Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF SMART TRASH BIN SYSTEM FOR SMART CITY USING GSM MODULE

IDHAM FADLI BIN MAT ISA

Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2022

DEVELOPMENT OF SMART TRASH BIN SYSTEM FOR SMART CITY USING GSM MODULE

IDHAM FADLI BIN MAT ISA

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJURUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek :

Sesi Pengajian :

Saya Idham Fadli Bin Mat Isa mengaku membenarkan laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (✓):

☐	**SULIT***	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
/	**TIDAK TERHAD**	

Disahkan oleh:

(TANDATANGAN PENULIS)
Alamat Tetap:

(COP DAN TANDATANGAN PENYELIA)
RAEIHAH BINTI MOHD ZAIN
Juruterа Pengajar
Jabatan Teknologi Kejuruteraan
Elektronik dan Komputer
Fakulti Teknologi Kejuruteraan
Elektrik dan Elektronik
Universiti Teknikal Malaysia Melaka

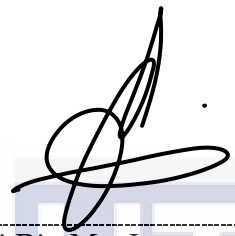
Tarikh: 13/01/2023

Tarikh: 13/01/2023

*CATATAN: Jika laporan ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh laporan ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I declare that this project report development of a Smart Trash Bin System For Smart City Using GSM Module is entitled the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

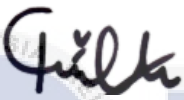
Student Name : Idham Fadli Bin Mat Isa

Date : 13/1/2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

Signature : 

Supervisor Name : : Puan Raeihah binti Mohd Zain,

Date : 13/1/2023

Signature :

Co-Supervisor :

Name (if any)

Date :

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEDICATION

This thesis is dedicated to whom who have support me from the early and end of the project development:
My beloved parent and family
My supervisors
My lecturers
And all my friend
Thank you for all the guidance, support and encouragement until the end.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRACT

Waste management is one of the world's most pressing issues, regardless of whether a country is developed or developing. Prior to the start of the next cleaning operation, public trash cans are frequently overflowing, which is the most significant problem in waste management. It may be the main cause of the spread of a number of diseases as a result of the resulting risks, such as foul odours and unsightliness. To avoid all such perilous situations and protect public sanitation and health, we employ a modern waste management system. This project presents a cost-effective design of smart waste containers for small-scale cases. The system is based on board Arduino Nano and ultrasonic sensors to monitor container fullness level and provide SMS alerts using a GSM module. The servo will open and close the lid of the dustbin. The system is powered by a lithium battery . In addition, the system will save usage events, recorded by the IR sensor, and fullness events on the memory card, which are also used to play audio messages using speakers, while the trash can is in use. In the end, the system was successfully implemented with an acceptable total cost for the intended application.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRAK

Pengurusan sisa adalah salah satu isu yang paling mendesak di dunia, tidak kira sama ada sesebuah negara itu maju atau membangun. Sebelum memulakan operasi pembersihan seterusnya, tong sampah awam kerap melimpah, yang merupakan masalah paling ketara dalam pengurusan sisa. Ia mungkin menjadi punca utama penyebaran beberapa penyakit akibat daripada risiko yang terhasil, seperti bau busuk dan tidak sedap dipandang. Untuk mengelakkan semua situasi berbahaya tersebut dan melindungi sanitasi dan kesihatan awam, kami menggunakan sistem pengurusan sisa moden. Projek ini membentangkan reka bentuk kos efektif bekas sisa pintar untuk kes berskala kecil. Sistem ini berdasarkan papan Arduino Nano dan sensor ultrasonik untuk memantau tahap kepenuhan bekas dan memberikan makluman SMS menggunakan modul GSM. Servo akan membuka dan menutup penutup tong sampah. Sistem ini dikuasakan oleh bateri litium. Selain itu, sistem akan menyimpan peristiwa penggunaan, yang dirakam oleh penderia IR, dan peristiwa kepenuhan pada kad memori, yang juga digunakan untuk memainkan mesej audio menggunakan pembesar suara, semasa tong sampah sedang digunakan. Akhirnya, sistem ini berjaya dilaksanakan dengan jumlah kos yang boleh diterima untuk aplikasi yang dimaksudkan.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Puan Raeihah binti Mohd Zain, for his precious guidance, words of wisdom, and patience throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) for the financial support through the Faculty of Electrical and Electronic Engineering Technology which enables me to accomplish the project. Not forgetting my fellow colleagues, for their willingness of sharing their thoughts and ideas regarding the project.

