



Waste Management System

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Introduction

Overflowing garbage bins have become an increasingly pressing issue in urban areas, particularly in densely populated neighborhoods. The current process for collecting these bins is highly inefficient, as it does not always indicate when a bin is full, and garbage trucks typically only pick them up once per day. The idea behind this project is to provide real-time information to garbage collection companies, allowing them to monitor the fill-level of each bin in the city. This information will be collected by sensors on the bins and sent to a server, where it will be aggregated and displayed on an interactive map.

Problem Statement

Our goal in this project is increasing the efficiency of the process of collecting garbage bins.

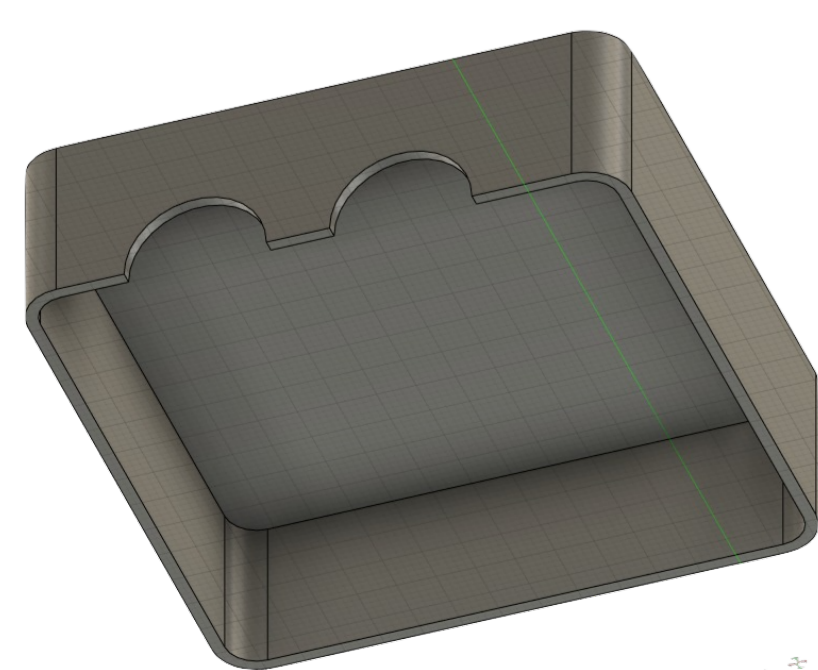
Constraints

- Time to produce the project
- Budget.

