1. OTAFU

- Video demonstaration of OTAFU: https://drive.google.com/file/d/1hrwzuMwFK4OqHUmetueOG86YaUXr09zq/view?usp=sharing
- Code commited to GITHUB repository.

3. Node-RED Design

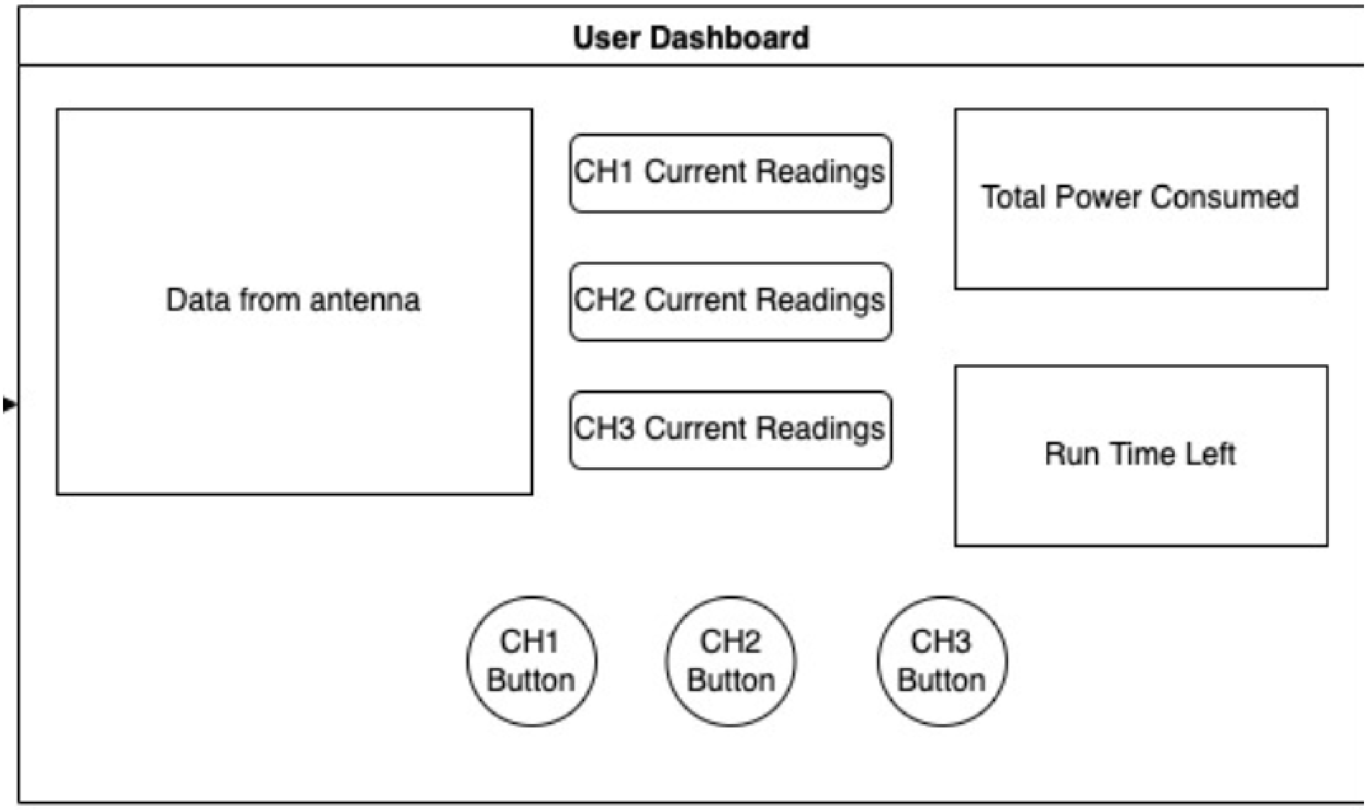
Data Flow:

- MCU → Cloud (Node-RED):

1. Sends current readings for CH1, CH2, CH3
2. Sends antenna data (graphical/streamed format)
3. Sends total power consumed
4. Sends remaining runtime

- Cloud (Node-RED) → MCU:

