Garden.ly

Plant Environment Monitoring System

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Problem Statement

- Plants at home requires as much care as any plant present in a garden or a science lab.
- If they are not watered regularly or cared for enough, they may wilt and eventually die.
- Sometimes watering the plant regularly or just moving it to a more sun-lit area can make huge improvements to the plant's environment providing it with a greater chance of flourishing.

What does **Garden.ly** do?

- Notify the user to move the plant to an area with more sunlight when it does not have enough light conditions
- Notify the user to water the plant when the soil does not have enough moisture content
- Getting the estimated time for watering the plant before the soil moisture decreases below a threshold
- Provide the home plant of the user with appropriate environmental conditions for better growth

Literature Study

- The research paper [1] has proposed a system that uses NodeMCU as a microcontroller. NodeMCU comes with the inbuilt ESP8266 WiFi module which connects our system to the Flutter app using WiFi.
- Soil moisture sensor continuously detects the level of moisture in the soil and displays it on the Flutter app.
- Real-time values from the DHT11 and light intensity sensor are also displayed on the app.
- They suggested that the performance of the system could be further improved in terms of the operating speed, memory capacity, and instruction cycle period of the microcontroller by using other high end controllers.

Literature Study

- In research paper [2] In this study, the focus is to collect and summarize various advanced forecasting models for multivariate time series dataset.
- They have discussed the inherent forecasting strengths and weaknesses related to these time series modelings.
- The paper has used the autoregressive integrated moving average models (i.e) ARIMA models.
- Some useful differencing and variance stabilizing transformations are introduced to connect the stationary and non-stationary time series models.

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Hardware Requirements:

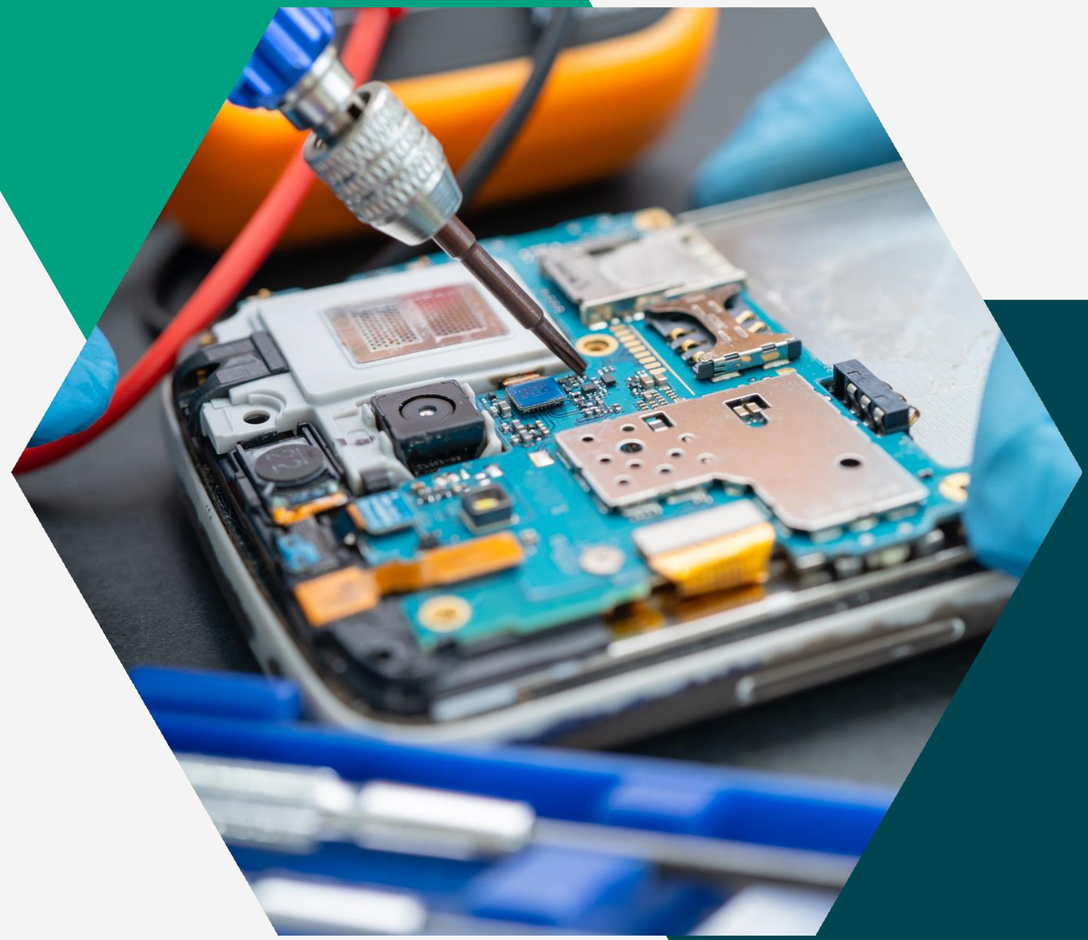
- NodeMCU ESP8266 Board
- Soil Moisture sensor
- DHT11 Sensor
- BH1750 Light intensity sensor

