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IOE Lab

Assignment -2

Q.2] Analyze and explain step-by-step procedure for designing and implementing a mobile or web interface to remotely monitor and control IoT sensor data.

Ans The procedure to construct a mobile or web interface for IoT involves multiple steps that integrate hardware, software and communication protocols. Each step contributes to overall functionality and reliability of the system:

1) Requirement Analysis: Analyze the project needs to identify the sensors, actuators, and type of data that must be monitored or controlled remotely. Decide whether a mobile app or web interface is more suitable for real-time access.

2) Hardware setup: Connect the sensors (e.g. DHT11 for temperature/humidity) and actuators (eg. LED, relay, fan) to a microcontroller such as ESP32 or Arduino. Ensure proper power supply, pin configuration and sensor calibration.

3) Coding and data Handling: Write codes using Arduino IDE to read sensor data and send it over internet. Implement communication protocols like MQTT or HTTP to publish data to a cloud server or directly to the interface.

4) Interface design: Analyze & design the dashboard using tools like Node-RED, Blynk or a custom web/mobile interface. Include charts, gauges, text displays and control elements (buttons or switches) to visualize and operate connected devices.

5) Data Publishing: Integrate the microcontroller with the interface using the selected protocol. Ensure that the sensor data is accurately transmitted and updated in real time on the interface.

6) Testing and Analysis: Analyze the system's performance by testing sensor readings, response time and actuators control through the interface. Identify any delays, inconsistencies or errors and redefine the hardware connections, code logic or interface configuration accordingly.

7) Evaluation: Assess the reliability, usability and efficiency of the interface. Confirm that users can monitor and control the IoT devices remotely without data loss or delay.

Q.3] Analyze ~~the~~ and explain the step-by-step process of integrating IoT sensors with a cloud platform to enable real-time data access and control via mobile or web interfaces.

Ans Integrating IoT sensors with a cloud platform for real-time data access and control involves multiple steps that require careful analysis of hardware, software and communication protocols:

Step-1: Requirement analysis

- Identify the sensors, actuators and type of data to be monitored.
- Decide the interface type (mobile app or web dashboard) based on accessibility needs.
- Analyze data frequency, precision requirement & real-time performance expectation.

Step-2: Hardware Setup

- Connect sensors (eg. DHT11 for temperature/humidity, Ultrasonic for distance) and actuators (eg. LED, relay, fan) to a microcontroller like ESP32 or Arduino.

- Ensure proper power supply and writing to avoid data loss or malfunction.
- ~~Implement~~ Calibrate sensors for accurate measurements.

Step-3: Coding and Data Acquisition
- Write the program in Arduino IDE or similar platform to read sensor data
- Analyze how the code processes raw data before transmission.
- Implement error handling and data formatting to ensure reliability.

Step-4: Cloud Integration
- Choose a cloud platform (eg. ThingSpeak, AWS IoT, Google Firebase) to store and manage sensor data.
- Configure MQTT or HTTP protocol for communication between the microcontroller and the cloud server.
- Analyze data flow to ensure secure and reliable transmission.

Step-5: Mobile / Web Interface Design
- Use tools like Node-RED dashboard or custom web apps to visualize data.
- Include charts, gauges, switches or buttons to allow real-time monitoring and control.
- Analyze the interface layout & interactivity to enhance user experience.

Step-6 : Publishing data

- Send sensor readings to cloud in real-time.
- Analyze how often data updates and ensure minimal latency for timely monitoring.
- Verify that actuator control commands sent from the interface reach the microcontroller effectively.

Step-7 : Testing and Analysis :

- Evaluate the system performance by monitoring sensor data on the mobile / web interface
- Analyze response times, accuracy and reliability under different conditions.
- Identify and correct any communication delays, sensor errors or interface glitches.

Step-8 : Evaluation and Optimization

- Assess the overall integration of sensors, cloud & interface
- Optimize, coding, network settings, and interface elements to improve responsiveness and usability.
- Confirm that the system enables secure, real-time access and control via mobile or web.

(Q.4) Design & implement an MQTT-based dashboard to control an LED conducted to a NodeMCU?

Ans Step-1 : Develop the following flow by placing a MQTT-in node with following setting.

Step-2 : Create a new tab in dashboard module and drag in the two buttons (ON/OFF) from dashboard module to control the LED & subscribe them to topic ledcontrol.

