Washing Machine Device

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Summary

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Introduction

This project focuses on **improving maintainability in industrial laundry machines** by developing a monitoring device that tracks chemical liquid levels, performs automatic and manual refills, and logs data to a database for analysis. The solution is developed in a fully **simulated environment** using alternative sensors to replicate real-world machine conditions.

Device Development

Problem context: In industrial laundry machines, the *soap container is built into the internal structure*, making it difficult to access and refill.

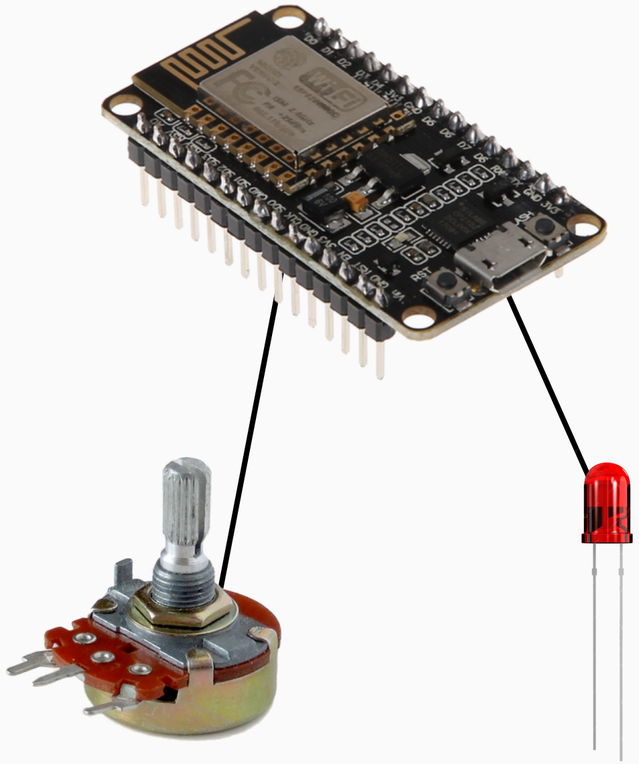
Solution proposed: An *external smart dispenser* that monitors the soap level, refills it automatically or manually, and sends real-time data for analysis and control.

Since this project was developed in a simulated environment, some hardware components were substituted.

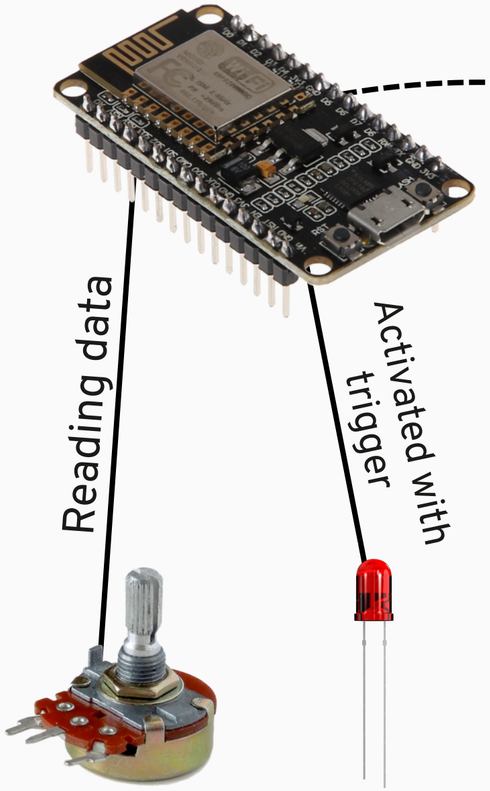
A **potentiometer** *was used in place of a water level sensor to simulate varying liquid levels* in the tank.

A **led** *was used to represent the motor responsible for pumping the chemical liquid.*

The **device prototype** according the simulated scenario:



How the *device* **communicate** *with the software* environment:



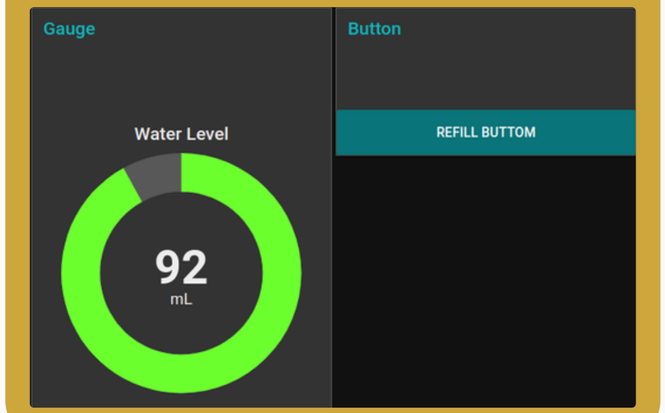
Reading data

Activated with trigger

Wi-Fi + MQTT Protocol

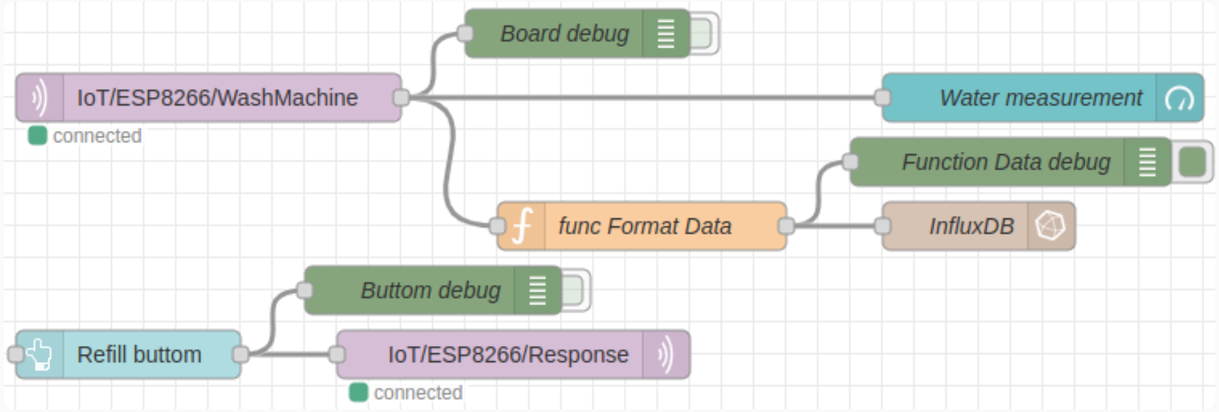
Wi-Fi + MQTT Protocol

Node-RED



InfluxDB

More detailed data transfer:

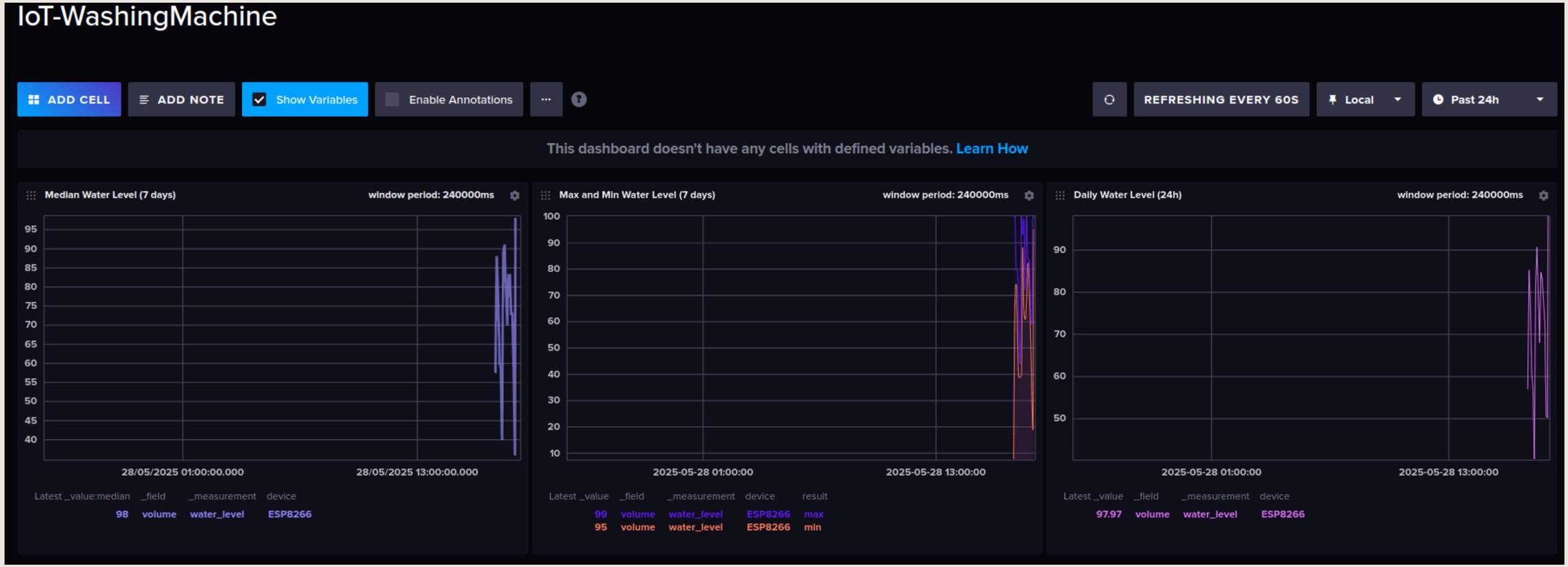



```
// Read Volume Sensor and check for auto refill
void readVolumeSensor(){
  int rawValue = analogRead(potentiometer);
  volumeML = map(rawValue, 0, 1023, 0, 100);
  Serial.print("Sensor volume: ");
  Serial.print(volumeML);
  Serial.println(" ml");

  if(volumeML <= 25 && !mqttRefillRequested && !autoRefillRequested){
    autoRefillRequested = true;
    digitalWrite(led_pin, LOW);
    Serial.println("Auto refill triggered due to low volume.");
  }
  digitalWrite(led_pin, HIGH);
  publishVolume();
}
```

```
// MQTT Callback
void callback(char* topic, byte* payload, unsigned int length){
  String message;
  for(unsigned int i = 0; i < length; i++){
    message += (char)payload[i];
  }

  if(String(topic) == "IoT/ESP8266/Response"){
    if(message == "true"){
      if(!autoRefillRequested){
        mqttRefillRequested = true;
        digitalWrite(led_pin, LOW);
        Serial.println("MQTT refill started.");
      } else{
        Serial.println("MQTT refill ignored: Auto refill in progress.");
      }
    } else if(message == "false"){
      mqttRefillRequested = false;
      digitalWrite(led_pin, HIGH);
      Serial.println("MQTT refill stopped.");
    }
  }
}
```

```
// Publish volume to MQTT
void publishVolume(){
  String volumeStr = String(volumeML);
  client.publish("IoT/ESP8266/WashMachine", volumeStr.c_str());
}
```

Database dashboards displayed for further data analysis:



Conclusion

This project successfully **simulates an IoT-based solution for monitoring and refilling liquid in industrial laundry machines.** Using *low-cost components and real-time communication*, it demonstrates how automation can improve efficiency and maintenance in industrial environments.

Thank you for your attention