Software Requirements:

- AWS IoT Core
- Flutter
- Flask (Python)

Network Requirements:

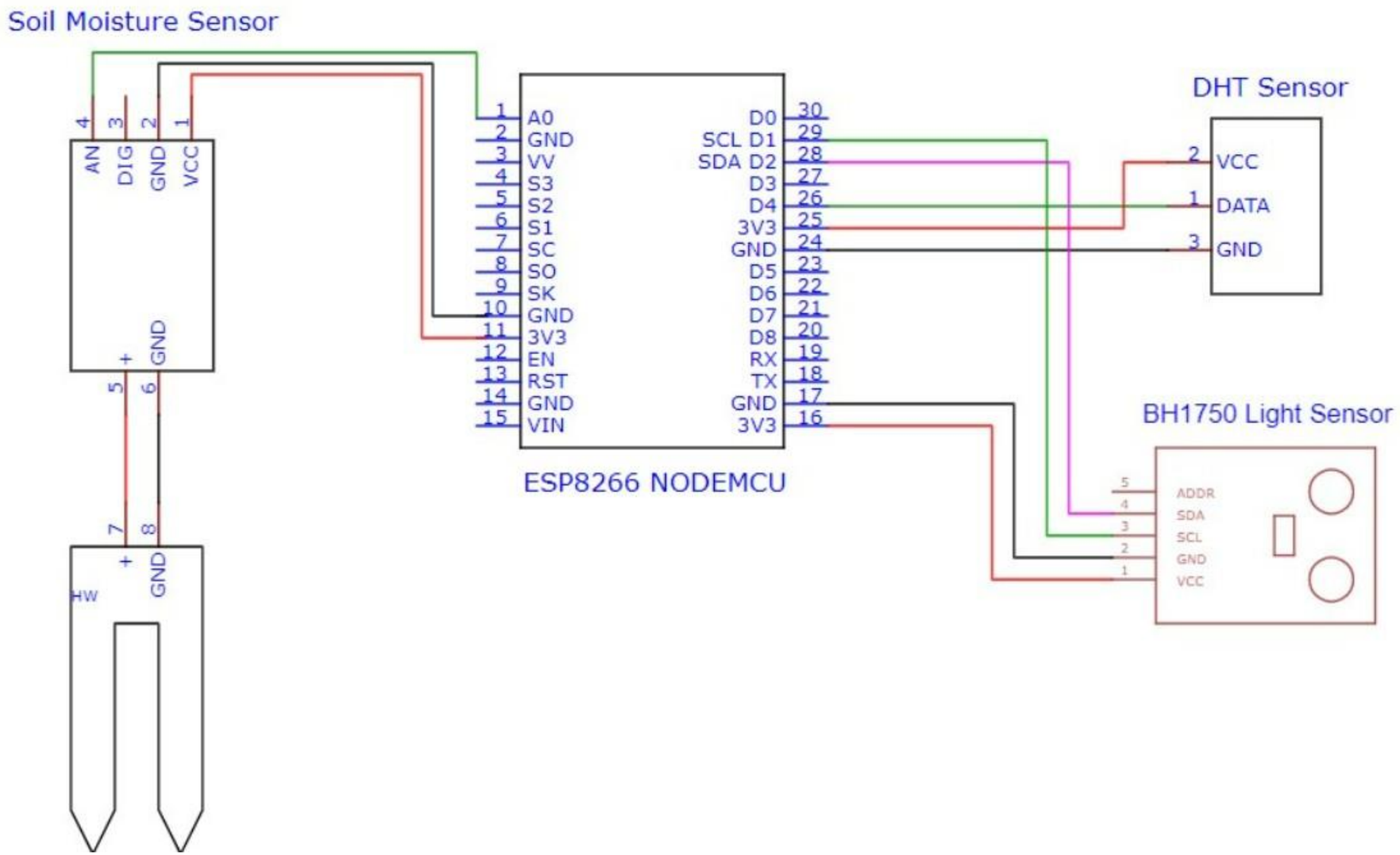
- Wi-fi connectivity



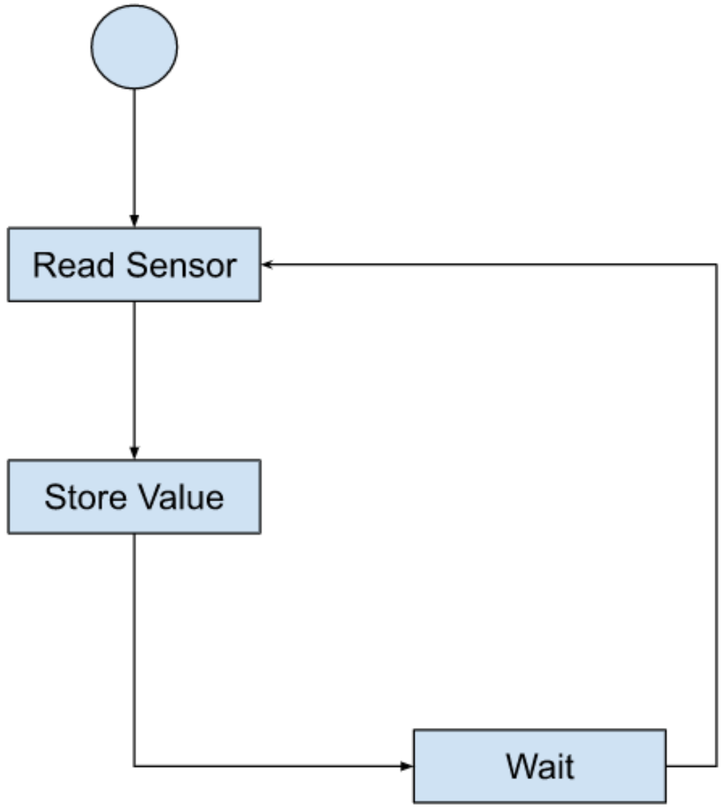
Wireless Technology :

- MQTT - for data collection and storing
- Wifi - for connection of sensor board to AWS
- HTTP (REST API) - for fetching prediction from analytics application