Step-3 : Create an MQTT-out node & connect them with buttons to publish the data ON/OFF to ~~turn on/off~~ the light at other client NodeMCU who has subscribed to topic ledcontrol via MQTT mosquitto online broker.

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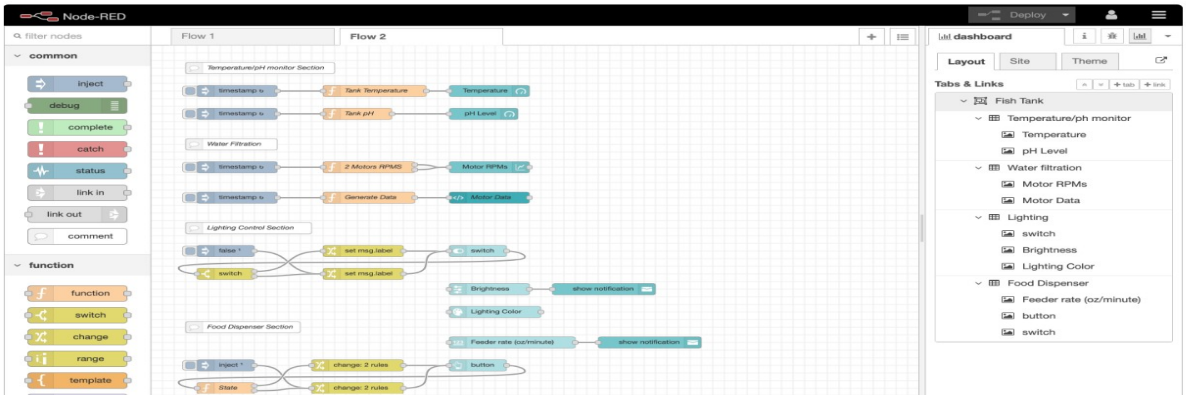
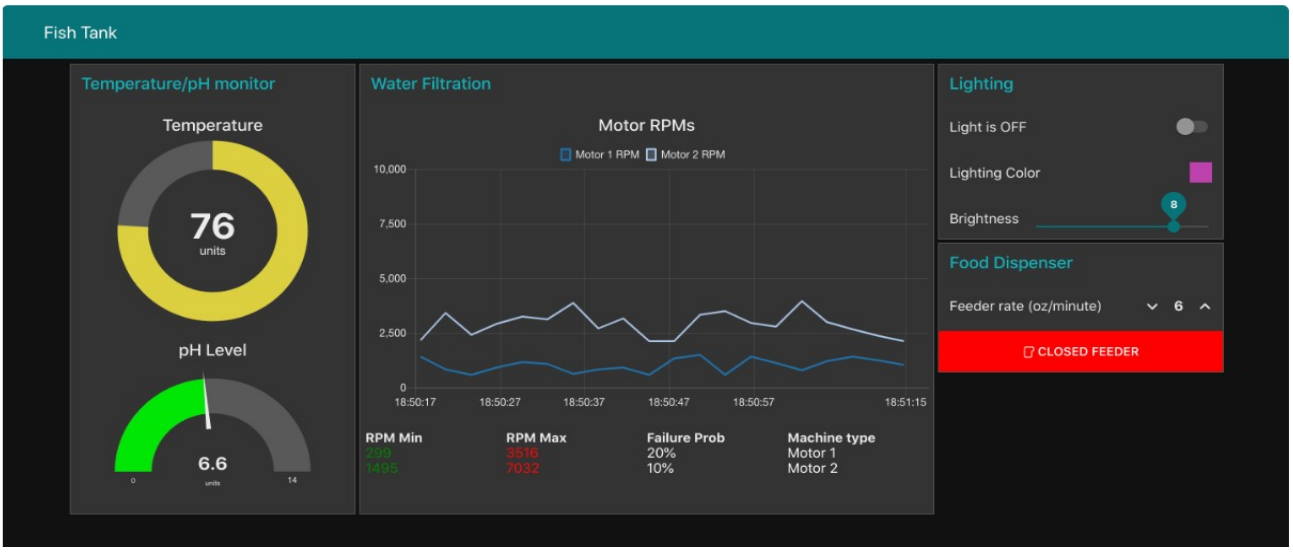
Assignment No 02 SET-1