1. Sends control signals for CH1, CH2, CH3 Buttons (e.g., activate/deactivate channel or trigger an action)



MQTT Topics

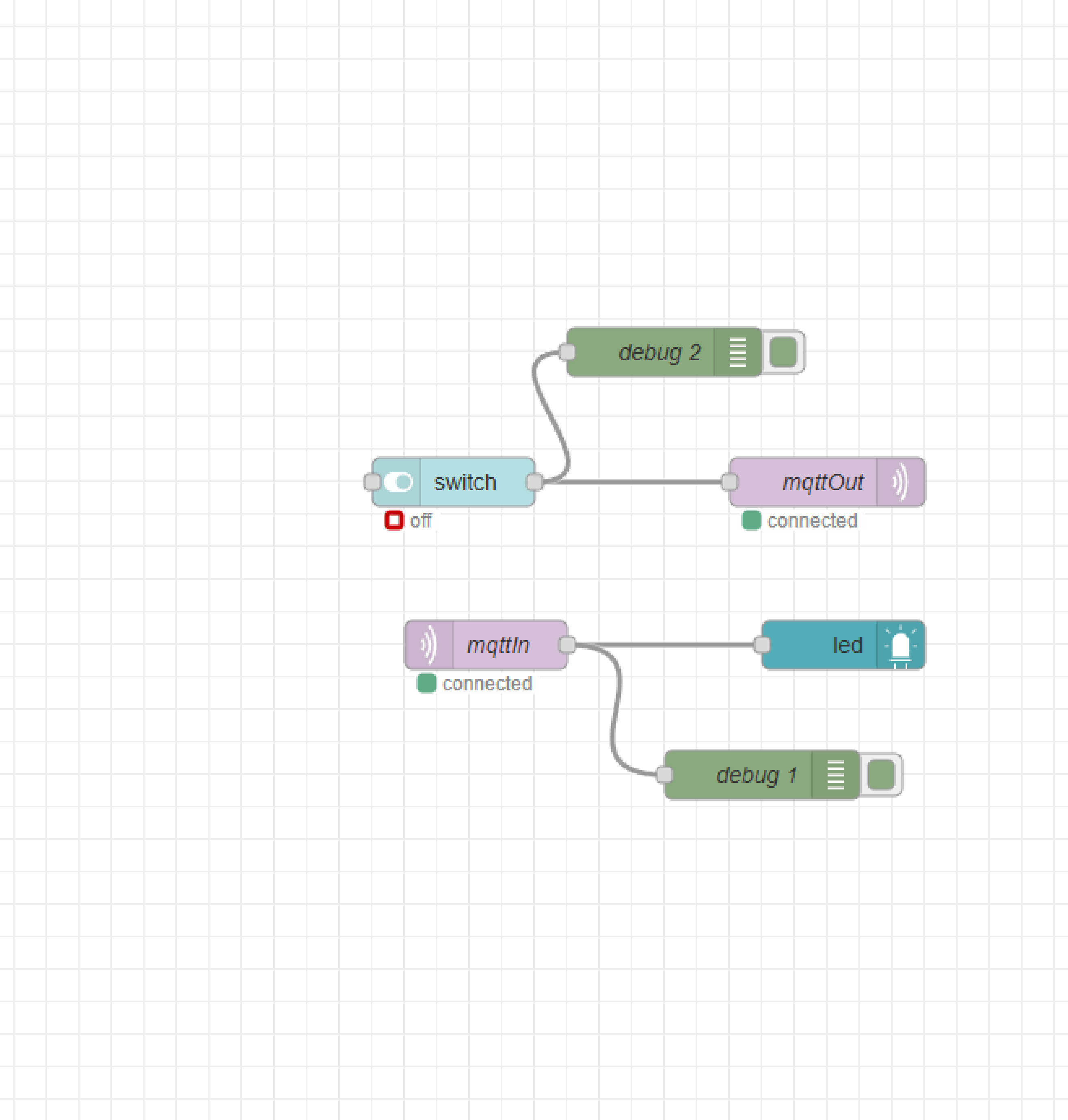
Topic	Data Type	Publisher	Subscriber	Purpose
device/antenna_data	JSON / Float Array	MCU	Node-RED	Streamed data from antenna (to plot graph)

Topic	Data Type	Publisher	Subscriber	Purpose
device/ch1_current	Float (e.g., 0.45)	MCU	Node-RED	Real-time current reading for CH1
device/ch2_current	Float	MCU	Node-RED	Real-time current reading for CH2
device/ch3_current	Float	MCU	Node-RED	Real-time current reading for CH3
device/total_power	Float	MCU	Node-RED	Total energy consumed
device/runtime_left	Integer (seconds)	MCU	Node-RED	Time remaining before shutdown
device/ch1_button	Boolean (true/false)	Node-RED	MCU	Toggle/action for CH1
device/ch2_button	Boolean	Node-RED	MCU	Toggle/action for CH2
device/ch3_button	Boolean	Node-RED	MCU	Toggle/action for CH3

Thread Structure

Thread	Function
MQTT Task	Handles all MQTT publish/subscribe logic using FreeRTOS MQTT or client API
Sensor Reading Task	Polls ADC/sensor for CH1/CH2/CH3 currents, antenna data
Power Calculation Task	Computes and tracks total power consumed
Runtime Monitor Task	Tracks and reports estimated runtime left
Button Control Task	Listens for incoming MQTT button commands, triggers GPIO/actions
Main CLI Task	Handles command-line interaction (via UART/USB)