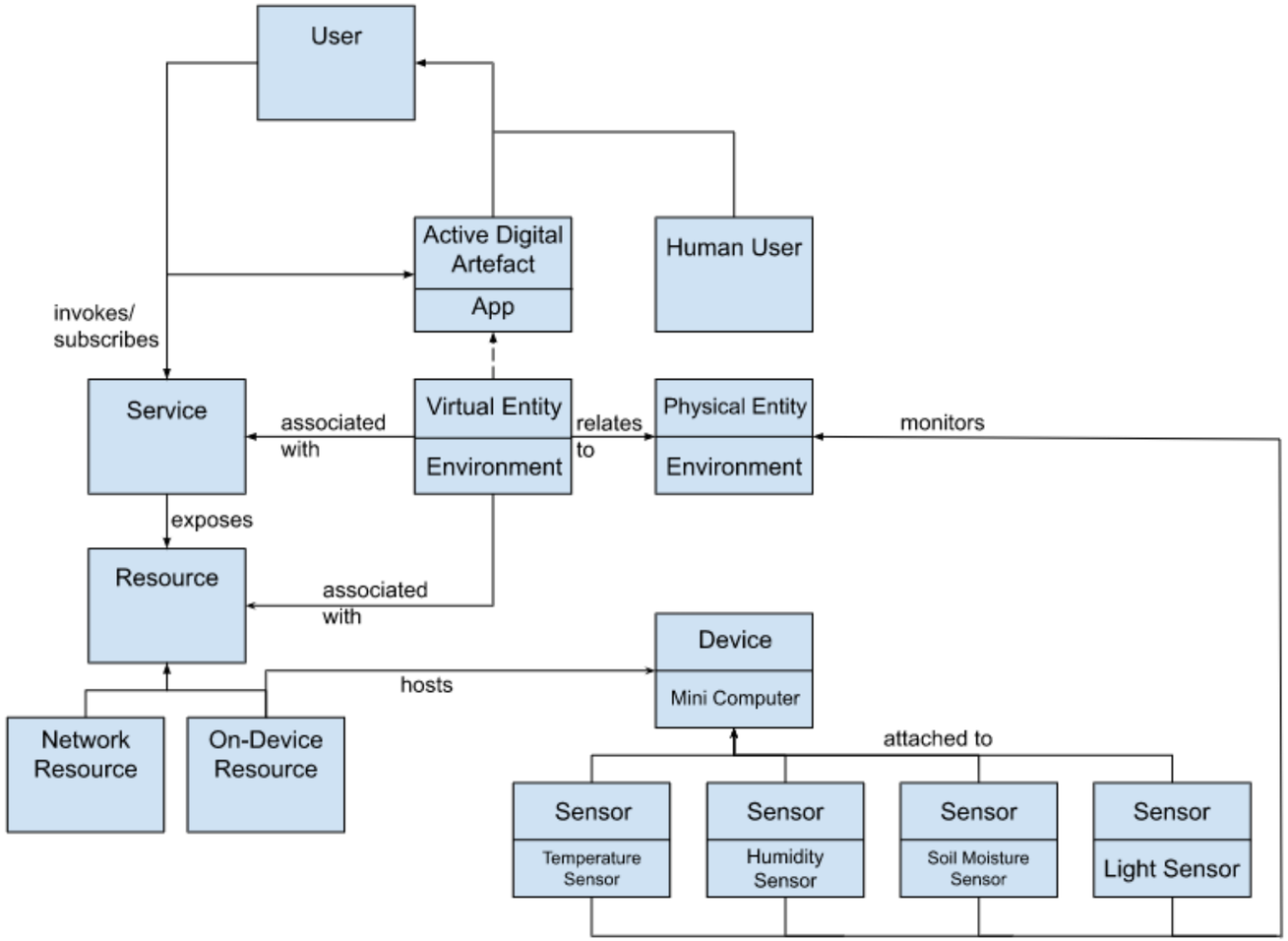
Circuit Diagram



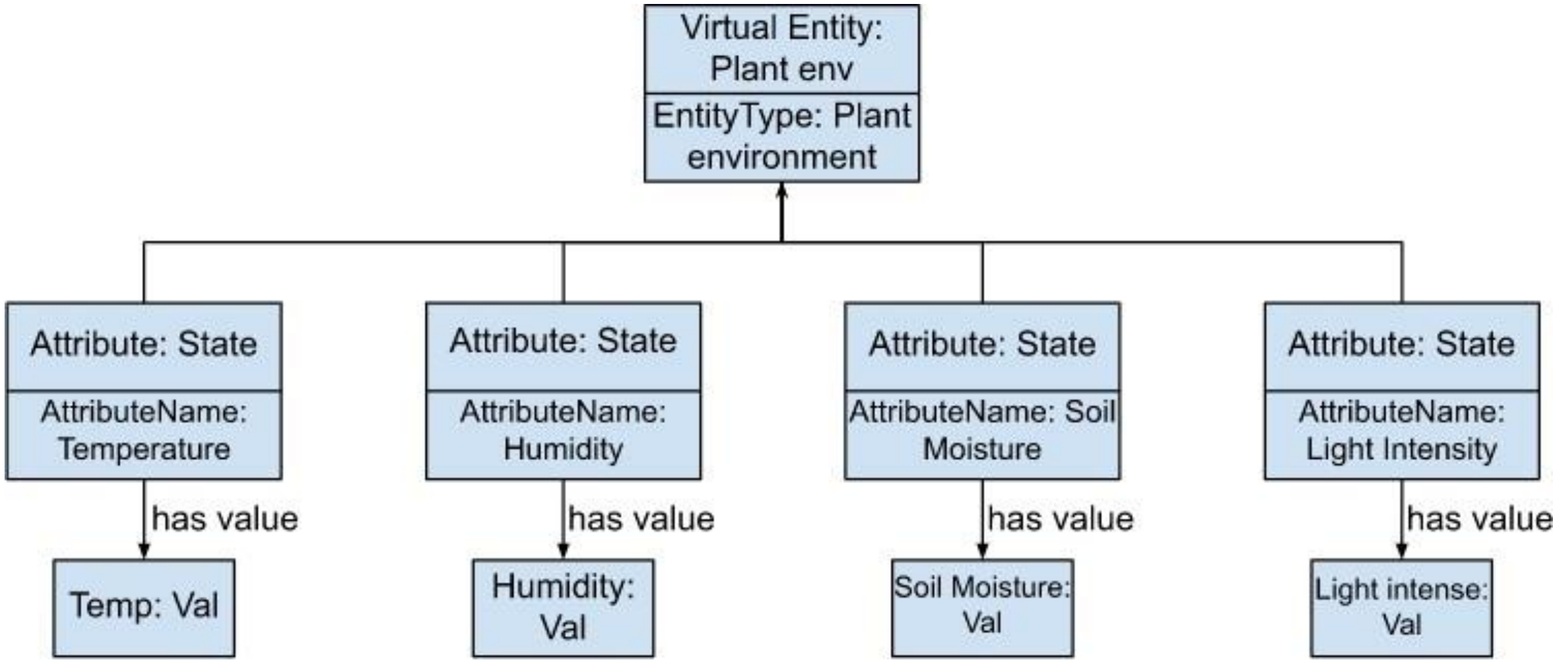
Process Model Specification