My highest appreciation goes to my parents and family members for their love and prayer during the period of my study. An honourable mention also goes to my mother Salbiah Binti Nasir for all the motivation and understanding.

Finally, I would like to thank all the staffs at the Faculty of Electrical and Electronic Engineering Technology, fellow colleagues and classmates, the Faculty members, as well as other individuals who are not listed here for being co-operative and helpful

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

TABLE OF CONTENTS

PAGE

DECLARATION

APPROVAL

DEDICATIONS

ABSTRACT **i**

ABSTRAK **ii**

ACKNOWLEDGEMENTS **iii**

TABLE OF CONTENTS **i**

LIST OF TABLES **iii**

LIST OF FIGURES **iv**

LIST OF SYMBOLS **vi**

LIST OF ABBREVIATIONS **vii**

LIST OF APPENDICES **viii**

CHAPTER 1 INTRODUCTION **1**

1.1 Background 1

1.2 Problem Statement 2

1.3 Project Objective

1.4 Scope of Project 3

CHAPTER 2 LITERATURE REVIEW **4**

2.1 Introduction 4

2.2.1 Robotic dustbin on wheels 5

2.2.2 Smart Dustbin For Waste Management 6

2.2.3 GSM Based Garbage Monitoring System 7

2.2.4 Smart Dustbin Utility System using IoT 8

2.2.5 Garbage Level Monitoring System using Raspberry Pi 9

2.2.6 Smart Dustbin The future of waste Management 10

2.2.7 Smart Dual Dustbin Model for Waste Management in Smart Cities 11

2.2.8 Smart E Dustbin 12

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.2.9 Smart Waste Management Using wireless sensor Network 13
2.2.10 Innovation waste collection system using wireless sensor network 14
2.2.11 Development of Automatic Waste Seregator with Monitoring system 15
2.2.12 IOT Based Smart Bin 16
2.3 Comparison previouse chapter 17
2.4 Summary 20

CHAPTER 3 METHODOLOGY 21
3.1 Introduction 21
3.2 Methadology 21
3.3 Project flowchart 23
3.4 Block diagram 24
3.5 Haedware Specfication 26
3.5.1 Arduino uno R3 26
3.5.2 Ultrasonic Sensor 27
3.5.3 Servo Motor 28
3.5.4 GSM Module 29
3.5.5 Infrared Sensor 30
3.5.6 EZMP3 31
3.6 Software Application 32
3.6.1 Arduino IDE 32
3.6.2 Protues 8 Professional
3.7 Summary 33

CHAPTER 4 RESULTS AND DISCUSSIONS 34
4.1 Introduction 34
4.2 Software Development 34
4.3 Circuit Diagram 35
4.4 Hardware Implementation 36
4.5 Result 37
4.6 Data Analysis 42
4.6.2 Data analysis infrared sensor 42
4.62 Data analysis for the ultrasonic and servo motor 44
4.6.3 Data analysis for the GSM module 45
4.6.4 Data Analysis trashbin perfomance 48

4.7 Summary 49

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS 50
5.1 Concolusion 50
5.2 Future Works 511