Q.1 Create a dashboard that will display some stored data to simulate a home automation fish where Motor RPM data, food dispenser status, pH level, temperature can be visualized in term of either gauge or chart. [BL5,LO6]

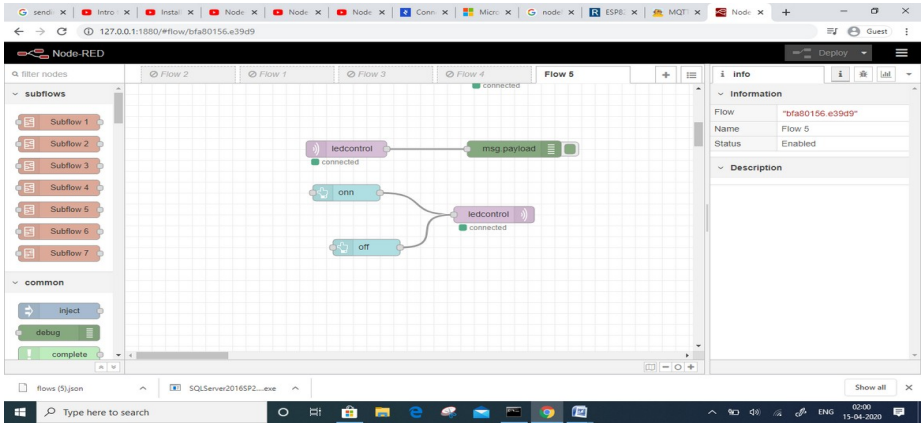
Answer:

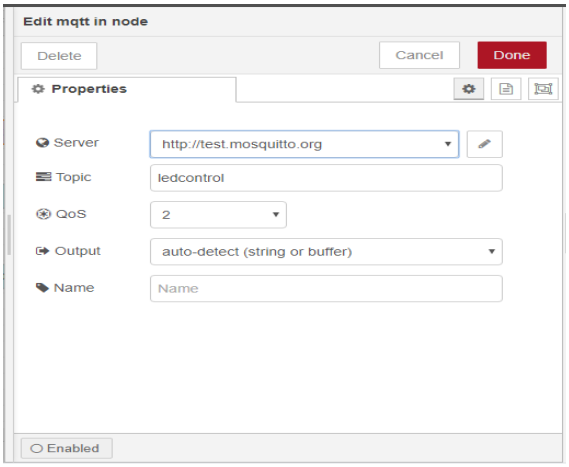




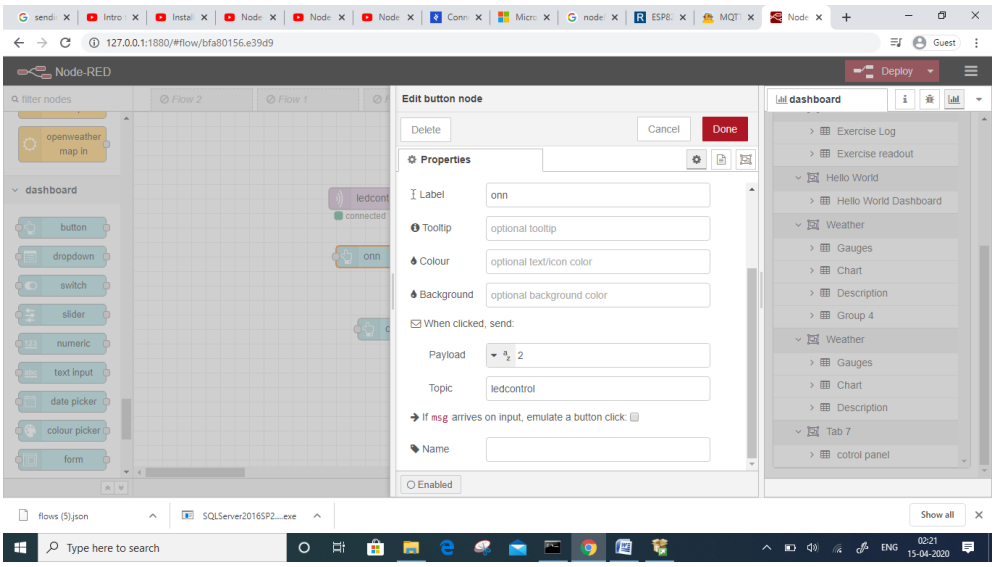
Q4) Design and implement an MQTT-based dashboard to control an LED connected to a NodeMCU [BL6,L5]

