dashboard).

Task 2:
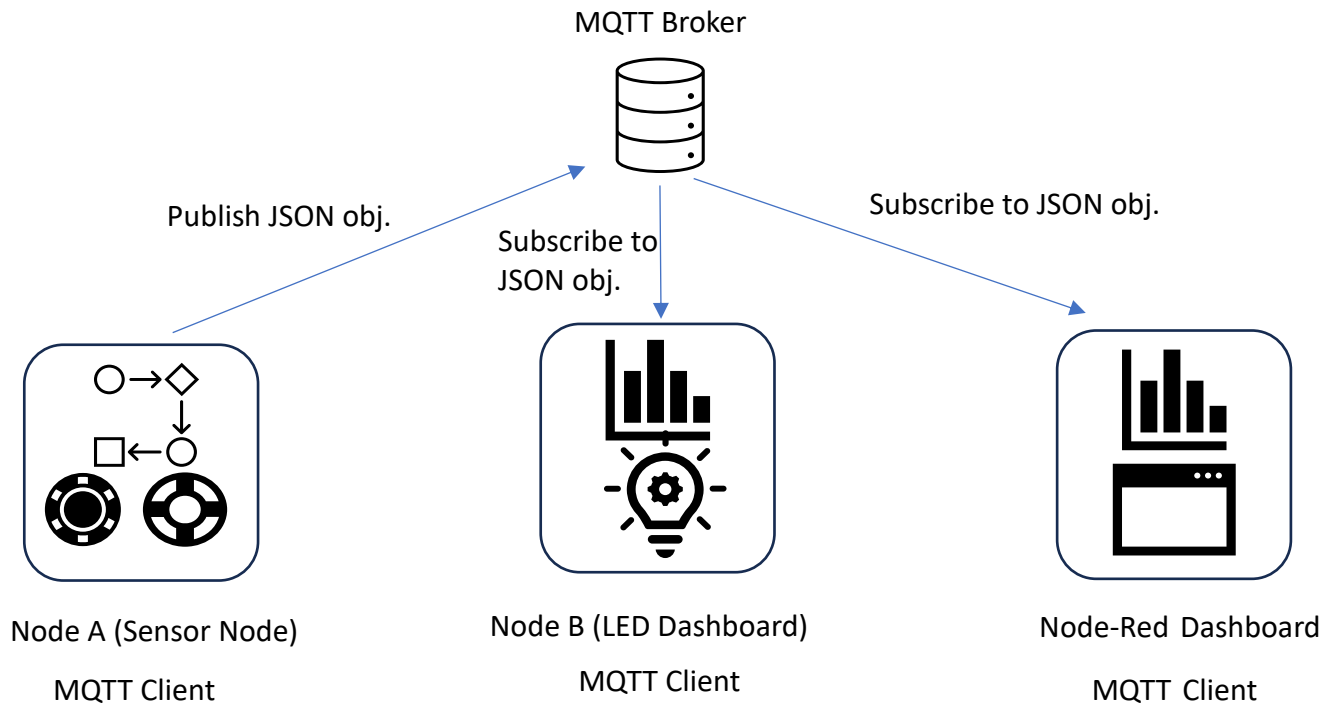
Design the IoT system with the following functionality:

- Divide the Potentiometer and LDR input ranges as "Low", "Medium" and "High" (sensor states)
- The sensor states should be published via MQTT to an appropriate Broker at 5-second intervals as a JSON object.
- The LEDs on the Dashboard should be activated as follows on receiving a single JSON object from the Broker.

Pot value	LDR value	Red LED	Orange LED	Green LED
Low	Low	Blinking	Blinking	Blinking
Low	Medium	Blinking	Blinking	Blinking
Medium	Low	Blinking	Blinking	Blinking
Medium	Medium	OFF	ON	ON
High	Low	OFF	ON	ON
Low	High	OFF	ON	ON
High	Medium	ON	ON	ON
Medium	High	ON	ON	ON
High	High	ON	ON	ON

Task 3:

Replicate the LED dashboard on Node-Red. In addition, the Node-Red dashboard should show the Potentiometer and LDR readings of the most recent 20s as charts. Label the information on the dashboard and make it look attractive.

The overall idea of the Tasks is illustrated in Figure A below:

MQTT Broker

Publish JSON obj.

Subscribe to JSON obj.

Subscribe to
JSON obj.

Node A (Sensor Node)

MQTT Client

Node B (LED Dashboard)

MQTT Client

Node-Red Dashboard

MQTT Client

Figure A

Assignment Part B:

In this part of the assignment, you will assume you have data collected in an Excel worksheet of the form shown in Figure B.

	A	B	C	D	
1	**Location**	**Temperature**	**Humidity**	**Light**	
2	Living Room	20	10	250	
3	Kitchen	25	30	200	
4	Bed Room	18	60	150	
5	Gararge	30	40	70	
6					

Figure B

Task 1:

Publish the entire contents of the worksheet as a single JSON object to a single topic in an MQTT broker

Sample format of the published object:

{"0":{"Location":"LivingRoom","Temperature":100,"Humidity":10,"Light":250},"1":{"Location":" Kitchen","Temperature":20,"Humidity":20,"Light":200},"2":{"Location":"BedRoom","Temperatu re":26,"Humidity":60,"Light":150},"3":{"Location":"Gararge","Temperature":30,"Humidity":40," Light":70}}

Task 2:

Publish the contents of the worksheet as separate JSON objects for each row to a single topic in an MQTT broker.

Sample format of the published object:

{"Location":"Bed Room","Temperature":26,"Humidity":60,"Light":150}

{"Location":"Gararge","Temperature":30,"Humidity":40,"Light":70}

Task 3:

Publish the contents of the worksheet as separate JSON objects for each row to different topics in an MQTT broker. The topic should be illustrative of the location.

e.g. <your group>/Living Room

Task 4:

Create a NodeRed dashboard to display the data pertaining to each location. Demonstrate variations by modifying the original data file.

Report:

Submit your report (one per group). The report should contain a brief description of your work in each task. Submit your Arduino files and Node-Red flows with descriptive names along with the report.

Evaluation: Based on Report and Demonstration