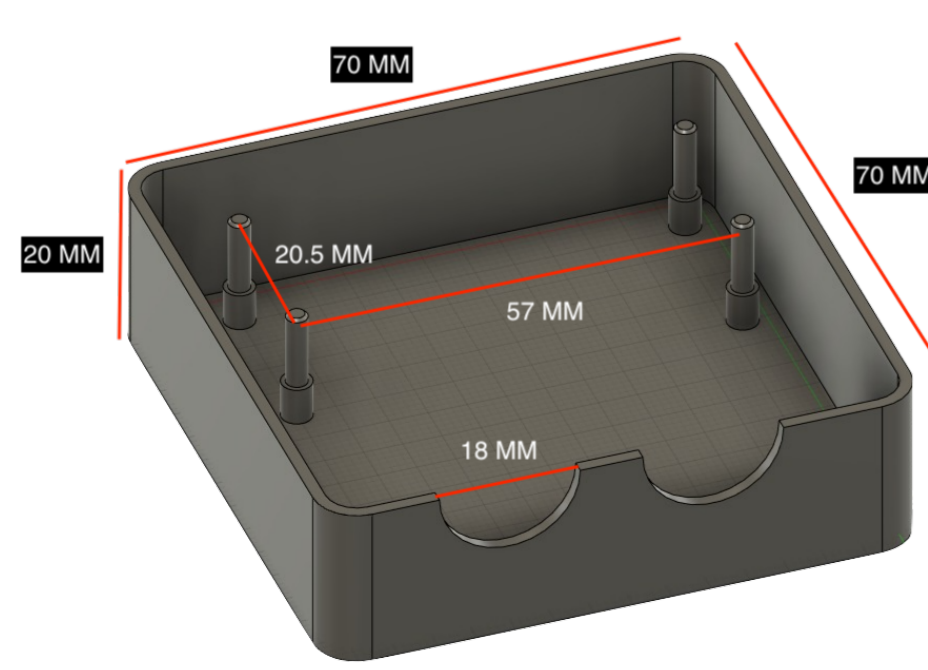
Target Specifications

- Steps of Installing (< 5 Steps).
- Setup & Calibration Time (< 5 Minutes).
- Cost (< 600 SAR per device).
- Fill-Level Scan Period (<= 3 Hours).
- Location of Bins (within 5 Meter).
- Power Consumption (< 1 watt).

