Industrial Internet Infrastructure

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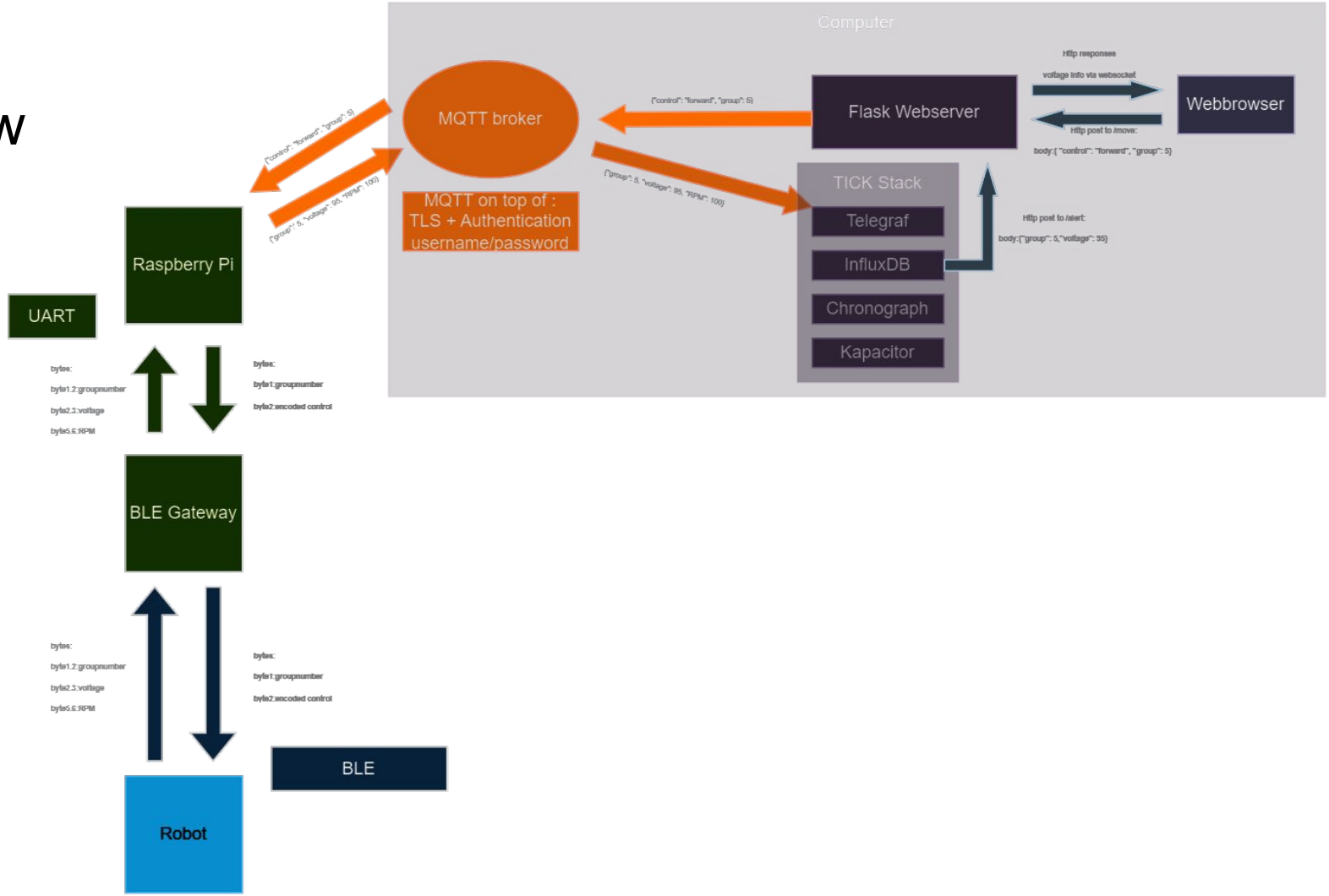
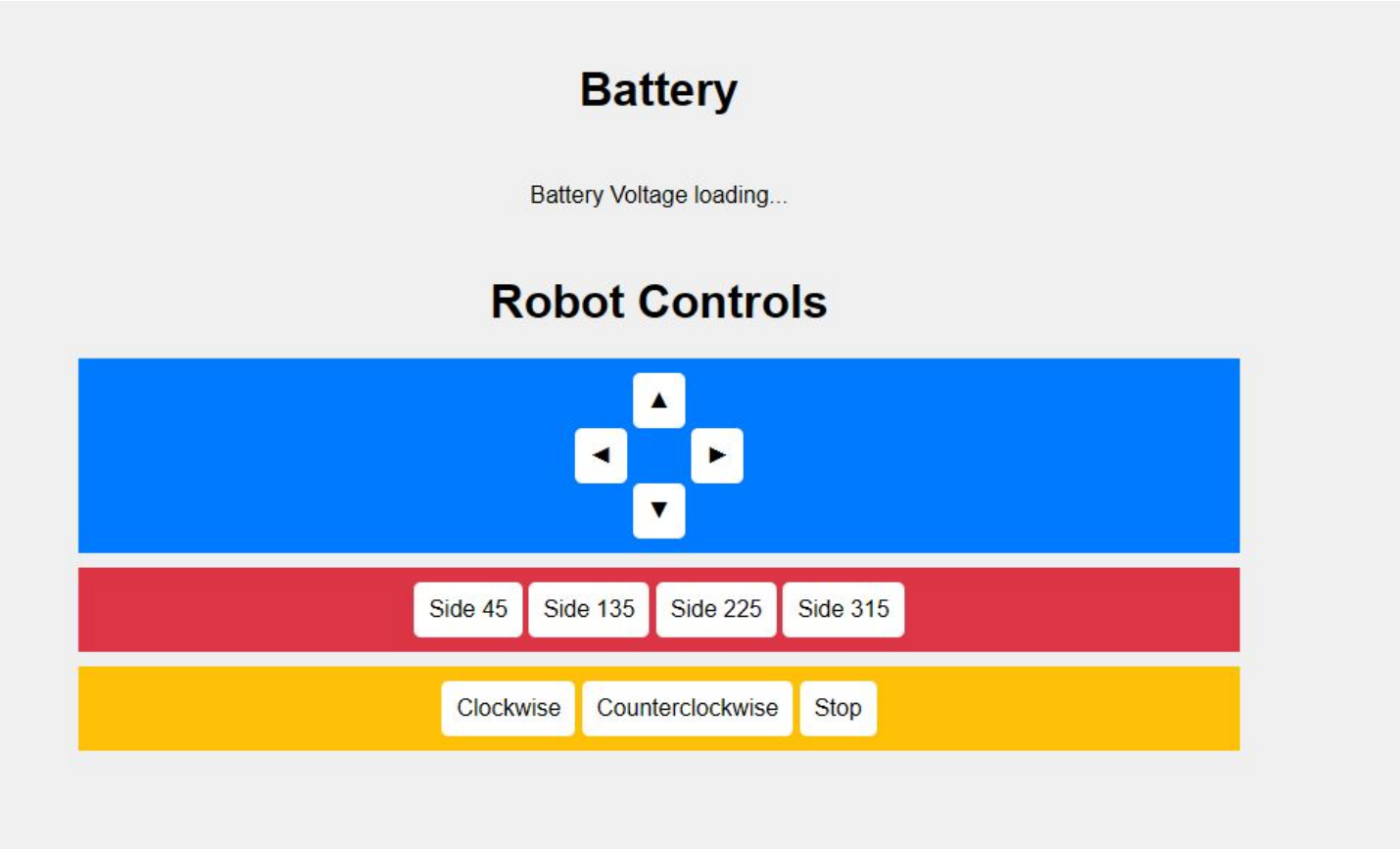
Overview


