



WEB OF THINGS PROJECT  
Design Document

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# Smart Trash bin Monitoring System

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# 1 General Introduction

Over 50% of the world's population now lives in cities, and the figure is set to rise to 75% by 2050. While the world's cities only cover 2% of the global land area, they account for a staggering 70% of greenhouse-gas emissions and share the burden of responsibility for global climate change. The problem we are facing is of the population, which is rising rapidly. In recent years, urban migration has skyrocketed. This has resulted in the rise of garbage waste everywhere. Dumping of garbage in public places creates a polluted environment in the neighborhood. It could cause a number of serious diseases to the people living around. atmosphere, health issues, extra collection costs and cleaning services.

## 2 Objectives

This project proposes an IoT-based smart system for efficient waste management, addressing the challenges associated with traditional methods. The system employs innovative sensory technologies to assess the fill levels of dustbins, optimizing the waste collection process. The essence of this approach lies in its ability to analyze past waste generation and fill level trends, which, in turn, optimizes collection routes, reduces fuel expenditures.

- **Efficient Garbage Monitoring:** Develop a system that efficiently monitors the fill levels of garbage bins to ensure timely waste collection.
- **Optimize waste collecting :** Utilize machine learning algorithms to predict peak waste accumulation hours based on historical data and real-time fill level information. This predictive analysis will enable proactive planning, allowing for the allocation of extra workers during peak times, such as holidays ensuring timely and efficient waste collection.
- **Real-time Data Communication:** Implement a reliable data communication mechanism to ensure real-time updates and alerts for fill level data.
- **Scalability:** The network should be salable, which means we could add new garbage containers to the IoT network's system easily.
- **User-Friendly Interface:** Create an intuitive hybrid Mobile interface that enables system administrators to manage and monitor the garbage monitoring system and provides end-user.

## 3 Use Case Diagram

The use case diagram preresents 2 major actors :

- Municipality workers and administration, their role consists of creating accounts , checking bin's status and viewing map to reach the nearest full bin .
- Admin who are responsible for maintaining and managing the fonctionnalities of the PWA.

