Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF AUTOMATED RECYCLE BIN COMPRESSOR USING ARDUINO FOR SMART CITY

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

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DEVELOPMENT OF AUTOMATED RECYCLE BIN COMPRESSOR USING ARDUINO FOR SMART CITY

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A project report submitted
in partial fulfilment of the requirements for the degree of
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Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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I declare that this project report entitled "DEVELOPMENT OF AUTOMATED RECYCLE
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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 : MADAM TS ELIYANA BINTI RUSLAN

Date : 24 Februari 2023

DEDICATION

To my beloved mother, Che Su Binti Kamis, and my father, Zulkarnain Bin Mohd Saad,

Thank you for supporting me when I continue my studies

for bachelor's degree in UTeM.

To my friend, Ezzat Muhammad Syahmy Bin Asri

Thank you for providing your creativity expertise and suggestion

for completing this project.

ABSTRACT

The rate of urbanisation has increased rapidly over the last several decades, necessitating the establishment of sustainable urban development plans around the world. The concept of smart cities is gaining popularity throughout the world because of today 's technology and a deliberate approach. A smart city is incomplete without a smart waste management system, since they play an important part in keeping cities clean and hygienic, as well as providing a better public image for tourists from all over the world. Development of Automated Recycle Bin Compressor using Arduino for Smart city is designed to automatically compress when the wastes inside the bin reached a specific level and before the wastes are collected. This bin is suitable to be placed in crowded area to ensure the objectives were achieved. Normally, the wastes will be collected without any compression and that will be a waste of space. The bin is equipped with a sensor to detect the level of wastes in the bin to make the DC motor to start working and compresses the wastes. The sensor is called infrared sensor (IR sensor). When the led light emits and it reflect to the infrared receiver, the sensor starts to detect wastes. The sensor is located by the side of the bin and can be removed manually. By doing this, it can reduce the problem of excessive wastes and overflowing bin that are not managed well. A high torque and low rpm DC motor is used to make sure the wastes are compressed perfectly. This DC motor is working under battery. To support the battery, the bin used 3 Watt of solar panel to recharge the battery using a solar charger circuit to avoid the charging is interrupt. For example, when the battery is full, the circuit will cut off the charging process. The switch off button is located behind the bin and can be turn off manually if anything happens. Then the ESP8266 Wi-Fi module is placed to collect the data from the recycle bin. It is expected the result will improve the waste collection, reducing pollution, reducing the carbon that emitted by the vehicle and maximum utilization of the internal space of the bin.

ABSTRAK

Kadar pembandaran telah meningkat dengan pesat sejak beberapa dekad yang lalu, memerlukan penubuhan rancangan pembangunan bandar yang mampan di seluruh dunia. Konsep bandar pintar semakin popular di seluruh dunia kerana teknologi masa kini dan pendekatan yang disengajakan. Bandar pintar tidak lengkap tanpa sistem pengurusan sisa pintar, kerana ia memainkan peranan penting dalam memastikan bandar bersih dan bersih, serta menyediakan imej awam yang lebih baik untuk pelancong dari seluruh dunia. "Development of Automated Recycle Bin Compressor using Arduino for Smart city" direka untuk memampatkan secara automatik apabila sisa di dalam tong mencapai tahap tertentu dan sebelum sisa dikumpul. Tong sampah ini sesuai diletakkan di kawasan sesak bagi memastikan objektif tercapai. Biasanya, bahan buangan akan dikumpul tanpa sebarang pemampatan dan itu akan membazir ruang. Tong ini dilengkapi dengan sensor untuk mengesan tahap sisa dalam tong untuk membuat motor DC mula berfungsi dan memampatkan sisa. Sensor itu dipanggil sensor inframerah (sensor IR). Apabila cahaya yang dipancarkan dan ia memantul ke penerima inframerah, sensor mula mengesan bahan buangan. Penderia terletak di tepi tong sampah dan boleh dikeluarkan secara manual. Dengan berbuat demikian, ia dapat mengurangkan masalah sampah berlebihan dan tong melimpah yang tidak diuruskan dengan baik. Tork tinggi dan motor DC rpm rendah digunakan untuk memastikan bahan buangan dimampatkan dengan sempurna. Motor DC ini berfungsi di bawah bateri. Untuk menyokong bateri, tong menggunakan panel solar 3 Watt untuk mengecas semula bateri menggunakan litar pengecas solar untuk mengelakkan pengecasan terganggu. Sebagai contoh, apabila bateri penuh, litar akan memutuskan proses pengecasan. Butang matikan terletak di belakang tong sampah dan boleh dimatikan secara manual jika apa-apa berlaku. Kemudian modul Wi-Fi ESP8266 diletakkan untuk mengumpul data daripada tong kitar semula. Keputusan ini akan meningkatkan kutipan sisa, mengurangkan pencemaran, mengurangkan karbon yang dikeluarkan oleh kenderaan dan penggunaan maksimum ruang dalaman tong sampah.

