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Smart Garbage Monitoring System

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1 General overview

The natural environment plays a quintessential part of our lives. Therefore, keeping it safe is a mandatory duty in order to live on a comfortable and healthy planet. However, the environment keeps facing issues such as pollution which have a noticeable impact on the ecosystem. Large cities are the biggest victims of this phenomenon. The rising population in these cities means more human waste that becomes harder and harder to manage. The traditional way of manually monitoring the garbage level has not been efficient in many cities around the world and has not yielded good results as the waste keeps piling up, and thus, becoming harmful to the environment. For that reason, it is necessary to develop a smart garbage monitoring system utilizing Cloud of Things technologies to notify the users of the the level of trash in each garbage can and optimize the path to clean the city. This project aims to provide the following functionalities:

- Detect and display the level of waste in garbage cans.
- Alert the user when the level detected exceeds the threshold set up beforehand.
- Provide the best path to clear all the garbage cans using geographic coordinates.

2 Use case diagram

The smart garbage monitoring system has two actors: the municipality and the administrators. Figure 1 demonstrates the use case diagram for both these actors:

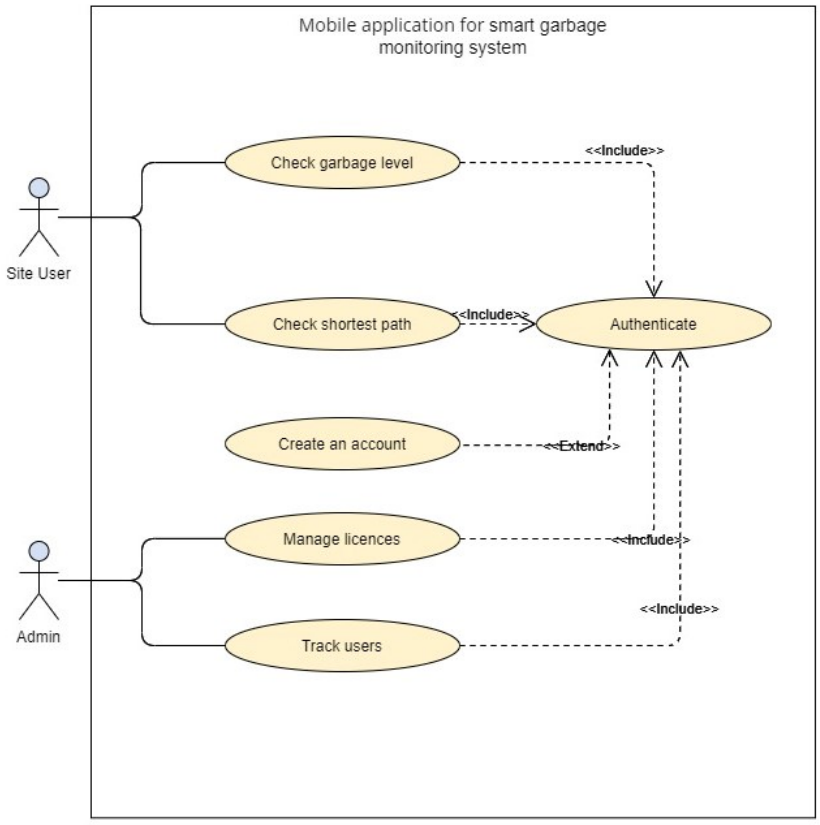

Figure 1: Smart garbage monitoring system use case diagram

For each actor correspond a specific use case of the system:

- For the municipality users, their role consists of creating an account and accessing the mobile application to visualize the garbage level and the shortest path to clean the city.
- For the the administrator team, their role consists of maintaining and managing the functionalities of the application.

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:

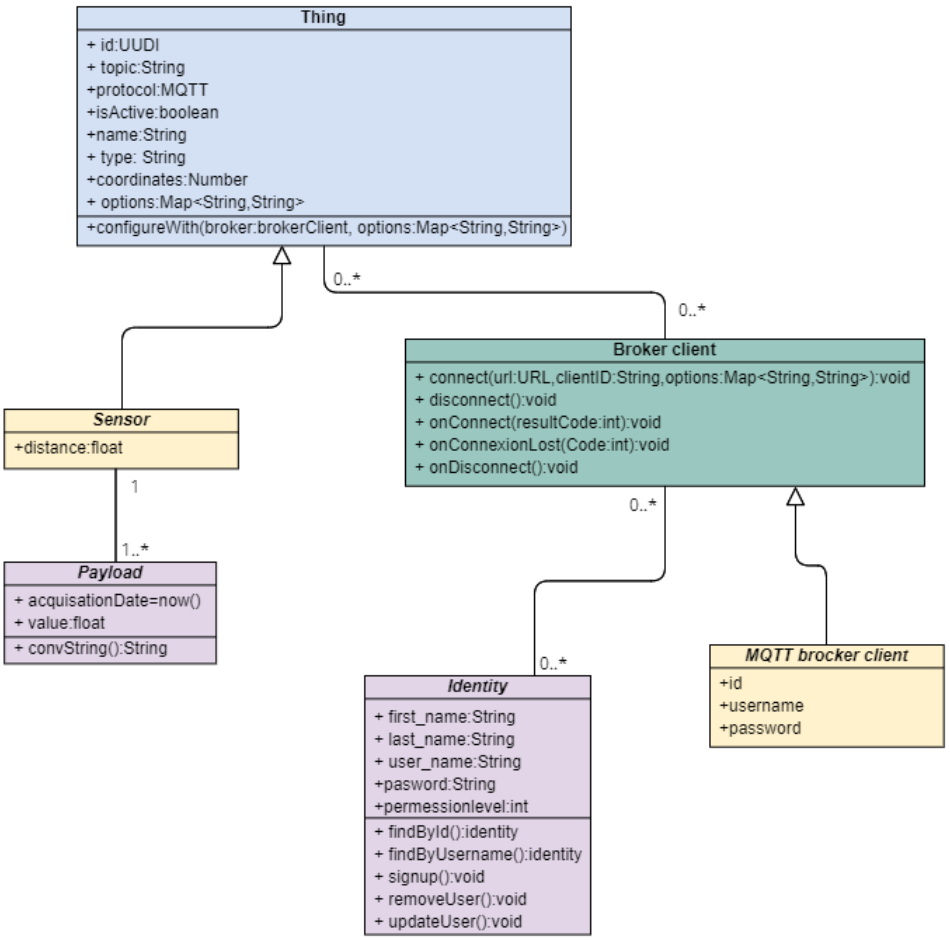

Figure 2: Class diagram

Sensors capture the information and communicate with each other via the broker. Communication is established through topics using MQTT protocol publish and subscribe method.

4 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 3 highlights the deployment diagram for the smart garbage monitoring system:

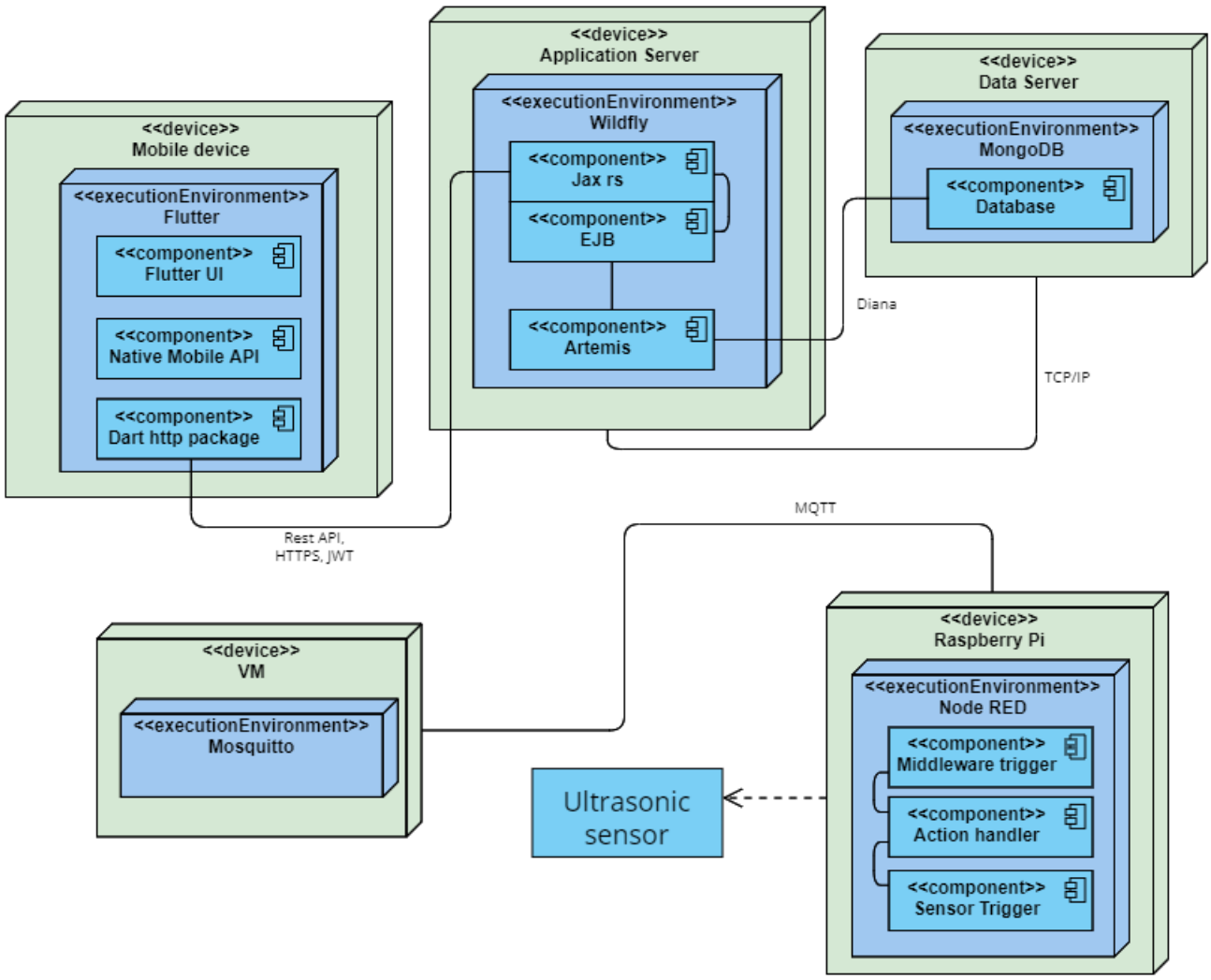

Figure 3: Smart garbage monitoring system Deployment diagram

As illustrated by the diagram, the application server which is composed of Jakarta EE and Jax RS takes charge of all communications between the different components. The MQTT broker mosquitto, the database MongoDB and the application server will all be hosted on a virtual machine on cloud. The electronic card sends data to the server via the Mosquitto broker. Finally, Rest API and security mechanisms such as JSON web token, HSTS and Oauth2 will be used between the mobile device and the server.