4. Bidirectional Cloud Communication



videos: https://drive.google.com/file/d/1G8nrUUNFcB0REIP3QopcXIRgDCPqiqul/view?usp=sharing

https://drive.google.com/file/d/1Q1BmWNhiygrBViEGwQJS0pxrlkyjzsMe/view?usp=sharing

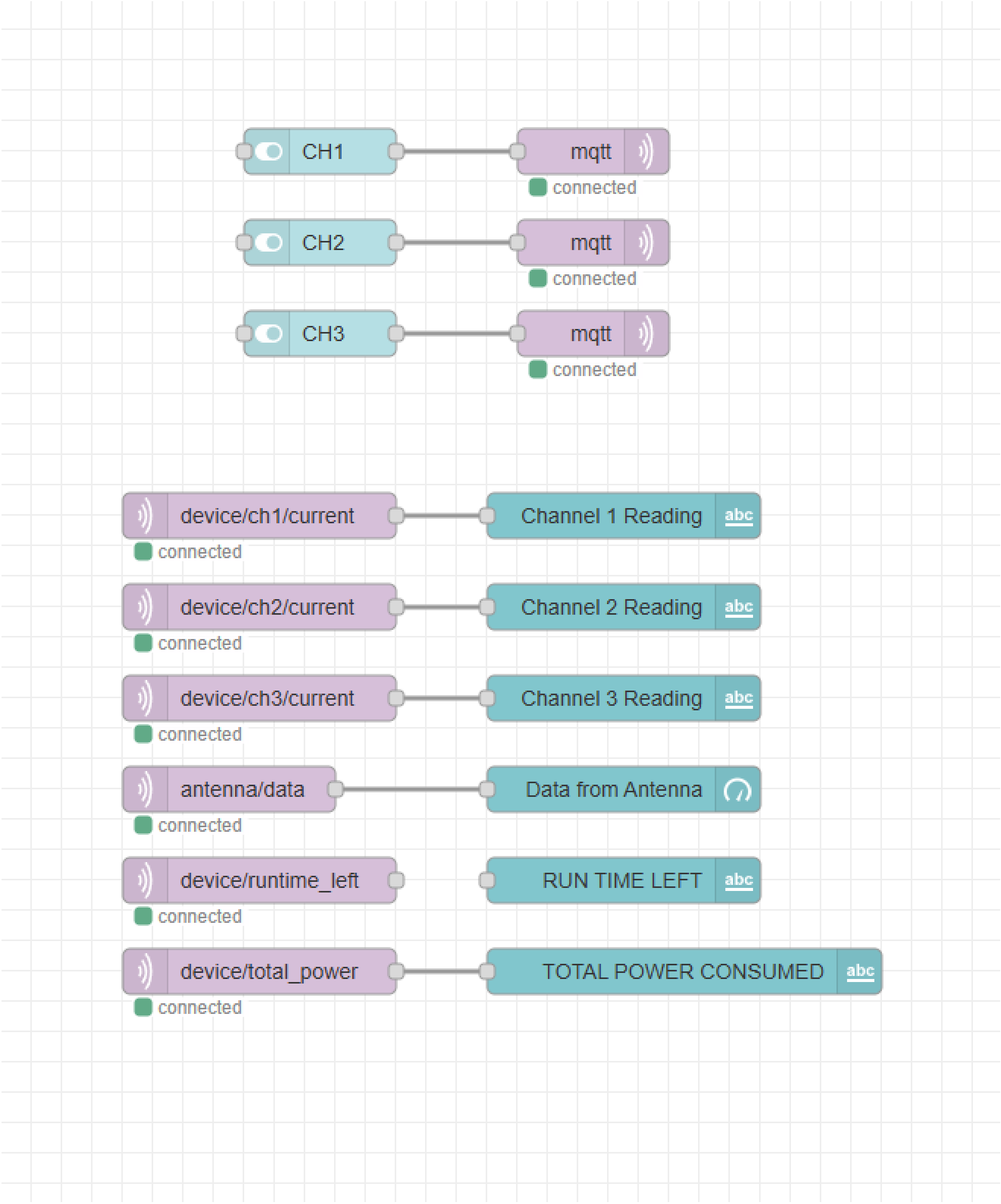
node red ui: http://48.217.67.9:1880/ui/#!/0?socketid=O06eFNbGRB-OuRkzAABr

