Final Year Project (Computer Science)

UMS UNIVERSITI MALAYSIA SABAH — FACULTY OF COMPUTING & INFORMATICS / FAKULTI KOMPUTERAN DAN INFORMATIK

GARBAGE DETECTION SYSTEM WITH GARBAGE LEVEL PREDICTION USING MACHINE LEARNING IN IOT

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ABSTRACT

There has been a rise in the development of waste in recent years, particularly in university hostels, where there are limited number of bins and shared among all the students. Due to the spillover of waste in the hostel area, the contaminated condition may trigger various serious diseases in the surroundings. This project proposes a Garbage Detection System with Garbage Level Prediction using Machine Learning in Internet of Things (IoT) where the system would measure the current level of waste in all garbage bins available around the area and notify the hostel management to collect the waste whenever the bin is loaded. The machine learning model will be required to learn and predict the waste that will be produced in the future. The methodology that will be used in this project is iterative and incremental model. Through this project, manual monitoring will not be needed anymore, since it requires significant human effort and time.

PROBLEM STATEMENT

It is cumbersome for the hostel employees to walk around the block for every few hours to check on the level of garbage bins to prevent overloaded bins. It led to the idea of a new system which detects the maximum level of the garbage using a sensor and will be emptied in a short time. The problems are:

- The traditional method can get the garbage bins overflowed in advanced before the waste disposal.
- UMS students that live in the surroundings might get infections, chronic diseases and accidents by the overflowing garbage.
- Higher cost for UMS hostel management as it needs tremendous human effort.
- It causes a burden for hostel employees to empty each bin at random times.

OBJECTIVES

i) To implement a garbage detection system that will send notifications to the hostel employees whenever the garbage bins are full.

ii) To design develop a garbage detection system with prediction of garbage level behaviour using random forest algorithm in IoT.

iii) To evaluate the garbage detection system in terms of its function's performance by predicting the garbage bin level predict garbage bin level based on the time of the day and different days of the week.

METHODOLOGY

In order to build this project, an iterative and incremental model was chosen. In order to build this project, an iterative and incremental model was chosen. There are six phases of iterative and incremental model which consists of planning phase, requirement analysis phase, design phase, implementation phase, testing phase and deployment phase.

CONCLUSION

The IoT-based rubbish monitoring system is a cutting-edge solution that will assist in keeping UMS hostels clean. The goal of this research is to use IoT sensors to notify the hostel employees to pick up the garbage. It also has the ability to predict whether the garbage is full or not, and will let the hostel employees create a more flexible collection schedule, lowering operational costs by eliminating unnecessary garbage collection trips.

IMPLEMENTATION

Hardware requirements:

Hardware	Function
Ultrasonic Sensor	To measure the distance with accuracy and stable readings
NodeMCU	To give the system access to Wi-Fi
Arduino UNO	Open-source platform to build electronics project
Jumper wires	To connect the Ultrasonic Sensor, NodeMCU and Arduino UNO
Garbage Bin	To put trash for the level to be measured

Software requirements:

Software	Function
Windows 10 Home Single Language	Operating System
Arduino IDE	Programming tools
Microsoft Word 2016	Report writing
Microsoft Excel 2016	Tools for Gantt Chart
Lucidchart	Diagram sketches
Figma	User Interface Design
Android Studio	Application Design
Pushingbox	Notifications for IoT devices
Firebase	Database
Pycharm	Python programming
POSTMAN	API Platform
Jupyter Notebook	Train Datasets

The interface designs including welcome page, sign in page, user information, bin level, collect bin report and daily updates for user were built by using Android Studio. The Firebase is added to the Android Studio as a database to store data.

The ultrasonic sensor, NodeMCU and ArduinoUNO were connected together by using jumper wires and coded by using Arduino IDE.

Pushingbox is used to push notifications to the device.

The machine learning model (random forest algorithm) is coded using Python and a Flask API is created using Pycharm which output will be in a JSON format. Then, the JSON is parsed and is presented in the Android.