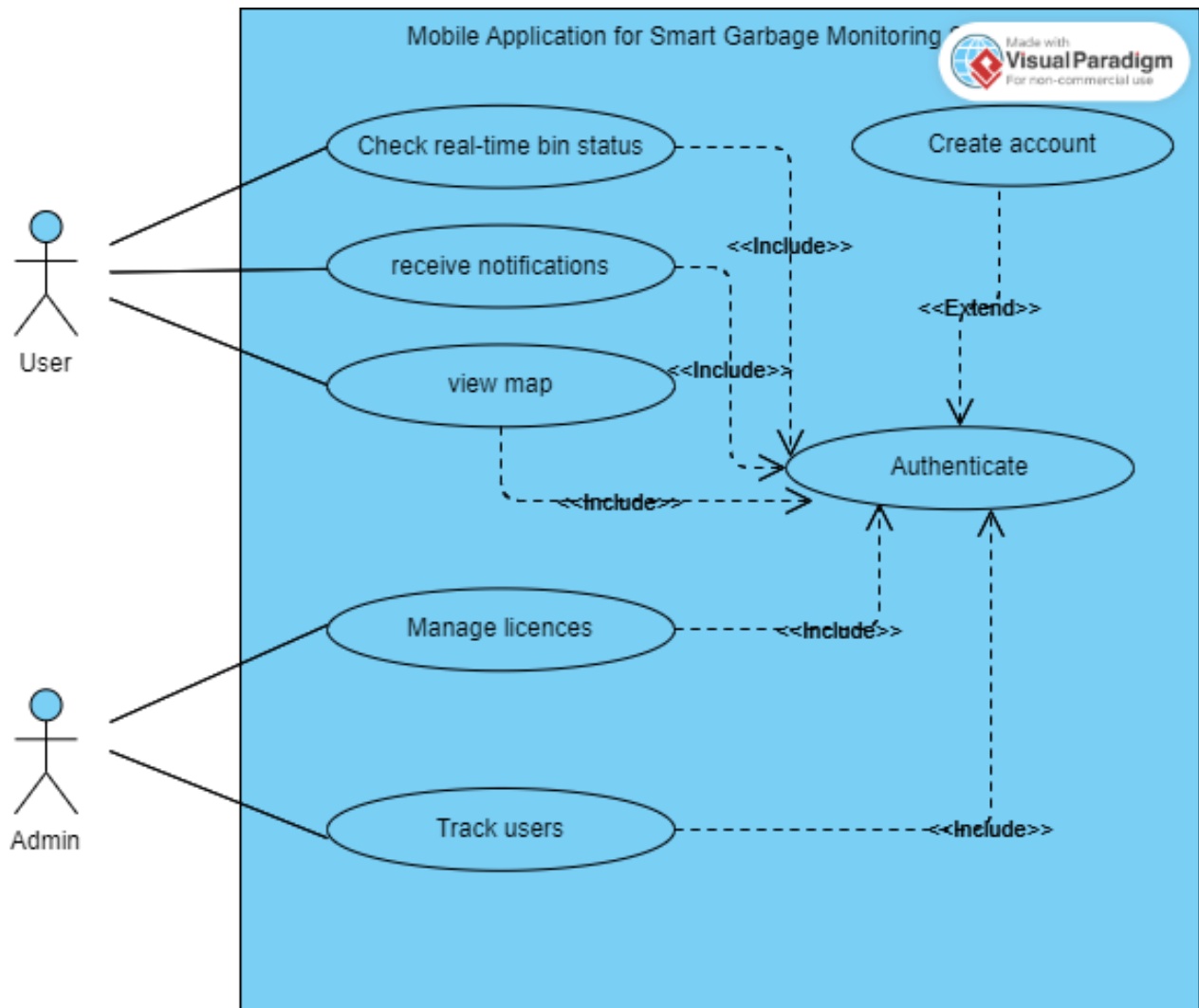


Figure 1: USECASE Diagram

## 4 Class Diagram

A class diagram shows the different components of the IOT network. Things capture data and send it to MQTT broker for specific topics, a broker who handles communication via publish/subscribe protocol.

