Final Report

## 1.0

# Smart Bin

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# Introduction

In urban areas, the problem of overfilled waste containers is a significant environmental and health concern. Overfilled containers can lead to unpleasant odors, attract stray animals, and create conditions conducive to the spread of infections. In response to these issues, we have developed an innovative solution designed to optimize waste collection processes and maintain cleaner urban environments.

# Project Overview

Our project focuses on the implementation of a smart waste management system utilizing IoT technology. The core of our solution is a sensor system that monitors the fill level of waste bins and reports this data to a centralized software platform. This system aims to streamline waste collection schedules, reduce overflow incidents, and ultimately improve the cleanliness and health standards in urban areas.

# Technical Implementation

The solution comprises two primary components: the sensor hardware and the data transmission system.

## Sensor Hardware

- Ultrasonic Sensor: We use an ultrasonic sensor to measure the fill level of the waste bins. This sensor provides accurate distance measurements, allowing us to determine the amount of waste in the bin.

- PIR Sensor: To enhance efficiency, a PIR (Passive Infrared) sensor is incorporated to detect movement. The fill level measurement is triggered 30 seconds after the PIR sensor detects movement near the bin. This approach helps to avoid unnecessary data transmission and keeps the database lightweight by sending only relevant measurements.

## Data Transmission

- ESP8266 Microcontroller: Data collected from the sensors is transmitted wirelessly using the ESP8266 microcontroller. This microcontroller is equipped with Wi-Fi capabilities, enabling real-time data transmission to our software platform.

# Advantages and Benefits

The implementation of our smart waste management system offers several advantages:

- Dynamic Monitoring: The combination of ultrasonic and PIR sensors ensures that the system only sends data when necessary, reducing the amount of data processed and stored.

- Environmental Impact: Reducing the incidence of overfilled bins contributes to a cleaner urban environment, minimizes unpleasant odors, and reduces the attraction of stray animals.

- Scalability: The system is designed to be scalable and can be deployed across various municipalities in the Western Balkans, improving waste management practices in multiple regions.

# Future Prospects

Our prototype demonstrates the feasibility and effectiveness of smart waste management. Moving forward, we envision several enhancements and expansions:

- Integration with Municipal Systems: Collaborating with municipalities to integrate our system into existing waste management infrastructure.

- Data Analytics: Implementing advanced data analytics to predict waste generation patterns and further optimize collection schedules.

- GPS Tracking: Adding GPS tracking to waste collection trucks to improve route efficiency and reduce operational costs.

# Conclusion

Our Smart Bin project represents a significant step towards modernizing waste management practices in urban areas. By leveraging IoT technology, we provide a solution that not only addresses the immediate issues of overfilled waste containers but also lays the groundwork for more efficient and sustainable waste management in the future. We are confident that our system will benefit municipalities by enhancing cleanliness, reducing health risks, and optimizing resource use.

# Open Source Code

The configuration code for the microcontroller with the sensors, as well as the data transmission code, is available as open source. You can access the complete code and documentation at the following link:

Link: <https://github.com/artinrexhepii/smart-bin>

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# Our team

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