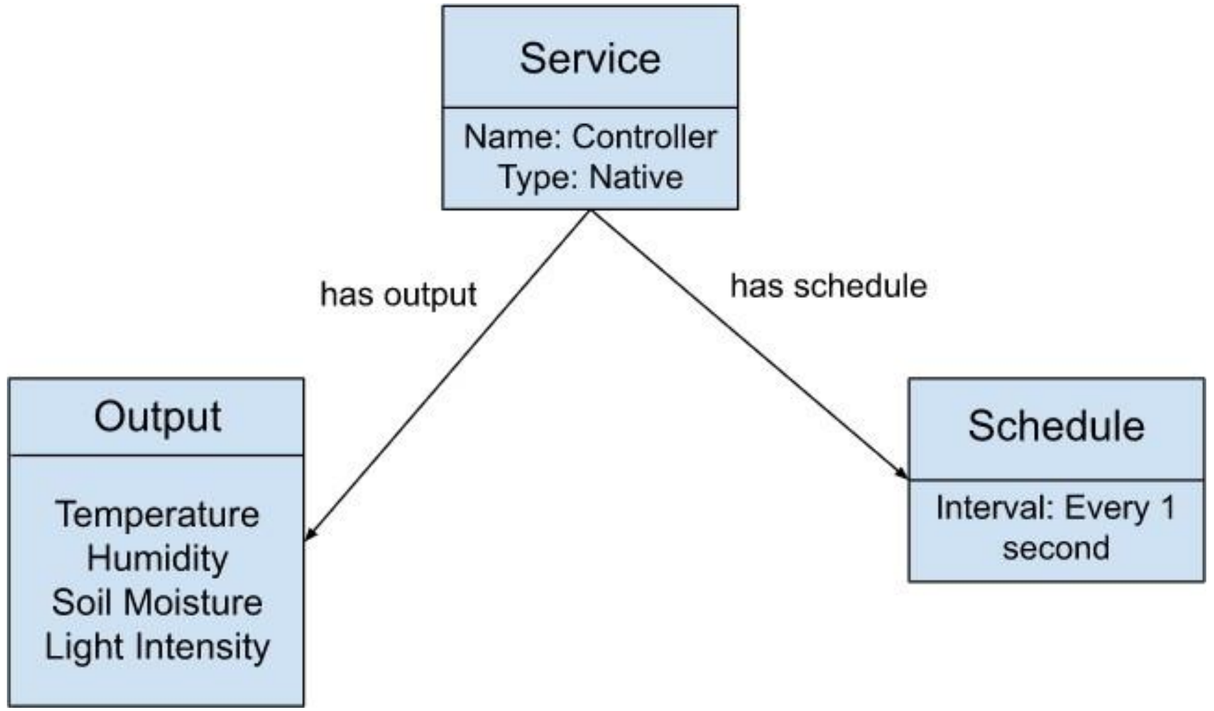
Domain Model Specification



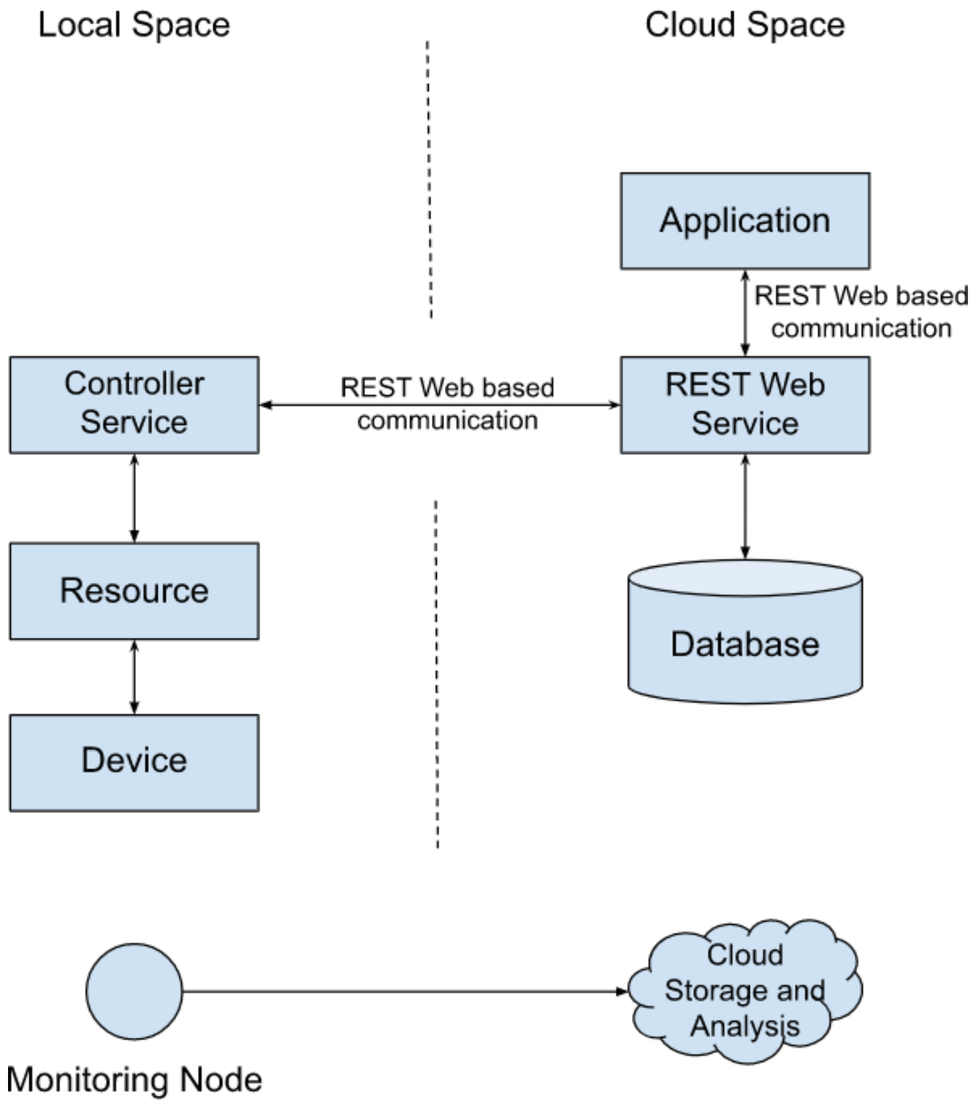
Information Model Specification



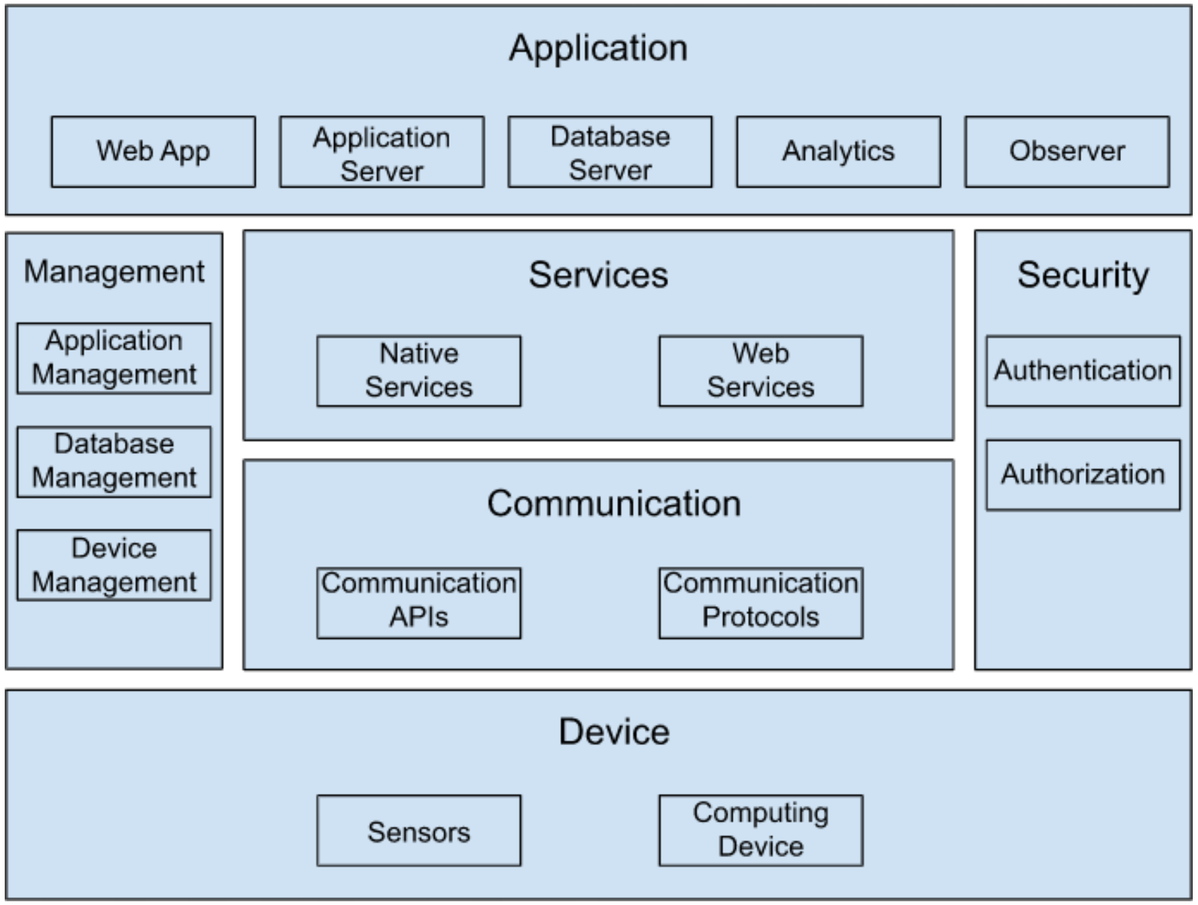