Step 1:Develop the following flow by placing a MQTT-in node with the following setting

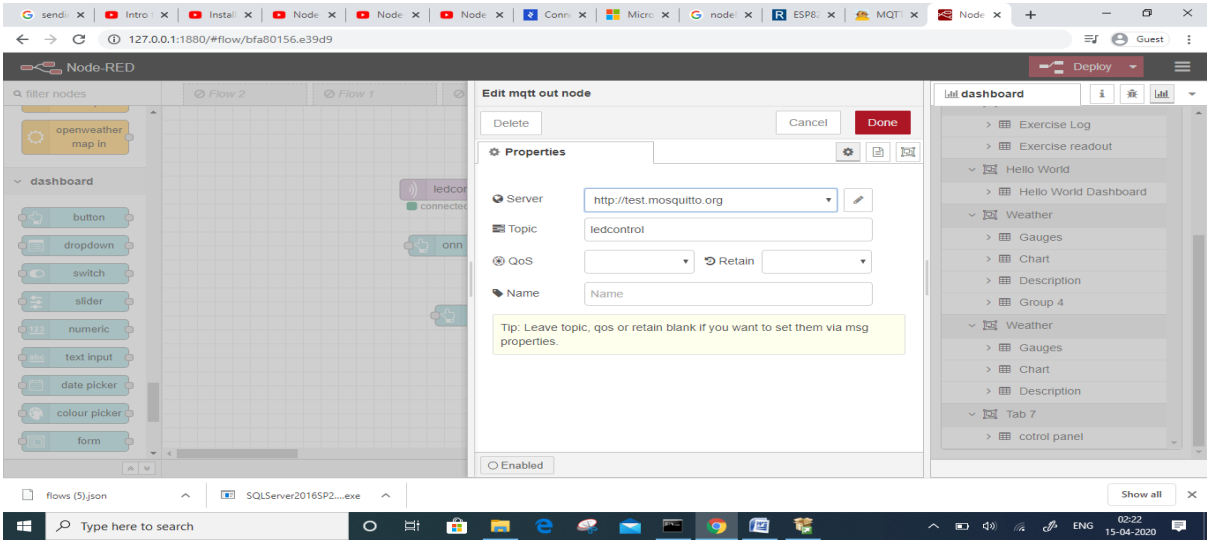


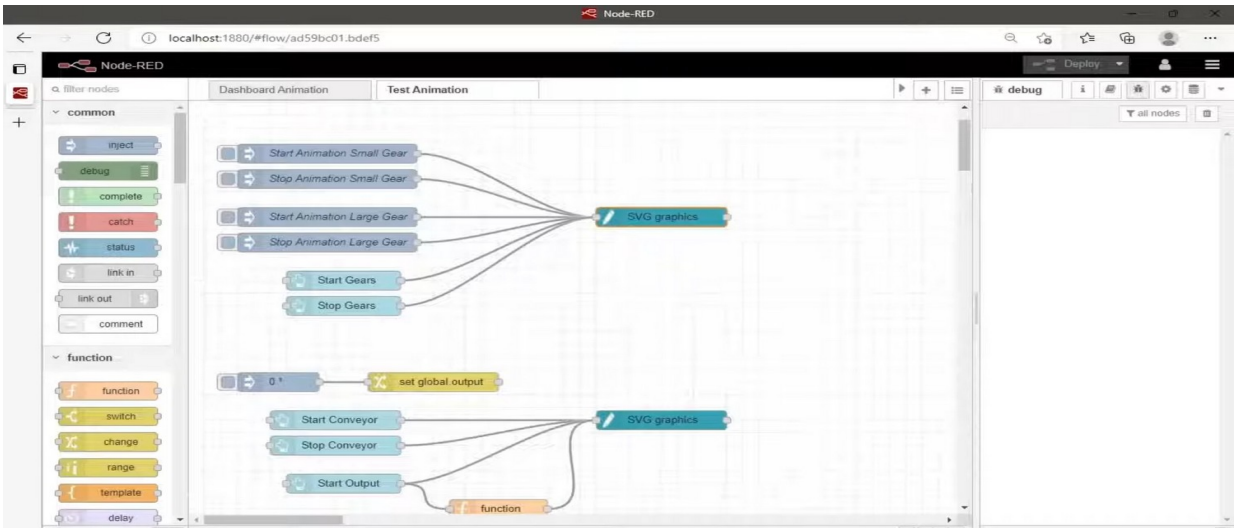


Step 2:Create a new tab in the dashboard module and drag in the two buttons (ONN/OFF) from dashboard module to control the LED and subscribe them to the topic ledcontrol.