3D Design

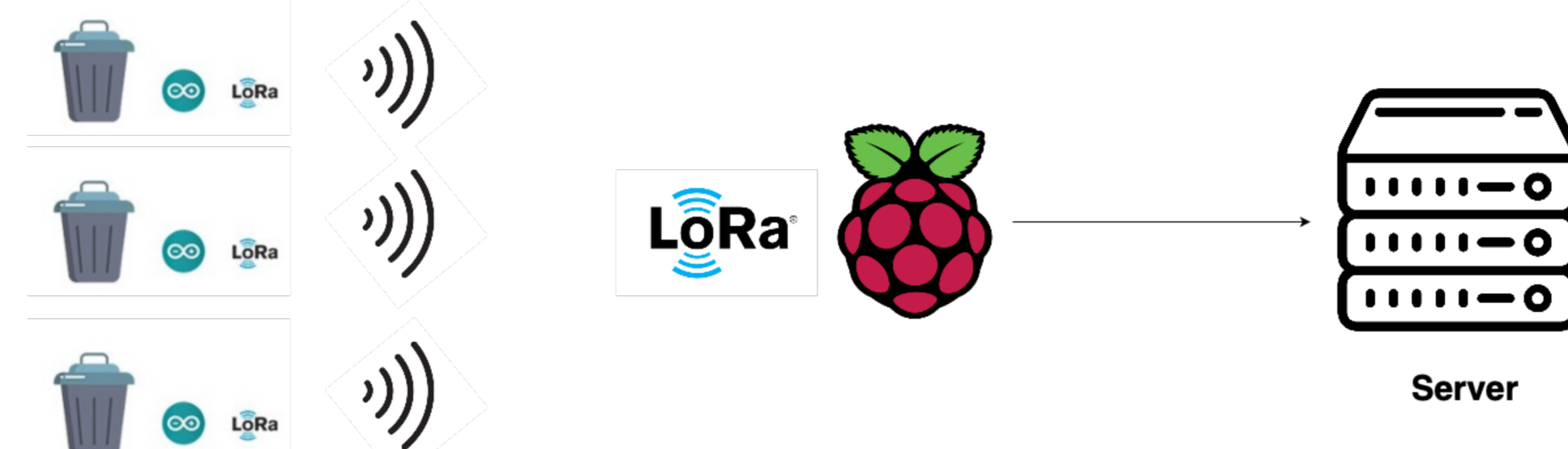


Top 3D Design



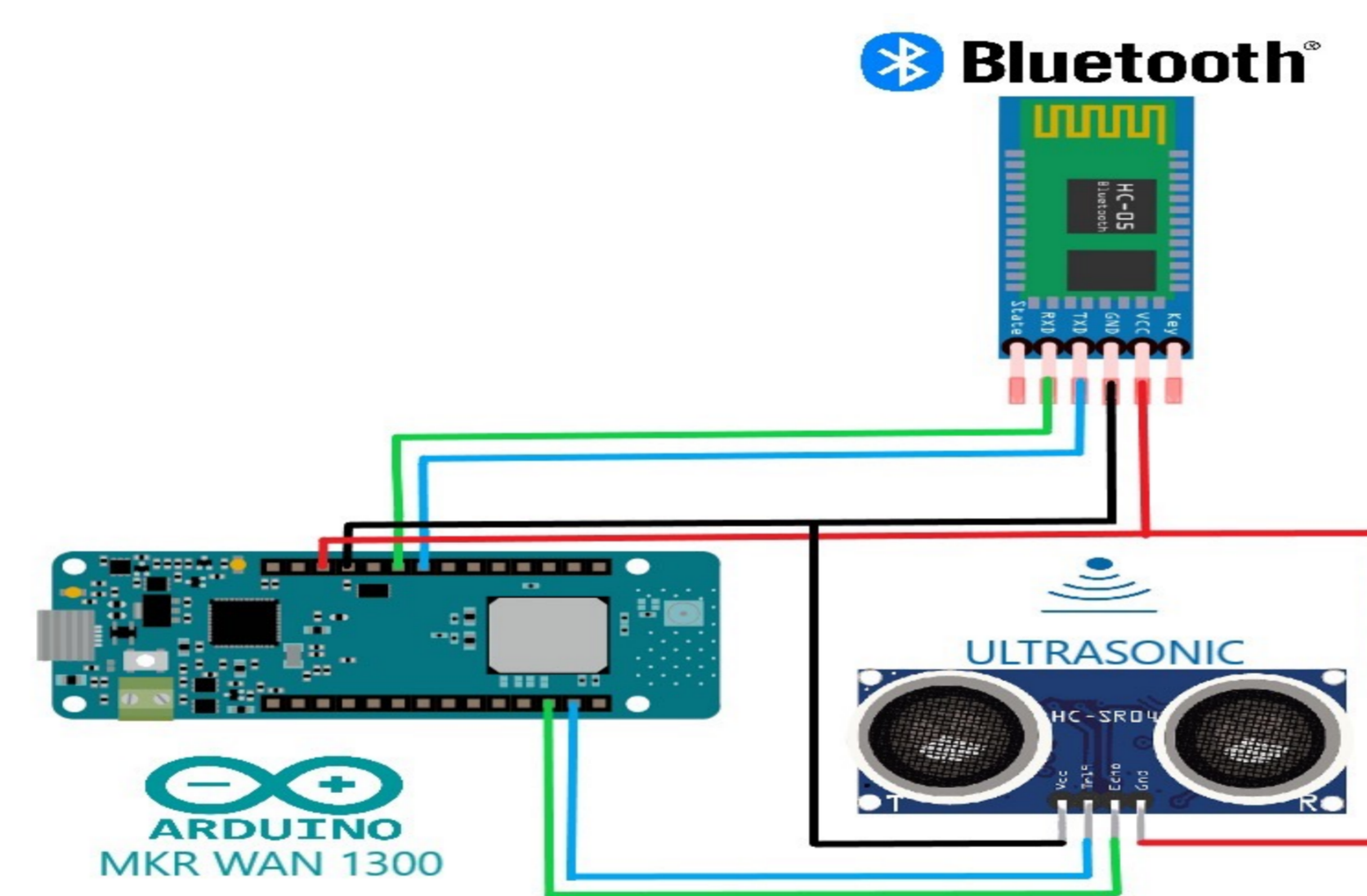
Base 3D Design

System Architecture



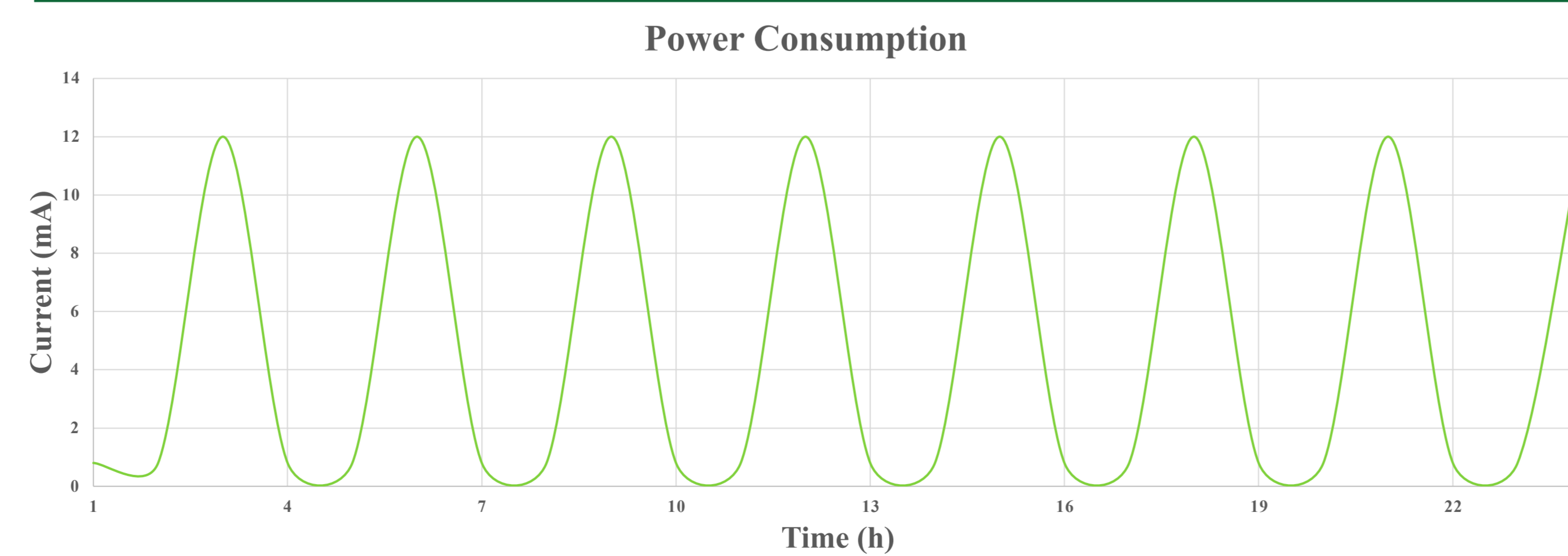
The device will check the fill-level periodically. If it reaches a certain cutoff, it will send the reading to the network server through the gateway. After that, the network server will forward it to the application server.

