IOT BASED SMART WASTE MANAGEMENT SYSTEM

FOR BUSINESS COMPLEX

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA
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This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering with Honours.

by

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I hereby, declared this report entitled **"**Iot Based Smart Waste Management System For Business Complex**"** is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology with Honours. The member of the supervisory is as follow:

Signature: …….

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ABSTRAK

Satu sistem baru untuk meningkatkan kecekapan pengumpulan dan pemindahan dalam pengurusan sampah telah dirancang. Projek ini bertujuan untuk membantu pusat pengurusan sampah mengumpulkan sampah dari tong sampah dengan cekap dan mencegah limpahan sampah. Projek ini merangkumi pelaksanaan perkakasan dan perisian. NodeMCU digunakan dalam pelaksanaan proyek ini kerana pengawal mikro ini telah memasukkan firmware yang berjalan berdasarkan ESP8266 Wi-Fi. Sementara itu, sensor ultrasonik dan sensor beban juga digunakan untuk menganggarkan dan mengesan keadaan sampah. Sistem projek juga dihubungkan ke aplikasi Blynk melalui Wi-Fi. Aplikasi Blynk akan memaparkan keadaan tong sampah dan juga menghantar pemberitahuan ke telefon pintar pengguna. Mesej pemberitahuan akan dikirim melalui jaringan Wi-Fi yang ada. Sistem pengurusan sampah akan lebih efisien dengan penggunaan sistem sampah pintar ini.

ABSTRACT

A new system to improve the collection and transfer efficiency in waste management has been designed. This project aims to help the waste management center collect garbage from the rubbish bin efficiently and prevent the overflow of garbage. This project covers the implementation of hardware and software. NodeMCU is used in the implementation of this project because this microcontroller has included firmware running based on ESP8266 Wi-Fi. Meanwhile, ultrasonic sensors and load sensors are also used to estimate and detect waste conditions. The project system is also connected to the Blynk app via Wi-Fi. The Blynk app will display the condition of the smart bin as well as it also sends notifications to the user's smartphone. Notification messages will be sent over the existing Wi-Fi network. The waste management system will be more efficient with the use of this smart trash system.

DEDICATION

To my supportive and beloved parents Wilfred Kurin and Masnah Binti Maskam.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

kg	-	Kilogram
Wi-Fi	-	Wireless Fidelity
IoT	-	Internet Of Things
RFID	-	Radio Frequency Identification
GSM	-	Global System for Mobile
GPRS	-	Genaral Packet Radio Service
RTC	-	Real-Time Clock
API	-	Application Program Interface
VCC	-	The voltage at The Common Collector
GND	-	Ground
LCD	-	Liquid-Crystal Display
IDE	-	Intergrated Developement Enviroment
I2C	-	Inter-Integrated Circuit
Cm	-	Centimeter
A.FULL	-	Almost Full
H.FULL	-	Half Full
Q.FULL	-	Quater Full
W	-	Weight

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will describe the background of this project and problem statement. This chapter also includes three project objectives and scope of work for this project. Lastly, the conclusion section is a summary of the chapter.

1.2 Background

Business complexes produce 13.3 kg of waste per day meanwhile for an average mall the waste produces per day is about 2 kg. Waste is a problem for all business complexes, from papers product to general waste. The waste produces per day typically is 0.9 kg worth of mixed paper products, 10.4 kg of food waste, and 2 kg of the general waste that consists of coffee cups, Styrofoam, and thin plastics (Shelby Belly, 2019).

Organic waste from food scraps or expired groceries almost immediately starts to decompose when disposed of. Decomposing organic waste produces a foul smell and attracts vermin such as rats and cockroaches. Improper waste management would create unhygienic conditions and cause the spread of diseases such as Leptospirosis (Rat urine disease). (Modupe, 2020)

1.3 Problem Statement

There is too much waste is produced in a business complex. Thus, the waste management department in the business complex still outdated because the cleaner or garbage collector regularly monitors the communal bin manually to prevent the bin from overflown by the waste before the next collection schedule.

Due to the large amount of excessive waste produced by business complex can be very difficult for the cleaner and waste collector to monitor the waste bin. Therefore, to facilitate monitoring work, an IoT-based smart waste management system for business complexes is developed. This project will help cleaner and waste collector to monitor the weight and level of the waste bin in the business complex.