Computer
MQTT broker
MQTT on top of :
TLS + Authentication
username/password
{"control": "forward", "group": 5}
{"group": 5, "voltage": 95, "RPM": 100}
Flask Webserver
Http responses
voltage info via websocket
Http post to /move:
body:{ "control": "forward", "group": 5}
Webbrowser
TICK Stack
Telegraf
InfluxDB
Chronograph
Kapacitor
Http post to /alert:
body:{"group": 5,"voltage": 95}
Raspberry Pi
UART
byte:
byte1,2:groupnumber
byte2,3:voltage
byte5,6:RPM
bytes:
byte1:groupnumber
byte2:encoded control
BLE Gateway
BLE
Robot

Frontend

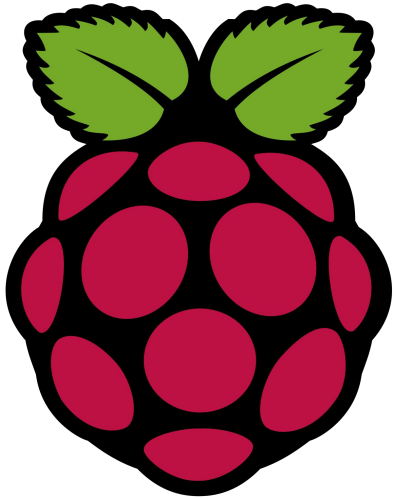
- Python Flask
- /move
- /alert
- TLS
- JSON security element



MQTT Broker

- Mosquitto MQTT broker
- Only accepts TLS encrypted connections
  - Provided with self signed certificate
- Requires username/password authentication

Raspberry Pi



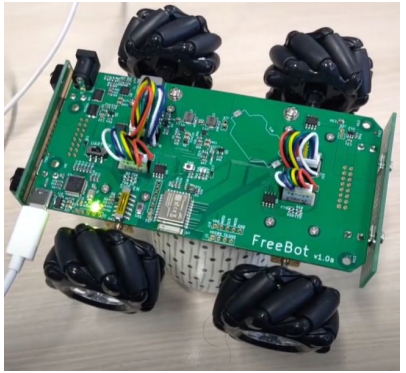
- Python based multi-threaded application
- Communicates with broker through MQTT over TLS with username/password authentication
- Thread 1: UART_TO_MQTT
  - Reads UART messages from serial port
  - Publishes sense data to “III2024/05/sense” topic
- Thread 2: MQTT_TO_UART
  - Subscribes to “III2024/05/control” topic
  - Writes control commands to serial port

nRF Central Gateway

- UART:
  - pin 1.07 for RX
  - pin 1.05 for TX
  - Continuous listening
- BLE:
  - Nordic UART Service
  - TX Characteristic
  - RX Characteristic
- Simply forward from UART to BLE & from BLE to UART
- No aggregating/modification of the data

Freebot peripheral

- Connected to the central using BLE
- Two threads
  - main: initializes freebot, NUS service, and advertises over BLE
  - notify: sends the sensing data to the central
- Sensing data
  - 2 bytes groupnr, 2 bytes voltage, 2 bytes rpm
- Control data
  - received by NUS receive callback
  - 1 byte groupnr, 1 byte action



TICK

- [“ssl://ip:8883”]
- Alert (http://127.0.0.1:5000/alert):
  - Kapacitor
  - InfluxDB Alert
  - InfluxDB Task