Circuit Schematic



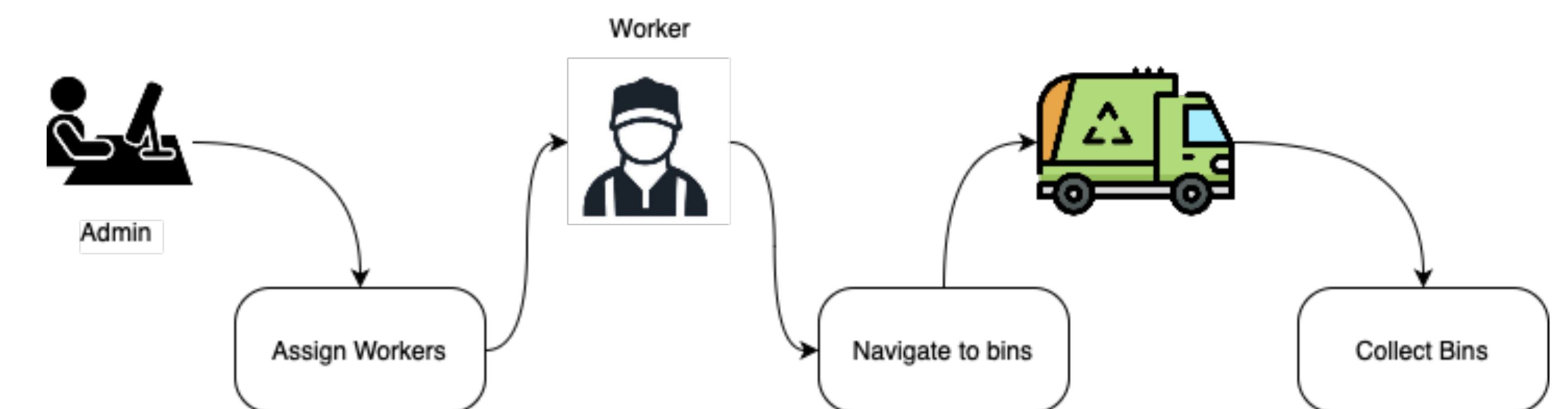
A schematic showing in components inside the device which will be attached to the bin. It consists of a Bluetooth module to receive the location during the setup, an ultrasonic sensor to measure the fill-level, and an Arduino MKR WAN 1310 to control the sensor and send the data.