Step 3: create an MQTT-out node and connect them with the buttons to publish the data ONN/OFF to turn on/off the light at the other client NodeMCU who has subscribed to the topic ledcontrol via MQTT mosquito online broker





Q5) Analyze the design and functionality of a Node-RED dashboard as shown in the provided interface. Explain how discrete and analog components (e.g., buttons, sliders, and gauges) interact with the system, and describe the steps to install and configure the Node-RED dashboard module for real-time monitoring and control. [BL4,LO4]

Answer:

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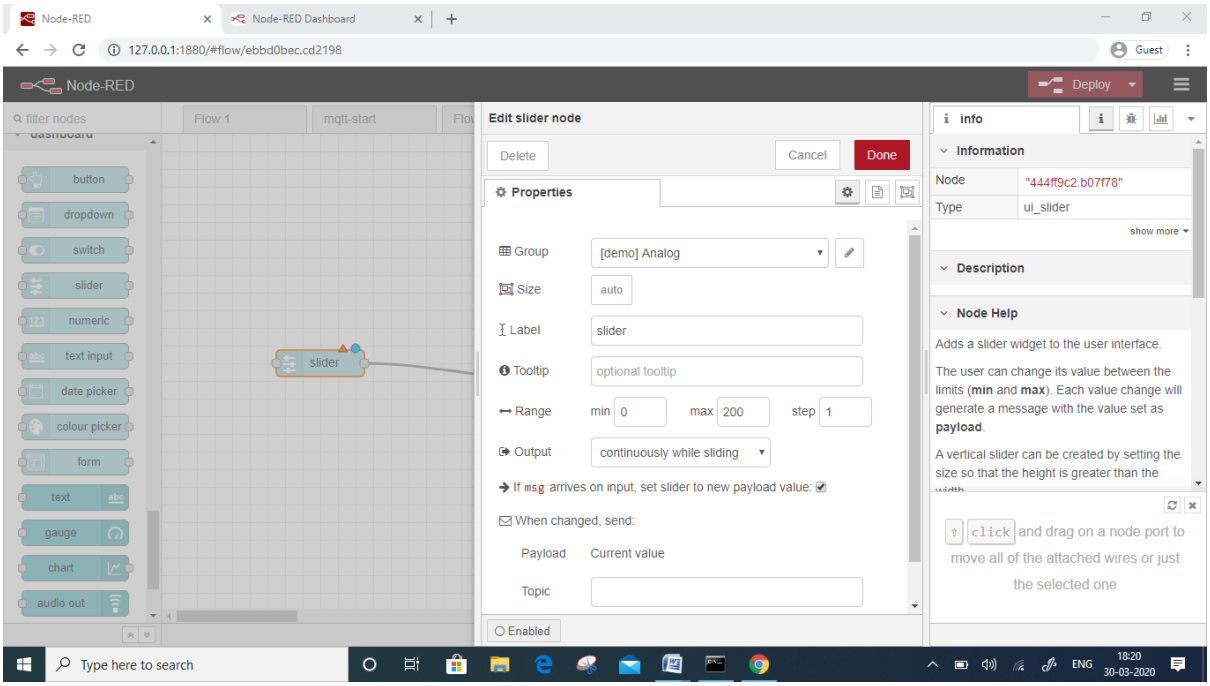