1.4 Objective

This project aims to provide technology for the waste management system solution in a business complex.

i. To design a waste management system for a business complex.
ii. To develop a prototype of the smart waste management system for a waste bin in a business complex.
iii. To implement a loT system for the waste bin.

1.5 Work Scope

The project is about managing waste in indoor in a business complex on how to effectively collect waste from the communal bin. This project consists of both software and hardware.

Therefore, NodeMCU works as a controller to the sensor system and Wi-Fi module. Both the ultrasonic sensor and load sensor are used simultaneously to increase the accuracy of the amount of trash in the communal bin. The combination of the ultrasonic sensor and weight sensor is designed to track the level and weight of waste in the communal bin.

The software is used to activate some components for input and output, such as a microcontroller. The notification is sent from the Wi-Fi module to the authorized person for the smartphone application. Blynk will be used to make an application that accepts notification on the smartphone.

1.6 Conclusion

The IoT Based Indoor Waste Management System in a Business Complex consists of five chapters which are Introduction, Literature Review, Methodology, Result and Discussion, Conclusion and Future Recommendation.

Chapter two explains the other researchers with waste management systems using various methods. Every previous system is provided with and compared processes, software and hardware. Conclusion of which methods are used for the proposed system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

For this chapter, previous project or work are discussed to the project "IoT Based Smart Waste Management in a Business Complex". Based on the previous project, a common mechanism, component and project design is used to the same problem which is to solve waste management problem.

2.2 Overview of The Previous Project

There are several types of a smart waste management system which has been developed by researches. Some of the existing methods use a similar type of microcontroller, sensors and wireless modules to manage and monitor the waste. Here are several previous studies related to the project.

2.3 Smart Waste Management System

2.3.1 Smart bin: Smart Waste Management System

This paper proposed a smart bin system designed to detect fullness of the litter bin. It combines mesh network functions as well as the duties cycle. Litter bin operators can define and determine summary data from the litter bin if a particular area needs extra litter bins to be located nearby. Cleaning operators will manage it better when to send their cleaners to empty the bins using standard seasonality information about the litter bin, and can even arrange the routes their cleaners would need to take. (Folianto, 2015)

2.3.2 Smart Waste Collection System Based on Location Intelligent

This system is based on the sensing technology of the IoT which helps to measure the waste level of the trashcans and sends data over the Internet to a storage and processing server. The level of waste shall be determined by using a sensor to detect the distance between the top of the trashcan and the waste. The Ultrasonic Ranging Module (HC-SR04) is the sensor used for the prototype. The Arduino Uno microcontroller is sufficient for collecting data from the sensors and sending it over a network interface to the Internet. CC3000 Shield with onboard antenna is used for Wi-Fi or network interface to collect data and send it to a remote server via a wireless connection. (Gutierrez, 2015)

2.3.3 Smart And Wireless Waste Management

This is a waste management system process from a smart waste collection system to a waste disposal system. The smart garbage bin will automatically send a message by using GSM technology when the bin is full. The Near-Infrared Reflectance Spectroscopy (NIRS) method helps to identify and extract the plastic item and provides all the biodegradable substances that can be further used in the biogas field. The biogas plant is automated and is controllable using SCADA software and PLC hardware. This whole method will help us tackle the waste management system as well as generate some renewable energy supply. (Thakker, 2015)

2.3.4 Design A Smart Waste Bin For Smart Waste Management

The real-time accurate data from the implemented system could be used for the effective solid waste management system by using a network environment. The system can collect reliable real-time data which can also be used as an input to a management system. It simplifies the calibration process with the load cell calibration method so that it can be added to the regularly used waste bin without adjustment or modification. The level sensors can be installed on the common waste bin. The system is thus suitable for use in newer systems for waste management. (Wijaya, 2017)

2.3.5 Smart Waste Bin With Real-Time Monitoring System

This paper had proposed a new waste management system structure. The developed system includes three important components: solar power, Wireless Sensor Network (WSN) and control station.

The design of a solar power system includes the assembling of three components: solar panel, solar charger controller and rechargeable battery. Solar panel absorbs and transforms the solar energy into electric energy. The smart waste bin implements Wireless Sensor Network (WSN) system interfaces that are mounted in the waste bin with a microcontroller. The microcontroller that is used in this subsystem is Arduino Mega. The data sent by the smart waste bin is received and stored in the database server by the control station. Control station runs two systems which are SMS notification system and web-based was the bin monitoring system. (Mohd Yusof, 2018)