Power Consumption Calculation

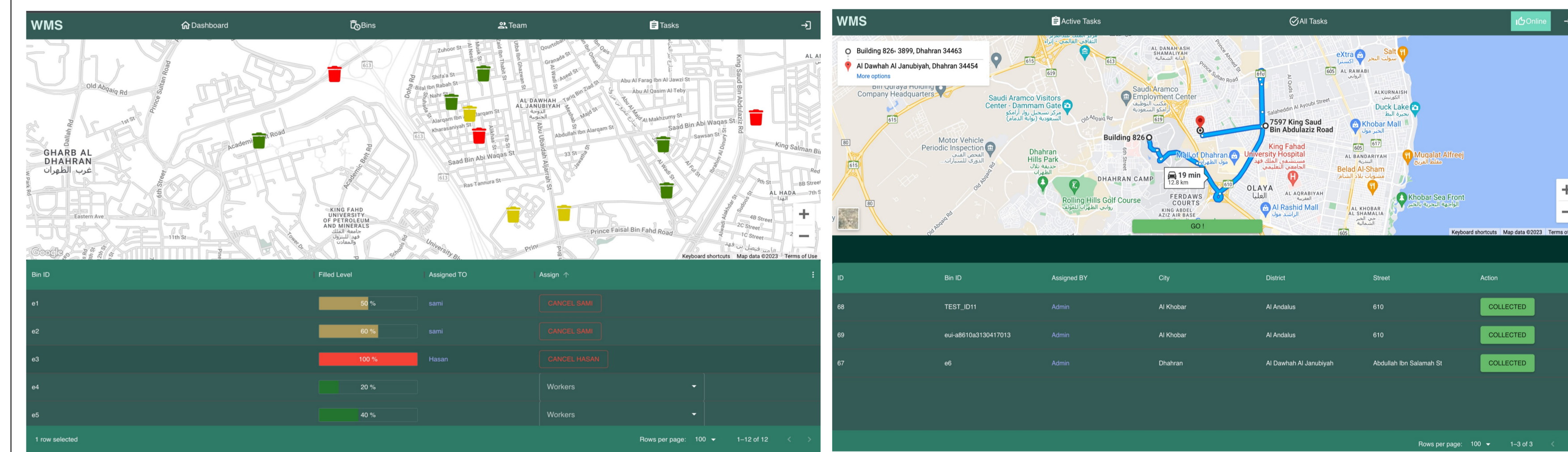


Calculation: assuming the device sends data 8 times per day, each transmission takes 2 seconds on 12 mA. For the rest of the day, it sleeps while consuming 0.8 mA. On average it consumes 19.25 mAh per day.

Process Workflow



The admin gets the information of bins' waste level with the help of the sensors attached to the bins, then admin has the ability to monitor and observe all the bins, which later he can assign certain workers to collect the filled bins. Moreover, the workers could see the bins assigned through a web app and navigate to bins' locations through an API that is already installed in the app.



Admin Page

Worker Page

Validation

- **Steps of installation** : The installation process comprises four steps, namely cleaning, mounting, sending the location, and verifying connectivity.
- **Setup & Calibration Time:** The entire sequence of these steps was completed within four minutes.
- **Cost:** the total cost of components from suppliers like Mouser and Alibaba is around SAR160. Assembly and packaging cost shouldn't exceed SAR400
- **Location of bins:** The system will use Google Maps to acquire the location with high accuracy.
- **Scan Period** : The system operates with a scan period of three hours.
- **Power Consumption:** The system uses components optimized for low power consumption. The device consumes an average of 19.25 mAh per day. Assuming 7000 mAh battery is used, it can last for up to 1 year.

Conclusion

We have successfully achieved our goals by designing a low-cost, low-power device that collects fill-level data and a web application that manages the process of waste collection in a more efficient manner than the current system