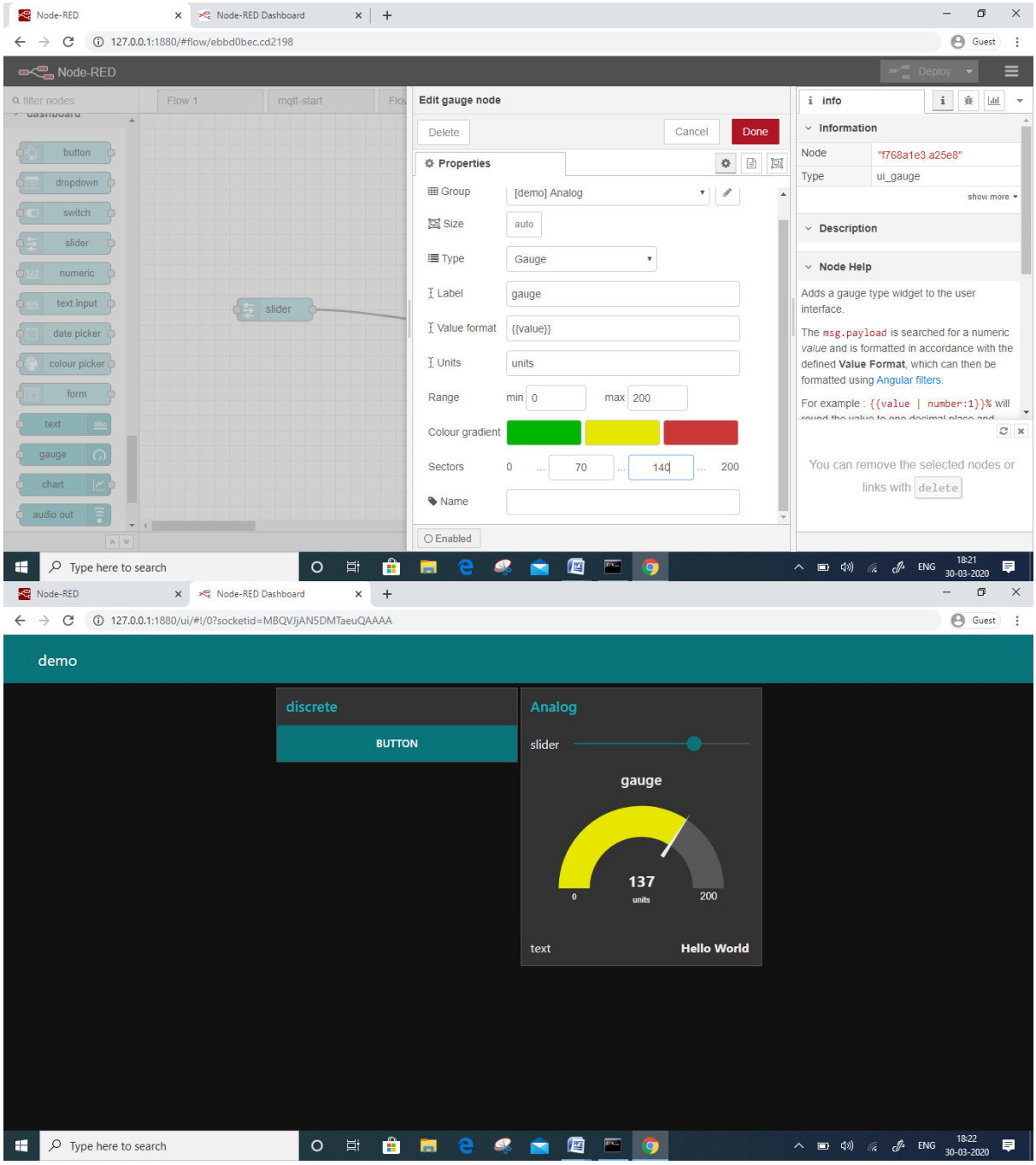
Node-RED
Node-RED Dashboard
127.0.0.1:1880/#flow/ebbd0bec.cd2198
Guest
Deploy
filter nodes
Flow 1
mqtt-start
button
dropdown
switch
slider
numeric
text input
date picker
colour picker
form
text
gauge
chart
audio out
Edit gauge node
Delete
Cancel
Done
Properties
Group
[demo] Analog
Size
auto
Type
Gauge
Label
gauge
Value format
{{value}}
Units
units
Range
min 0
max 200
Colour gradient
Sectors
0 70 140 200
Name
Enabled
info
Information
Node
"f768a1e3.a25e8"
Type
ui_gauge
show more
Description
Node Help
Adds a gauge type widget to the user interface.
The msg.payload is searched for a numeric value and is formatted in accordance with the defined Value Format, which can then be formatted using Angular filters.
For example : {{value | number:1}}% will
You can remove the selected nodes or links with delete
Type here to search
ENG
18:21
30-03-2020
127.0.0.1:1880/ui/#!/0?socketid=MBQVjAN5DMTaeuQAAAA
demo
discrete
BUTTON
Analog
slider
gauge
137
units
0
200
text
Hello World
18:22
30-03-2020