Service Specifications



IOT Level Specification



Functional View Specification



Operational View Specification

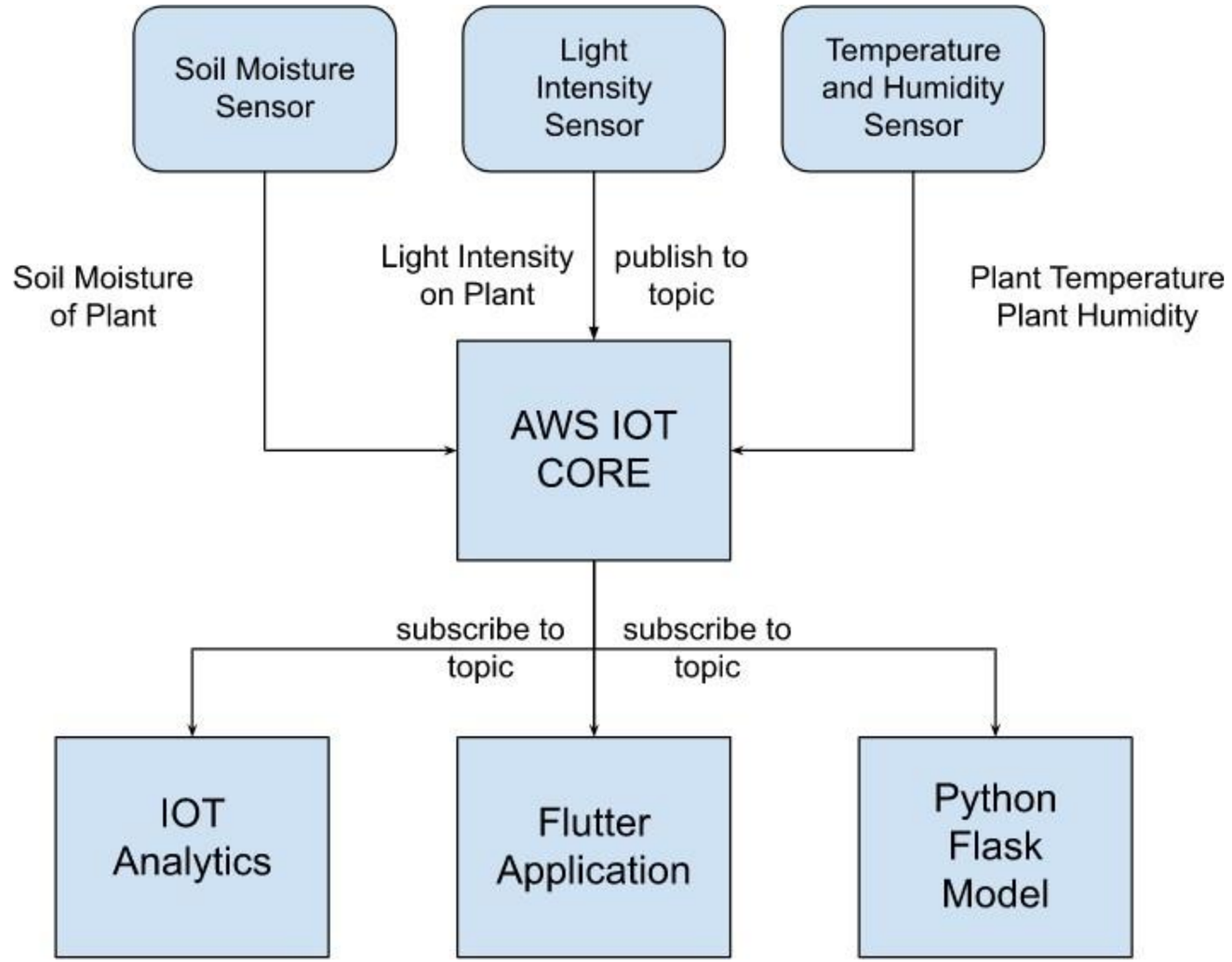
- Native Service: Controller Service
- Web App: Flutter App
- Application Server: Flutter Server
- Database Server: Lively Cloud Storage
- Analytics: Python
- Observer: Cloud App, Mobile App
- App Management: Flutter App Management
- DB Management: AWS DynamoDB Management

