EN2853: Embedded Systems and Applications
Programming Assignment 2

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Index No: XXXXX

May 1, 2023

This is an individual assignment!
Due Date: 16 June 2023 by 11.59 PM

Instructions

In this assignment, you will enhance the Medibox, based on what you learned in class. As you already know, Medibox is a device that assists users in managing their medication schedules effectively. This assignment aims to enhance the basic features of the Medibox and implement additional features to improve the device's functionality. Below are the features that you need to implement as a part of the assignment.

- It is essential to monitor light intensity when storing certain medicines as they may be sensitive to sunlight.
  - To measure the intensity of light, it is recommended to use a Light Dependent Resistor (LDR).
  - Use a separate group to display the light intensity on the Node-RED dashboard. Within this group, it is recommended to use a gauge to display the real-time intensity and a plot to visualize past variations.
  - To ensure consistency in the display of intensity values, use a range of 0 to 1, where 0 represents the minimum possible value of intensity and 1 represents the maximum possible value of intensity.
- A shaded sliding window has been installed to prevent excessive light from entering the Medibox.
  - The shaded sliding window is connected to a servo motor responsible for adjusting the light intensity entering the Medibox. The motor can adjust its angle between 0-180 degrees based on the lighting conditions. This enables the system to dynamically regulate the amount of light entering the Medibox to ensure optimal storage conditions for sensitive medicines.
  - The following equation represents the relationship between the motor angle and the intensity of light entering the Medibox:
    $\theta = \theta_{\text{offset}} + (180 - \theta_{\text{offset}}) \times I \times \gamma$
    where,
    - θ is the motor angle
    - θ_{offset} is the minimum angle (default value of 30 degrees)
    - I is the intensity of light, ranging from 0 to 1
    - γ is the controlling factor (default value of 0.75)
- Different medicines may have different requirements for the minimum angle and the controlling factor used to adjust the position of the shaded sliding window.
  - To enable the user to adjust the minimum angle and controlling factor, create a new group in the Node-RED dashboard.

– To adjust the system's minimum angle and the controlling factor, it is recommended to use two slider controls in the Node-RED dashboard. The first slider control should range from 0 to 120, allowing the user to adjust the minimum angle of the shaded sliding window as needed. The second slider control should range from 0 to 1, enabling the user to adjust the controlling factor used to calculate the motor angle.

Figure 1 shows a sample dashboard for the project. Note: **This does not include all the required features**. This is to get an idea about the dashboard. You are free to choose colors and placements of components.

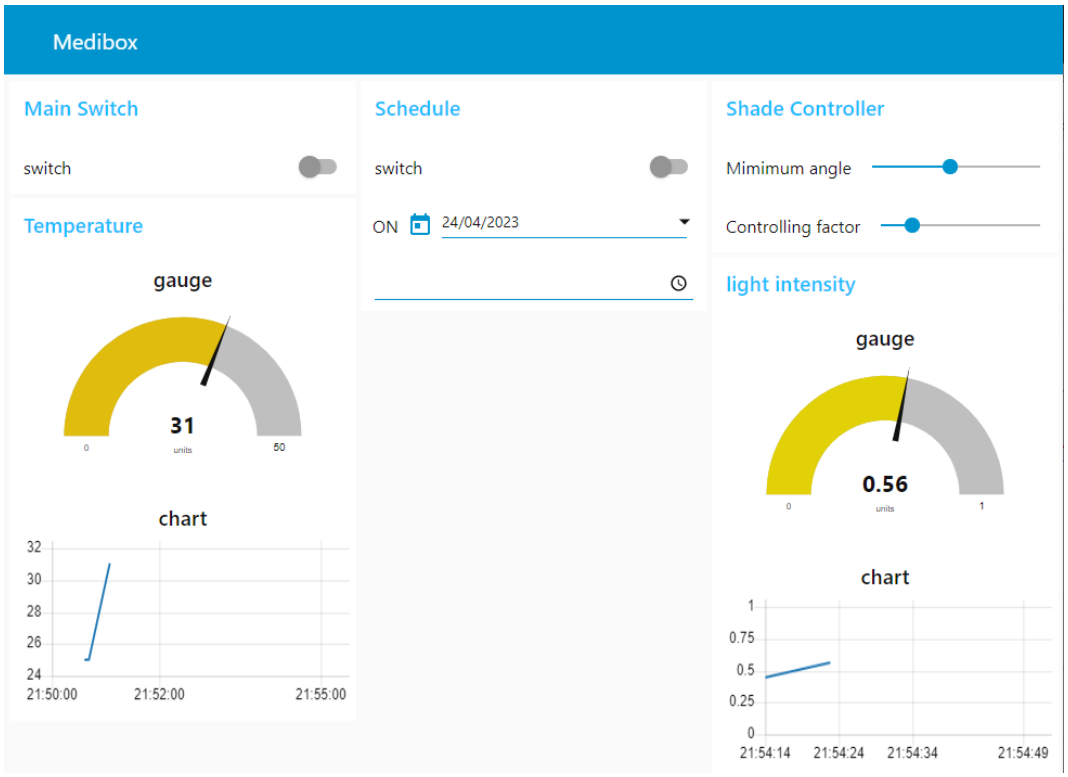

Figure 1: Sample dashboard.

Figure 2 shows the basic architecture of the project. **Use, test.mosquitto.org/ as the broker**.

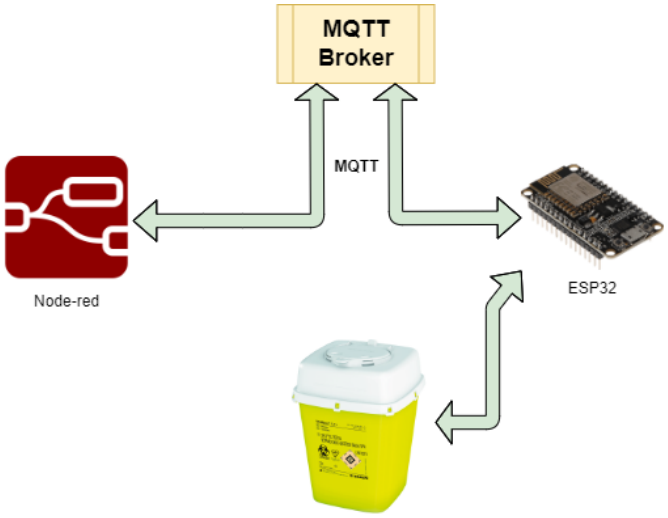

Figure 2: High-level architecture.

Marking Rubric

This assignment accounts for 20% of your final grade. The marks allocation for the required functionality is as follows.

Table 1: Marks Allocation.

Criteria	**Allocated Marks**
Taking LDR input properly	10%
Sending LDR data to the dashboard via MQTT	15%
Visualize light intensity with a plot and a gauge	10%
Setting up a servo motor properly	10%
Programming ESP32 to control the servo angle with the given equation	15%
Setting sliders in the node-RED dashboard for controlling parameters	10%
Sending parameters to ESP32 and setting them to the equation	20%
Creativity and neatness	10%

Submission

Add the Node-RED flow as a JSON file and Arduino code to the same folder. Make a .zip file with these files and submit it to Moodle as XXXXX.zip, where XXXXX is your index number.