UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SMART SORTER DUSTBIN USING ARDUINO

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

by

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TAJUK: **DEVELOPMENT OF SMART SORTER DUSTBIN USING ARDUINO**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

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ENCIK AHMAD SAYUTHI BIN MOHAMAD SHOKRI

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ABSTRAK

Tujuan utama projek ini adalah mereka bentuk dan mencetakkan sistem automatic yang mampu isihan umum recyclable bahan seperti logam, dan juga bukan logam ke dalam tong sampah yang berbeza. Sistem menggunakan microcontroller sebagai sistem pemantauan untuk mengendalikan komponen-komponen melekat padanya.

Sistem ini direka bentuk untuk mengisihkan dua jenis bekas minuman kosong, iaitu tin aluminium, dan selain pada tin aluminium. Langkah pertama, sistem akan mula menganalisis jenis bahan ketika mempunyai objek muncul. Langkah kedua, stepper motor akan berubah kepada kawasan tong sampah yang telah dibahagikan dengan tepat. Langkah ketiga, tutup akan dibuka supaya membenarkan objek itu jatuk ke dalam.

Kelebihan sistem ini adalah mudah, perlindungan alam sekitar dan juga murah. Sistem ini dapat mengisihkan jenis sampah tanpa usaha manusia.

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ABSTRACT

The objective of this project is to design and develop an automatic system capable of sorting common recyclable materials, which is metal, and non-metal into distinct waste dustbins. The system uses a microcontroller to become a monitoring system to control the components attached to it.

The system was designed to sort two types of empty beverage container which is aluminium can, and others. First, the system will start to analyse the type of material when there is an object appeared. Second, the stepper motor will turn to the correct partitioned area of the bin. Third, the lid will open and let the object to drop.

The advantages of this system are that it is simple, environmentally green and inexpensive. The system is able to sort trash materials without human effort.

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DEDICATION

This project is dedicated to my parents, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my supervisor, who taught me that even the largest task can be accomplished if it is done one step at a time.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

SARTB	-	Smart Automatic Recycling Trash Basket
ATSS	-	Autonomous Trash Sorting System
STB	-	Smart Trash Bin
SSD	-	Smart Sorter Dustbin

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CHAPTER 1

INTORDUCTION

1.0 Introduction

The process of making plans for waste management and recycling of all of the rubbish produced in this country is an enormous and expensive task which involves both logistical planning and scientific knowledge and understanding in order to balance the impact on the environment and the cost effectiveness of the process. In this chapter, background of waste management will be discussed. Besides, the problem statement, objectives and scope are also discussed.

1.1 Background

Waste is valuable resource that is largely underutilized. As a society, we are living beyond our environmental means and consuming natural resources at an unsustainable rate. The most crucial treat of exceeding environment waste is climate change. Waste management is significant in treating our environment. Recycling are now emphasize by many country and so we are responsible for it. (Czajkowski et al. 2014) Process of recycling is converting waste materials into new material and reusable objects. It is an alternative method of waste disposal that can save material and help lower greenhouse effect. It plays an important roles to lower the consumption of fresh raw materials, therefore reducing: air pollution, energy usage and water pollution and many more. The world has faced increasing population which results to increase production for human to maintain lifestyle. (Bhor & Morajkar 2015)

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Recycling is a primary component to reduce waste material and is the third component of the "Reduce, Reuse, and Recycle" waste hierarchy. (Sheau-Ting et al. 2016) There are different kinds of recyclable materials which include many kinds of paper, glass, and cardboard, electronics, plastic, tires, textiles, and metal. Materials to be recycled are either brought to a collection centre or picked up from the curbside, then sorted, cleaned, and reprocessed into new materials destined for manufacturing.

Recycling has been a common practice for most of human history, with recorded advocates as far back as Plato in 400 BC.

Figure 1.0: An American poster from World War II

Source: www.wikipedia.org

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The recyclable material have to be sorted when it is collected and delivered to a main waste collection facility. There are bunch of process and systems used to sort different waste materials in this stage. Single-stream recycling is used to sort paper, different types of plastics, glass, metals, food scraps, and most types of batteries.

Initially, all the mixed waste materials will be taken away to a conveyor belt, all the materials has to be spread out in a single layer. Meanwhile, there is some waste material has to be removed by hand for example, large pieces of plastic bags and corrugated fiberboard, big objects like them could easily cause the later machinery to jam and they are big and easy to be spotted. From the process here, we can tell that even an expensive and professional machine that purposely build to separate waste material cannot sort out all the waste material perfectly.

After that, an automated machinery is used to split between light weight object and heavy object through weight, this process usually involve paper, plastic, glass, and metal. Since this automated machine is very expensive, not all the sorting centre can afford it, therefore there are still lots of sorting centre doing this process by hand. Plastic and paper are differentiated by spectroscopic scanner based on the absorbed wavelengths, and subsequently divert each material into the proper collection channel. (Paulsen et al. 1995)

Now, the separation of iron, steel and tin are using magnets. Recycling has proven advantageous because it reduces amount of waste that need to be disposed in landfills, prevent overuse of natural resources, conserve energy, reduce greenhouse gas emissions, and helps create new jobs.

Therefore, waste segregation is important to reduce the burden on our earth. About 80% waste generated at source can be reduced by providing a waste segregation system in place such as in public or household. This project is to develop a prototype of smart sorter dustbin which will sort out the waste materials as soon as people throw it in. To study how to differentiate types of materials automatically and separate waste into correct bin. The project is only segregate dry waste including metal and non-metal. It is an interesting solution and hope smart sorter dustbin can raise people's environmental awareness so that it could minimize pollution to the environment. (Ordoñez et al. 2015)

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1.2 Problem Statement

With the progress of time, so many things have been made to keep longer and portable in aluminium can or some kind of bottle for example beverage. Students tend to grab a can of soft drink or a bottle of water in any convenient store or vending machine. Nowadays, university produce big amount of beverage container rubbish (aluminium can, plastic bottle and others) a day. This circumstance has already became critical and some small effort had been done by university side which is implementing the three categories dustbin to classify the rubbish type.