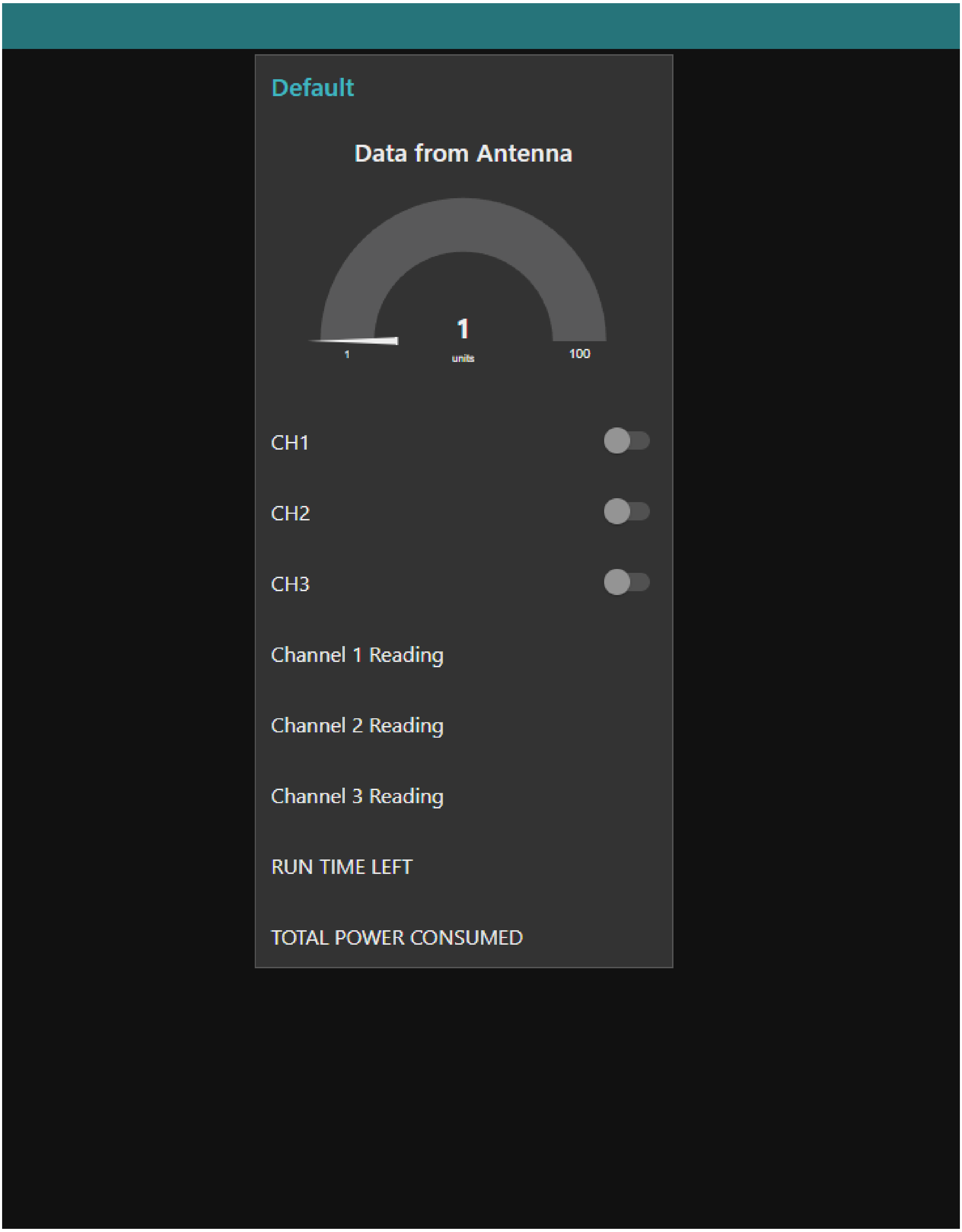
we have to diable the flows to see the individual working, for part 4,5.

- code commited under node red --> part 4

5. Node-RED Implementation

- video: https://drive.google.com/file/d/1gRww2jtuho2YyNBBDNXxrbzIWRHYyYAw/view?usp=sharing
- backend and frontend:


CH1
mqtt
connected
CH2
mqtt
connected
CH3
mqtt
connected
device/ch1/current
connected
Channel 1 Reading
abc
device/ch2/current
connected
Channel 2 Reading
abc
device/ch3/current
connected
Channel 3 Reading
abc
antenna/data
connected
Data from Antenna
device/runtime_left
connected
RUN TIME LEFT
abc
device/total_power
connected
TOTAL POWER CONSUMED
abc



Default

Data from Antenna

CH1

CH2

CH3

Channel 1 Reading

Channel 2 Reading

Channel 3 Reading

RUN TIME LEFT

TOTAL POWER CONSUMED

- node red Ui link: http://48.217.67.9:1880/ui/#!/0?socketid=Wyy_iX-FNenFcKOWAABp
- code submitted in node red --> part 5