SUP'COM
Higher School of Communication of Tunis

Design statement: Hydroponic Tomato Farm Monitoring and Management System - Smart Hydro

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1 General overview

The agricultural environment is essential to sustaining life, and protecting it is key to ensuring a healthy and productive ecosystem. However, agriculture faces numerous challenges, such as crop diseases and environmental stressors, which can have a significant impact on crop yields and food security. Traditional methods of manually monitoring crop health are labor-intensive and often inefficient, especially in large-scale agricultural settings. These methods may miss early indicators of plant health issues, resulting in delayed interventions that can harm crop quality and productivity. Therefore, there is a need to develop an intelligent hydroponic farming management system that leverages IoT and cloud-based technologies to provide real-time monitoring and alerts on plant health.

This project aims to offer the following functionalities:

Continuous monitoring of key environmental parameters (temperature, humidity, nutrient levels) and crop health. Alerts to users when sensors detect conditions that could negatively impact plant health. Location-based notifications to guide users to affected plants and prompt timely interventions, optimizing farm management and enhancing crop yield.

2 Use case diagram

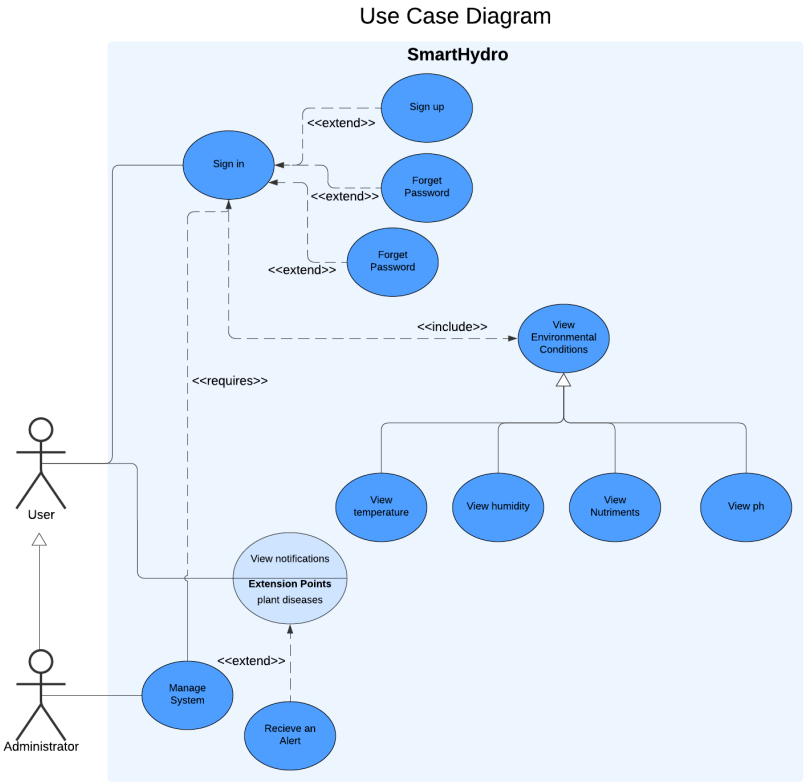

Figure 1: Use Case Diagram.

The advanced hydroponic farming management system features two main actors: farm administrators and users. Figure 1 illustrates the use case diagram for both of these actors: For each actor correspond a specific use case of the system:

- For Farm Users: Their role consists of creating an account and accessing the Progressive Web Application (PWA) to monitor environmental conditions such as temperature, humidity, pH, and nutrient levels for tomato crops. They can also receive alerts through the application if any environmental condition reaches critical thresholds or if any disease is detected in the crops. Additionally, they can view historical data and insights to optimize crop yield.
- For the Administrator Team:

  Their role consists of maintaining and managing the functionalities of the application, including user accounts, sensor integrations, and machine learning model updates.