REFERENCES 522

APPENDICES 544

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF TABLES

TABLE	TITLE	PAGE
2.1	Comparison previouse chapter	17
3.1	Comparison between IR and PIR sensor	30
4.2	Analysis for infrared semsor for distance and hand motion	42
4.3	Data analysis for ultrasonic and servo motor	44
4.4	Analysis trashbin perfomance	48

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1	Robotic Dustbin on Wheels	5
Figure 2.2	Smart Dustbin for waste management	6
Figure 2.3	GSM Based Garbage Monitoring System	7
Figure 2.4	Garbage Level monitoring system using Raspberry Pi	9
Figure 2.5	Smart Dual Dustbin Model for Waste Management in Smart Cities	11
Figure 2.6	The block diagram for smart E dustbin	13
Figure 2.7	Development Of Automatic Waste Segregator With Monitoring System	15
Figure 2.8	The block diagram for Iot Based Smart Dustbin	16
Figure 3.1	The program flowchart for this project.	23
Figure 3.2	The block diagram for this project	24
Figure 3.3	Arduino R3	26
Figure 3.4	Ultrasonic Sensor HC-SR04	27
Figure 3.5	Servo motor	28
Figure 3.6	SIM900D GSM Module	29
Figure 3.7	Infrared Sensor	30
Figure 3.8	EZMP3	31
Figure 3.9	Logo IDER Arduino	32
Figure 3.10	Logo Protues	32
Figure 4.1	Library Included	34
Figure 4.2	The circuit diagram of the project	35
Figure 4.3	The front view	37

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 4.4	Top view of the smart dustbin	38
Figure 4.5	The servo motor and the rod connect to the motor	39
Figure 4.6	The ultrasonic attach below the lid of the dustbin	39
Figure 4.7	The infrared sensor will open when it detect the hand motion	40
Figure 4.8	show the message receive when the dustbin is full	40
Figure 4.9	show the umobile sim card been use in GSM	46
Figure 4.10	show the DIGI sim card been use in GSM	46
Figure 4.11	show the maxis sim card been use in GSM	47
Figure 4.12	show the maxis sim card been use in GSM	47

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF SYMBOLS

UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF ABBREVIATIONS

UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاك
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Coding A	53
B	GANTT CHART PSM 1	58
C	GANTT CHART PSM 2	59

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 1

INTRODUCTION

1.1 Background

Nowdays the population in Malaysia increase rapidly, so the trash also increase which also increase the environmental issue. A dustbin is a bin for collecting trash or storing materials that are recyclable or non-recyclable, decomposable or non-decomposable. The dustbin will be used at the office, house , park and at the roadside.

Almost all dustbins at the public place have problems where dustbins are overflowing, and the trash is spilling out all over the place. The dustbin will fill up very quickly when special period such as festival ,weekend and holidays. They are many impact overflowing dustbin on health and environment. For example overflowing garbage cans provide the perfect breeding habitat for bacteria and insects. Flies that visit the trash are the same flies that fly near our food and drop their offspring on our plate. They raise our chances of getting salmonella, the bacteria that causes typhoid fever, food poisoning, and enteric fever. Beside flies , rats and stay dog also live around the dustbin. Beside that, Garbage that is overflowing is a public nuisance and an eyesore. Everyone wants to live in and visit places that are clean, fresh, and safe. A dirty city with unsatisfactory cleanliness and rubbish all over the place does not attract visitors

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

This happen because there is no flexible waste collection schedule in our current system. Therefore, the project is design to monitor the fullness level of the dustbin and will give SMS alerts using a GSM module. The user will receive an SMS alert .This will help the dustbin from overflowing.