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CHAPTER 1

INTRODUCTION

1.1   Background

A waste bin (or recycle bin) is a container used to hold recyclables before they are taken to recycling centers. Recycling bins exist in various sizes for use inside and outside homes, offices, and large public facilities. Separate containers are often provided for paper, tin or aluminum cans, and glass or plastic bottles, or may be commingled. Recycling bins began to be known around 1965. Recycling bins were labeled to facilitate people to remove recyclable materials.

Many recycling bins are designed to be easily recognizable and are marked with slogans promoting recycling on a blue or green background along with the universal recycling symbol. Others are intentionally unobtrusive. Bins are sometimes in different colors so that user may differentiate between the types of materials to be placed in them. While there is no universal standard, the color blue is commonly used to indicate a bin is for recycling in public settings.

1.2   Problem Statement

Based on our observations, the existing garbage bins are often full before the collection day is made especially in the recreational area. A waste collection timetable has been issued by SWM Environment Sdn. Bhd. on Figure 1, recycling waste collection is collected once a week. This causes the waste bin to overflow causing the surrounding area to be dirty. In addition, there is a waste of space when the waste is less compressed because by compressing the garbage, it can increase the space of a recycle bin equivalent to 5 to 8 times based on a survey conducted on the internet. Subsequently, the increase in cost to collect recyclable waste since the collection of recyclable materials and raw materials are collected in different time. More often the waste is compressed, the collection time will be reduced. For example, from once a week to fortnightly collection. Therefore, this project is suggested to over the problem by proposed Development of Automated Recycle Bin Compressor using Arduino for Smart City. The idea of this project aims to analyze the system designed in terms of its functionality. There will Internet of Things (IoT) installed to monitor the level waste in the bin.

Figure 1: Schedule collecting recycle item

1.3 Project Objective

The main aim of this project is to Development of Automated Recycle Bin Compressor, the objectives are as follows:

a) To develop automated recycle bin compressor using arduino for smart city.

b) To compress the recyclables when the level is reached.

c) To analyze the system designed in terms of its functionality.

1.4 Scope of Project

To avoid any uncertainty of this project due to some limitations and constraints, the scope of the project are defined as follows. Development of Automated Recycle Bin Compressor using Arduino for Smart city is designed to reduce waste collection work in all areas such as recreational areas and indoor recycle item. This project can be devoted to municipalities in every state where the municipalities can reduce the cost and time of waste collection at the certain places. It uses infrared sensor to detect excess waste in the recycle bin. The programming of the project will be using Arduino Uno software in C language. A ESP 8266 wifi module will be used in this project to interact with user. The wifi module model being used in the project act as Internet of Things (Iot) to monitor the level of the waste in bin. So from here we can develop the project.

1.5 Summary of Chapter

The proposed research is carried out by covering the project background, problem statement, objective, and project scope. The project background is explained to initiate the project, what prerequisites are, and what results are supposed to be obtained at the successful completion. Problem statements is a concise description of waste issues that are addressed so our project will help to overcome the problems and achieve our objective.

1.6   Thesis organization

The first chapter in this thesis is chapter 1, the introduction for this project. The project background, problem statement, objectives, and project scope are all written in this chapter. This chapter helps the reader to understand the reason for the development of this project.

The next chapter will be chapter 2 which is literature review. In the chapter it shows related research done by the other researchers will be observed and studied one by one. Comparison and review of the studied papers will be done to recognize each project advantages and disadvantages.

Next, chapter 3 is discussed about the methodology which is the method and technique is applied to the project. Therefore, the design of the procedure used on the project that represents the process of the hardware also will be included.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, I have been comparing others research project related with the own project. It is related to the function and operation of each research project. All the comparison process during the literature review were made to complete the Development of Automated Recycle Bin Compressor Using Arduino for Smart City.