3 Class diagram

A class diagram clearly represents the structure and different components of a system to help view the application. The figure below showcases the class diagram of the IOT system:

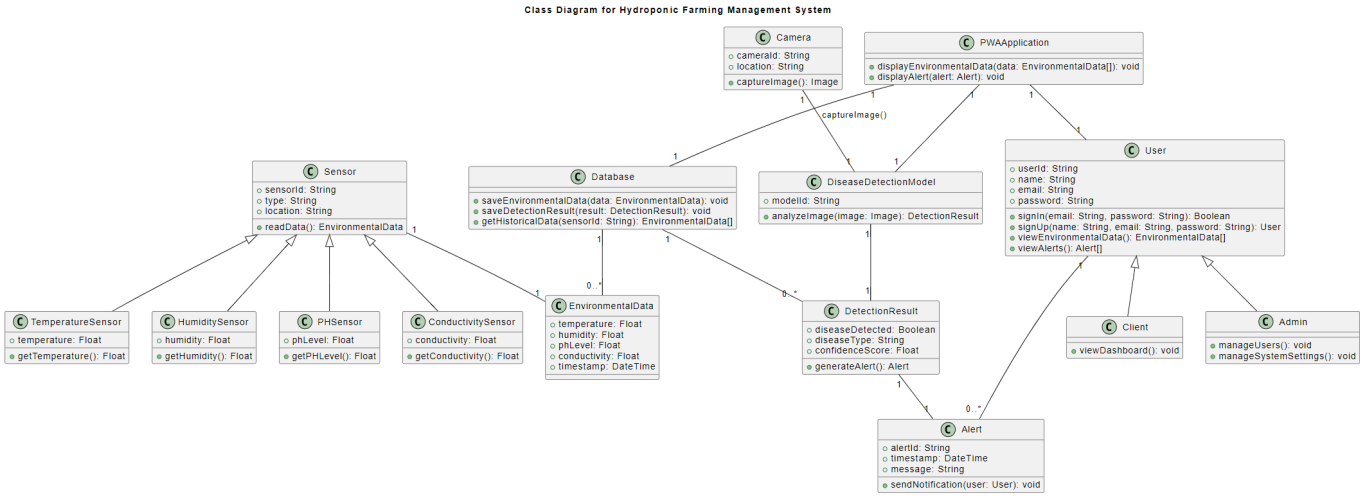

Figure 2: Class Diagram.