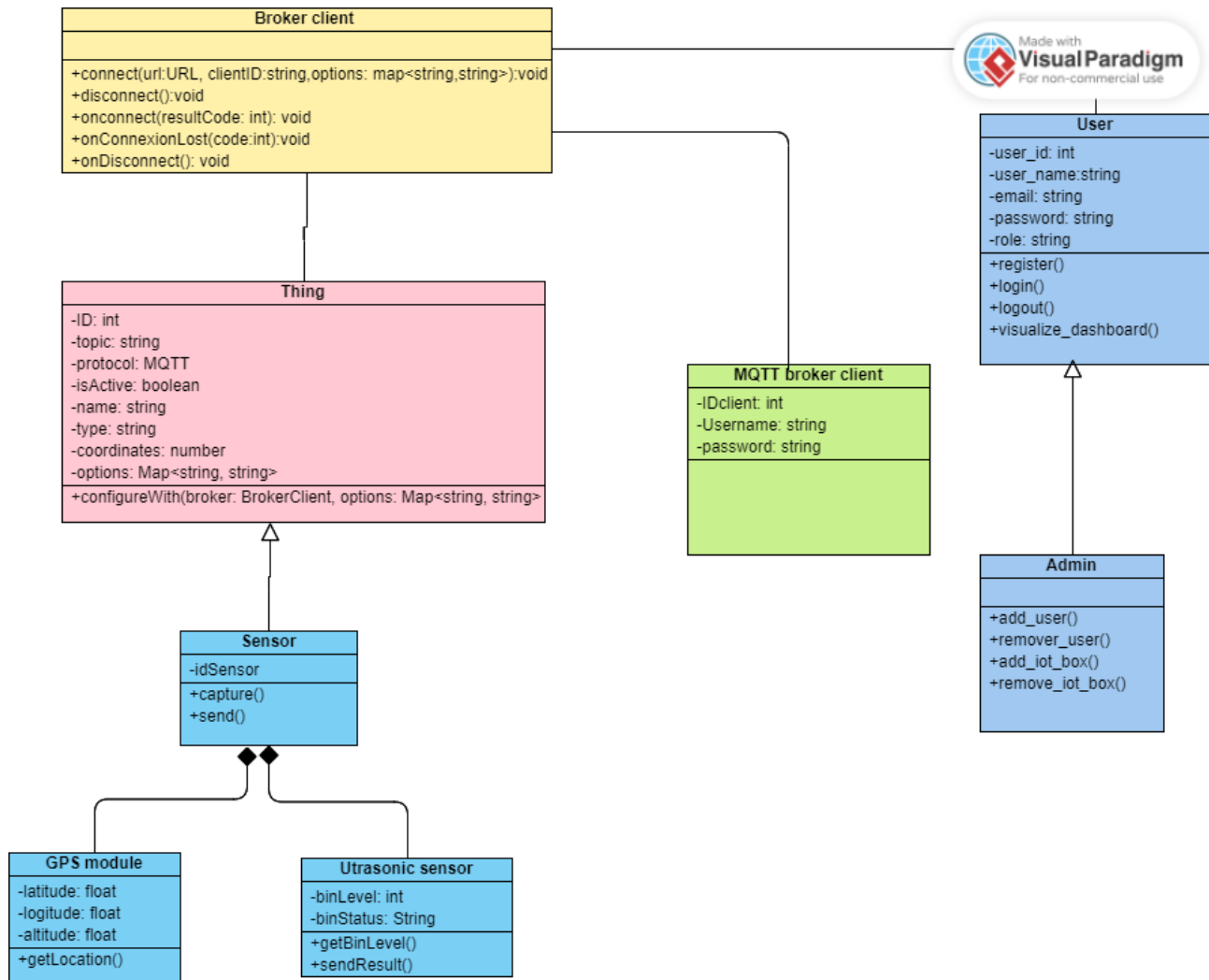


Figure 2: Class Diagram

## 5 Deployment Diagram

The deployment Diagram visualizes the physical deployment of software components to nodes such as hardware devices or servers.