However, students tend to be ignorance and still throw their trash randomly without considering its categories. Since different types of materials has their own way to recycle or reuse, we must keep these different types of materials separately in order for the waste management system works smoother. However, people are not aware of this circumstances and also not giving attention about the garbage classification system that has been implemented long ago.

A smart sorter dustbin is what we need the most in current time, this smart sorter dustbin will detect the types of rubbish (beverage can) and sort it accordingly. The aim of this development is to reduce human power sorting process as well as to prevent people from throwing wrong types of waste into different partitioned bin.

1.3 Objectives

The objectives of the project are:

i. To develop a prototype of smart sorter dustbin.
ii. To separate waste into the particular partitioned bin.

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1.4 Work Scope

In this project, the focus will be mainly on;

i. Creating a smart sorter dustbin prototype which can separate different types of waste material automatically
ii. The machine is mainly focus on separation of types of beverage container which is metal and non-metal
iii. The machine only accept empty beverage container
iv. The scope is set in our campus area because a lot of soft drink can and plastic bottle are spotted in dustbin.

1.5 Thesis Organization

The thesis consists of 5 chapters, which is Introduction, Literature Review, Methodology, Result, and Conclusion.

In the first chapter, the study begins with introduction of the study accompanied with the problem statement, objective and working scope for this project.

The literature review in chapter 2 is discussed some related previous project and some component information that would be used to build the prototype. This section contain details about the concept and technique used in this project.

The methodology in chapter 3 is to discuss how the project is done. There will be flowchart of the project and its description to illustrate how the project is been done.

Chapter 4 is construed the result of that are obtained from the experimental activities in order to completing of this project. The results also will be analysed and further discussed in this chapter.

Chapter 5 will summarizes the outcomes of the project. The objectives of this project will be achieved. This chapter outlines recommendations for the further development and improvement on design of the product. Suggestions for future work will also be provided in in this chapter.

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CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter discuss about literature review of the previous project that have been done by researcher that is related to this project. Some of the literature review that have been discussed in this chapter is about the available sensor that are used in identify the types of beverage container materials. The fundamentals of each related review for this project are described in detail in this chapter. This study is very necessary in order to gain more knowledge and understanding in waste bin system level, waste identifying system, level sense technology, sorting system, related research, programming language and environment, background of Arduino, hardware requirements and existing technology.

2.1 **Waste Bin System Level** (Peong et al. 2016)

From time to time, the waste bin have been improved. From the standard black dustbin to multi-colored .Others, from one specific partition to many specific partition. By doing the research, we had conclude that most of the people eager to use the waste bins if the waste bins have an appropriate colored, having sensor, easy to handle, and odorless. A few of waste bins had been made before such as waste bins only one specific partition, waste bins in different partition and waste bins but have four partition in one bin. (HP n.d.)

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Subsystem level 1: Waste bins only one specific partition

Figure 2.0: Outdoor decorative bin

Source: www.google.com

Subsystem level 2: Waste bins in different partition

Figure 2.1: Fiberglas recycle bins

Source: www.google.com

Figure 2.2: Fiberglass recycle bins with shaped holes

Source: www.google.com

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Regarding to the figure 2.1, they used different bins. Every bins have their specific type of waste bins .These management can help the organization for cleaning the bins instead of recycle the wasted. However for figure 2.2, the cover trash had been made with different shape. It is to show the different wasted must throw at their own bins.

Subsystem level 3: Waste bins but have four partition in one bin

Figure 2.3: Fiberglass recycle bins 4 Partition

Source: www.google.com

All of these bins having partition in one bins. After these wasted are throw then it further processing to separate out any recyclable material. Plastic bags supplied from the supermarket cannot be placed in the recycle bin. Do not fill plastic bags with recyclables and put it in the recycle bin as plastic bags are NOT recyclable. (Amores et al. 2015)

2.2 Related Project

After reviewing some project and research, there are three journals found to be related to this project. These journal have been analysed, summarised, and evaluated. The similarities and the differences between the related project and this final year project also has been listed.

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2.2.1 **Smart Automatic Recycling Trash Basket** (Fan 2012)

The SARTB is created by Suwon Shin and Kaiyuan Fan. The idea of creating SARTB is to save time for recycling.(Fan 2012) SARTB can differentiate only metal and paper by using metal sensor. The metal is detected by metal sensor and anything besides of metal will be considered as paper.

The most stunning thing for the project is the automatic motion movement which the lid will open when an object approach. Then, the sorting plate will sort out the different material. (Bhor & Morajkar 2015) Lastly, it has a LED to warn user when trash basket is full. (Rahman et al. 2014)

2.2.2 **Autonomous Trash Sorting System** (Janelle Williams, Hunter Phillips 2015)

The ATSS is created by Janelle Williams, Hunter Phillips, and Chang-kwon Kang. This ATSS are built and test of its capability to sort common recyclable materials, ferrous and nonferrous metals, plastics and glass into distinct waste containers. There are a lot of advanced sensor in the autonomous system that use to monitor the system. Besides, there are also classification techniques to improve the accuracy of sorting procedures. (Anuradha et al. 2017)

The system was designed with aluminium chassis, loading carrier moved by geared motor and rubber band, sensors, control board, DC motor to push sorted material, and container. Electromagnetic sensors used electrical and magnetic properties to distinguish different materials. A microcontroller combined the interfaces of all the system components using programming to control all the system actions. Diverse iterations were used for distinguishing different trash materials.

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