Operational View Specification

- Authentication: Web App
- Authorization: Web App
- Device Management: NodeMCU and ESP8266 Management
- Communication APIs: REST APIs
- Communication Protocols:
  - Network Layer: IPv6
  - Transport: TCP
  - Application: HTTP
- Computing Device: NodeMCU, ESP8266
- Sensor: Temperature, Humidity, Soil Moisture, Light sensors

Application Development

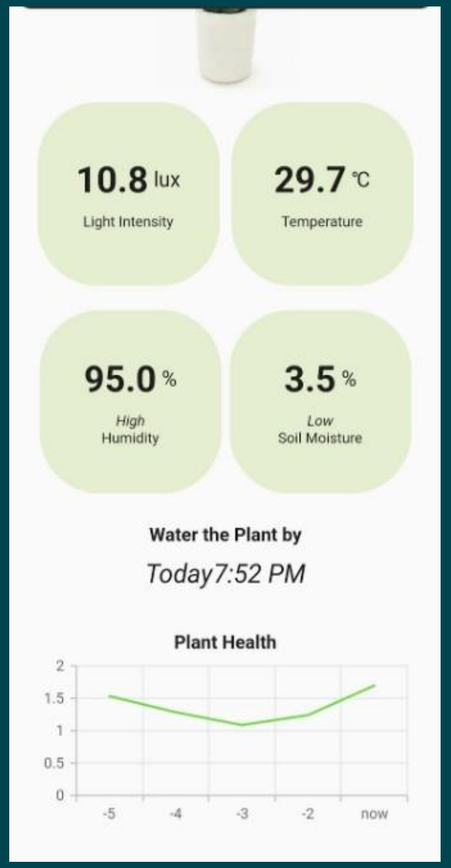
Block Diagram of the System



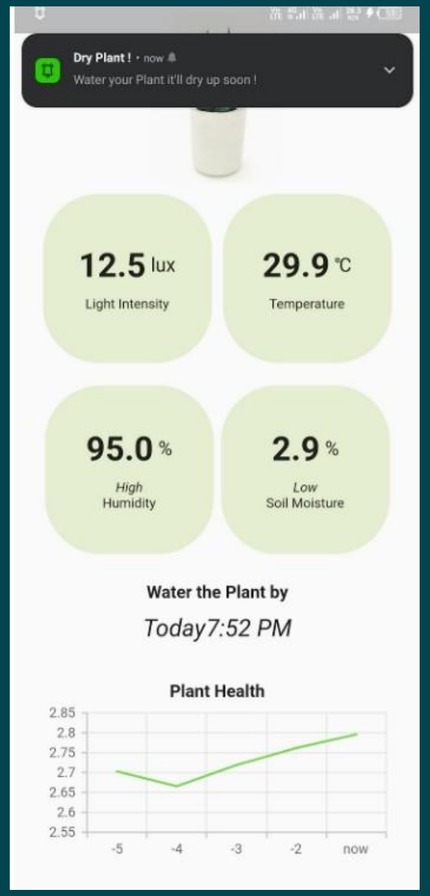
User Interface Modules:

1. **Home Page:** Created the landing page for our application.
2. **Local Page:** Alerts the user by showing them notifications on watering the plant based on their date and time of the mobile application.
3. **NotfiScreen Page:** Created a function to make the UI of the notification to be shown to the user.
4. **PlantScreen Page:** To display the sensor readings and display a graph depicting the health of the plant. Also showing them the date and time to water the plant.

User Interfaces



Main Page



Notification Alert

Cost Estimation

NodeMCU Board	₹380
Soil Moisture Sensor Board	₹90
DHT11 Sensor	₹140
BH1750 Sensor	₹190
Total	₹800

Future Scope

- Adding rotation shield with motor for automatic shade in times of intense sunlight
- Adding a water pump which automatically waters when the soil moisture is below the threshold.
- Inserting a NPK sensor in the soil to monitor the quality of the soil.

References

1Pawar, P., Gawade, A., Soni, S., Sutar, S., & Sonkamble, H. (2022, May 31). IOT Based Smart Plant Monitoring System. International Journal for Research in Applied Science and Engineering Technology, 10(5), 505–510. https://doi.org/10.22214/ijraset.2022.42194

2 Wang, Miss. (2018). Advanced Multivariate Time Series Forecasting Models. Journal of Mathematics and Statistics. 14. 253-260. 10.3844/jmssp.2018.253.260.

Thank You

Let's move on to the demonstration