2.1.1 A cloud based smart recycling bin for in-house waste classification

The main of the development of the smart bin that proposed in [1] is to classify each of the waste that will be going into the bin by using the camera inside the Raspberry Pi Zero. Raspberry Pi Zero comes with camera module that enable the users to program it to detect present of plastic, paper, glass, metal and trash. Its also equipped with Wi-Fi to store the result of the waste in the bin. The smart recycling bin also equipped with ultrasonic sensor in order to measure the fullness percentage. The proposed project also conducted experiment in city of Kozani. The result they gathered is successfull to detemined the effiency of the proposed system. In the future, they will improve the project by doing custom microcontroller instead of Raspberry Pie Zero. The weakness of the system is on the software side which is execution time of the data received need to be improved.

2.1.2 Design a smart waste bin for smart waste management

A trash bin that is proposed in the project [2] basically a general waste-bin equipped with sensing units. The purpose of the system is to monitor all the waste in the city with the concept of smart waste management. System is equiped with ultra sonic sensor to monitor the level of waste. Load cell sensor device is used to measure load in the waste bin either directly or indirectly. This help gather information more effective to monitor the waste bin level. Mobile application also help to the system proposed to help it maintain the project as smart waste management. The system that have been proposed successfully collect real time accurate data so that this project is suit using in any kind of regular waste management.

2.1.3 Design and Assembly of A Smart Recycling Bin

This system is introduced in [3] named as Enviro-Bin. The system consist of microcontroll by Arduino Uno that control sensor such as inductive sensor and colour sensor to seperate the recycle waste that goes in the bin. IR sensor is placed to detect whether the object has been placed inside the bin. Stepper motor is being used in the system to seperate the waste. It consist of 4 compartments for plastic, metal, glass and etc. The system is design multipurpose and suitable for all type of homes. Futhermore, the mobile application will notify the user to empty which compartment.

2.1.4 Design Of Smart Bin For Smarter Cities

According to [4] , the system of smart bin proposed is not like other ordinary bin. The system is equipped with network of sensor that capable of providing various of information to monitor waste in real time. Each of the sensor is controll by Arduino Uno. The workflow of the [4] is when the waste is full, the system should close the lid and notify the user. The design is made to protect the waste from animals and unnatural weather condition that can cause the waste all over the place. The ultra-sonic sensor is important role here to close or open the lid of the smart bin. The bin has an LCD monitor that shows the fill percentage, date, and time in real time. The result shown as graph have been carried out to show the fill vs time.

2.1.5 Waste Management using Solar Smart Bin

A smart waste management system that presented in [5] is a project that offer the compressed waste to reduce the volume of the waste bin. Not only reducing the volume of the bin its also can reduce pollution caused by the garbage vehicle by reducing the number of time its collection. The project that proposed also design consist of two bin. One container is for biodegradable garbage alone, while the other is for non-biodegradable waste. This distinction is formed because the recycling process for biodegradable garbage is essentially identical, however the recycling procedure for non-biodegradable waste is different for plastic, glass, and metal. Furthermore, non-biodegradable garbage should not be pulverised. The biodegradable materials are crushed by a motor attached to crushers. All of this action are triggered by the ultra-sonic sensor that had been placed in the bin and monitored by GSM module in mobile application.

2.2   Journal Comparison for Relevant Previous Research

Table 2.1 show the comparision table for 5 different research related to this proposed project so that we can improve or avoid the drawback for this project after analyzing it.

Between the research had been made, most of the project used microcontroller Arduino Uno which is easy to use and program. It also user friendly because it a open source program. The program also easy to learn from the internet source. Then, most of the author are using mobile application as monitoring system because of its mobility. We can monitor our project data in any places. The idea can be implented to our project for a good result.

Next, most of this research are using GSM module because of easy to use and very common. The idea of our project will be using ESP8266 arduino module because it easy to interact with our Arduino Uno that will be using in this project.

Moreover, most of the researcher are not using solar panel as maintaining the green technology. But for our project, we will implement the solar panel to maintain the power of the battery that recharge the power for our system. Thus, we can apply the green technology to our project. Futhermore, I will use latest technology for example Arduino Uno, Infrared Sensor module, Ultrasonic sensor module, ESP8266 wifi module because of the source can be found on internet easily as reference.

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