1.2 Problem Statement

Dustbin wasted is collected at regular intervals by cleaning employees, and the segregation of waste cannot be do in properly way. By using manual way method they are several weakness such as the dustbin fills up really fast and spill out from the dustbin at the crowded area. The dustbin will fill up very quickly when special period such as festival ,weekend and holiday.This bad enviroment this will lead to the addition of pests and will cause various diseases .This happen because the cleaner dont know the level of waste in the dustbin. This method also waste the plastic bag because the cleaner need to pick up the dustbin even dustbin is not full.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

1.3 Project Objective

The main of this project is to propose a systematic and user friendly methodology to measure the level of the trash in the dustbin using the arduino and the GSM module .The objectives are as follows:

a) To monitor the fullnes of the dustbin and sent the data when dustbin is full for collect the trash

b) To notify the waste management about the fulness of dustbin through message.

c) To design the smart bin that user-friendly

1.4 Scope of Project

The project scope is to develop technique for monitor the level of dustbin. It may help to prevent the dustbin from spill out. The main aim of this project to monitor the level of trash .The sensor that used in this project could detect the level the trash in the dustbin and can detect the person that come near the dustbin. This project used an Arduino UNO microcontroller to analyse sensor data before sending it to the GSM module, which will communicate with the user via SMS if the level is full.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This initiative aims to identify the problem the dustbin at the cities. With ongoing research moving toward the benefits of lowering the rate of, the lack of a system to monitor the waste level of the dustbin in the cities become significant problem . This chapter looks at the different ways people have tried to solve the problem. Different studies have tried different ways to solve the problem, and some of these methods have been looked at. After looking at what other researchers have done, a brilliant possible solution will be put together using some of the same ideas. Since then, many methods and equipment have been created to measure, analyze, and notify the condition of dustbin.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.2 Previous Project Research

This chapter analysed and described a few papers and prior journals that traced a similar technique and covered subjects that can be used as references for the Garbage Monitoring System with IoT. This chapter also contains research based on a similar existing system, similar sensors, and an IOT board, which can be used as a guideline or a model for upgrading or developing a new, better system in comparison to the existing system.

2.2.1 Robotic Dustbin on Wheels

. In a paper proposed by a system that proposed to keep the environment clean, in which the robotic dustbin moves along a lined path with the assistance of two infrared sensors located at the robot's base facing forward.[1]This project uses Arduino ATmega 32p.The Arduino will send the signal to the motor driver.They are 4 motors that use in this project for the project to move left, right and forward. Then when the IR sensor detects an object in the path and emits the IR signals, it sends a signal to the microcontroller, which detects black color and causes the system to will stop at that black color. After that, the controller will send a signal to the ultrasonic sensor, which produces sound waves and detects the distance between the garbage and the dustbin's lid. If the dustbin is full the cooperation operation will receive the message using the wifi module.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 2.1 Robotic Dustbin on Wheels

2.2.2 Smart Dustbin for waste management

The project by authors Wikramarathne and R. M. I. S use web application to process and view a collection of Recycling Center data and maintain user profiles. By accessing them, their profiles can see their eyes for the waste of each category, as well as the details of these users[2]. The Recycling Center can also access this web application. The main components of this project are servo motor, ultrasonic sensor, RFID reader, GSM module and load cell. The user need to touches his RFID tag against the RFID reader, the trash can lid will open. The system will then open the lid by confirming the user ID against the server's database using the GSM module. Before the lid opens, an ultrasonic sensor will check the level of rubbish, and if the bin is full, the system will send a warning message to the authorities informing them that the bin is full. The user can then throw the trash in the bin. The garbage's weight will be measured by a load cell and transmitted to the database via a GSM module.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

.

Figure 2.2 Smart Dustbin for waste management

2.2.3 GSM Based Garbage Monitoring System

In a project done by the author S.Kal ,they propose a system that monitor the dustbin and sends the message to update on the level of the dustbin[3]. This system detects the rubbish level by placing four ultrasonic sensors over the bins and comparing it to the depth of the bins. For data transmission, the system uses an Arduino Uno board, an LCD screen, and a GSM modem. A 12V transformer provides electricity to the system.This system also use the GSM to sent the status of the dustbin.The status will be sent in the form of percentage and it will display at screen.

Figure 2.3 GSM Based Garbage Monitoring System

UNIVERSITI TEKNIKAL MALAYSIA MELAKA