4 Deployment diagram

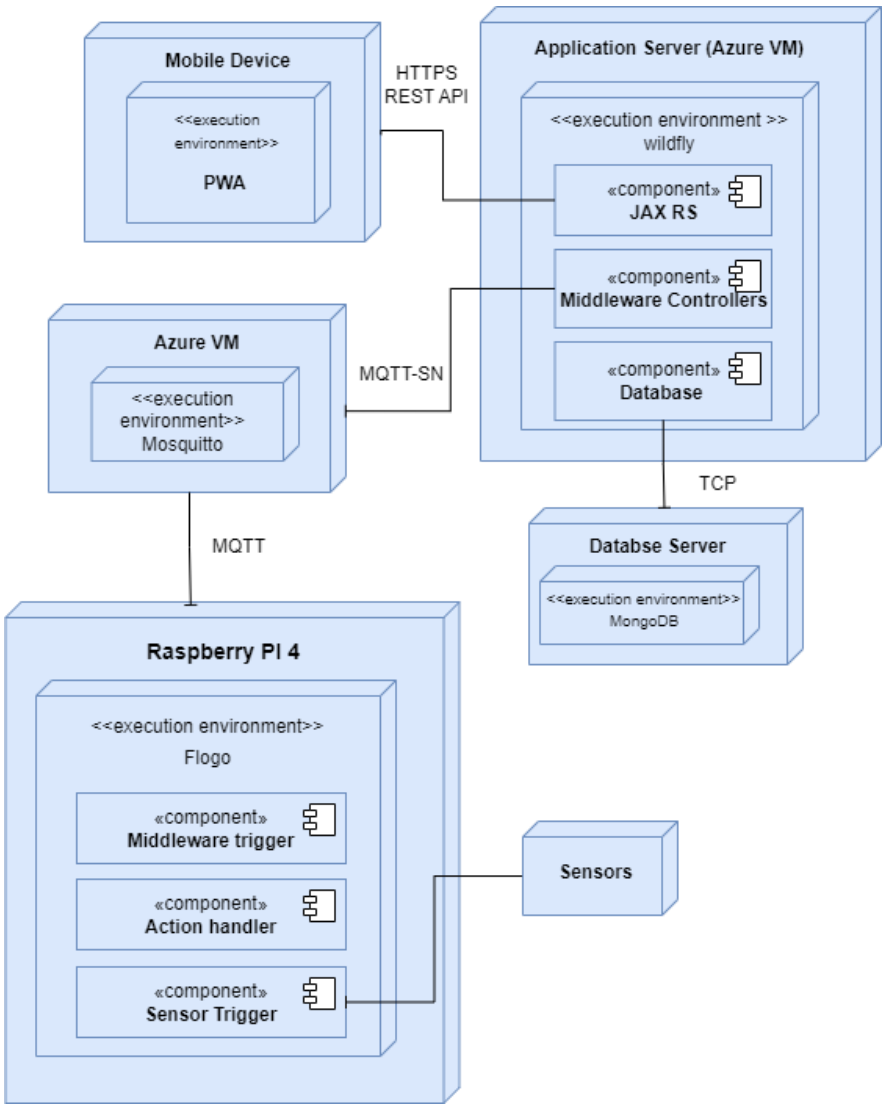

Figure 3: Deployment Diagram.

A deployment diagram is an UML diagram for visualizing the hardware components and devices, the links of communication between these different components and the software files on that hardware. Figure 4 highlights the deployment diagram for SmartHydro

5 Sequence diagram

This sequence diagram illustrates the process of monitoring environmental conditions and detecting diseases in crops. IoT sensors send environmental and image data, which is transmitted via an MQTT broker to Jakarta EE middleware for storage and analysis; alerts are triggered if disease symptoms are detected.

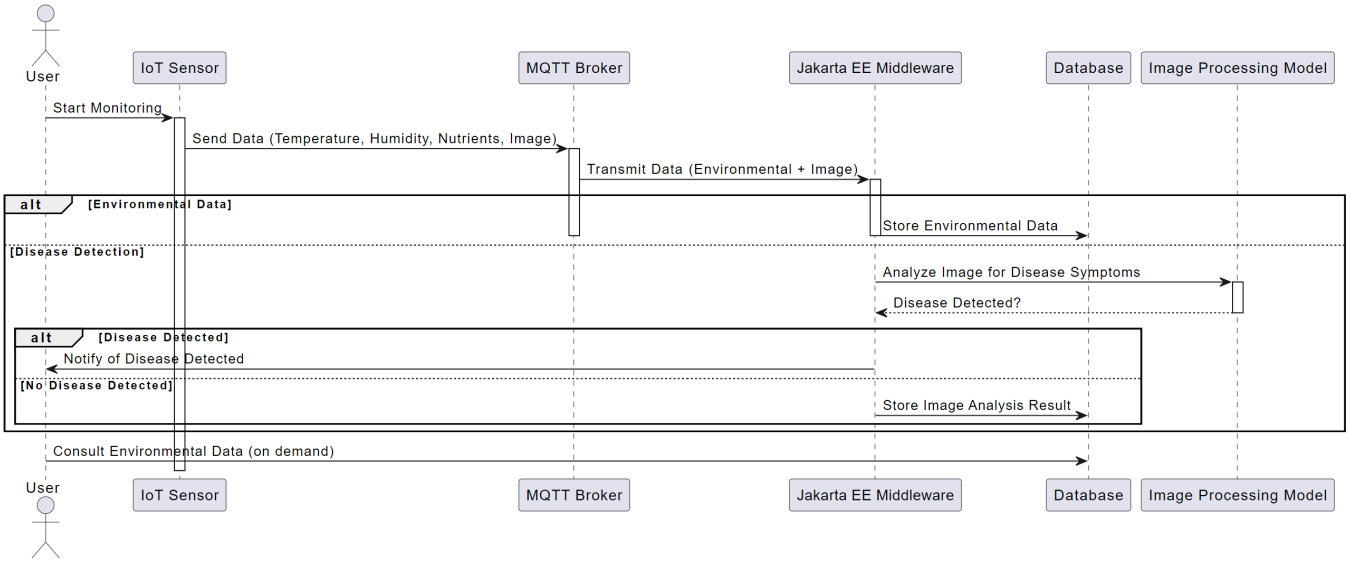

Figure 4: Sequence Diagram.