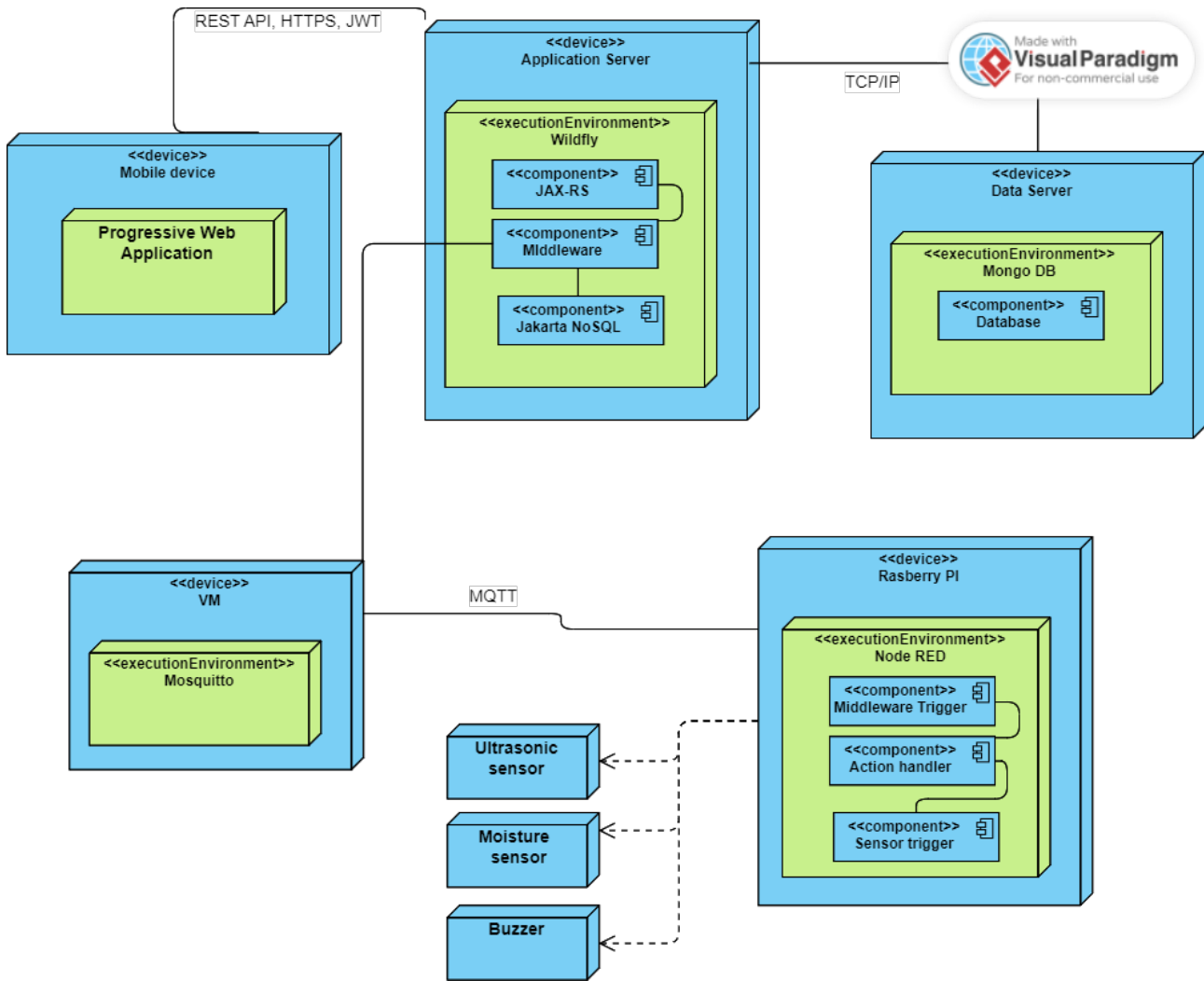


Figure 3: Deployment Diagram

This architecture shows a Jakarta EE application server, WildFly, serving as the application server. It is responsible for processing requests, interacting with databases, and managing the overall application behavior. MongoDB is used as the database server, and the communication between electronic devices and the server is facilitated by the Mosquitto broker.

## 6 Sequence Diagram

This diagram shows the flow of data between the Raspberry Pi, which collects the data from sensors (ultrasonic, GPS module) and sends them to MQTT server. An authorization server adds a complementary layer of security in order to enable data confidentiality.

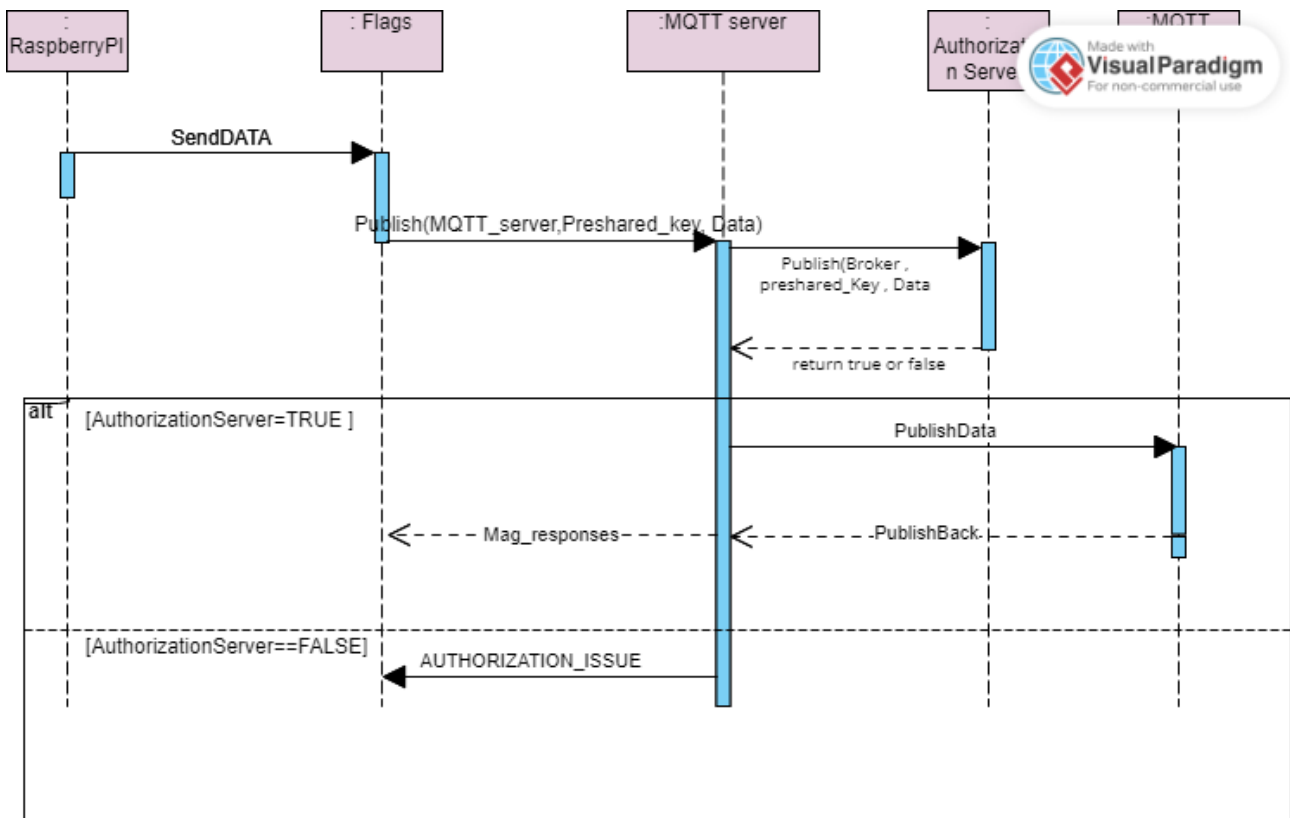


Figure 4: DeploymentDiagram