SUPERVISOR DECLARATION

"I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Design and Innovation)."

Signature: .....

Supervisor: .....

Date: .....

SMART AUTOMATED TRASH CAN

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This report is submitted in partial fulfilment of the requirements for the award of a Bachelor of Mechanical Engineering (Design & Innovation)

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"I hereby declare that the work in this report is my own except for summaries and quotations which have been duty acknowledged."

Signature: .....

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Date: 28/06/13

Specially dedicated for my father and mother

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ABSTRAK

Terdapat pelbagai kaedah yang digunakan untuk mengukur nilai kapasitan untuk sesuatu bahan. Namun begitu, apa yang ditekankan di dalam projek ini ialah penggunaan sensor kapasitan untuk menentukan nilai kapasitan yang terdapat pada sesuatu jenis bahan yang ada di negara kita ini. Ini adalah merupakan kaedah utama yang sangat penting untuk menjadikan sistem yang direkabentuk berhasil dan dijadikan konsep asas. Ini kerana, dengan menentukan nilai kapasitan sesuatu bahan itu, kita dapat mengetahui apakah jenis bahan yang terkandung di dalam sesuatu sampah seperti mana yang ditekankan di dalam projek ini. Sebagai contoh, terdapat pelbagai jenis sampah yang terdapat di negara kita seperti kayu, plastik, besi, kertas, polisterin, kaca dan sebagainya. Oleh yang demikian, proses menentukan nilai kapasitan bagi setiap bahan ini adalah sangat penting untuk dijadikan sebagai konsep rekabentuk yang akan bertindak sebagai sistem operasi untuk projek ini. Projek ini bertujuan untuk merekabentuk suatu konsep dimana ianya mampu untuk mengasingkan sampah mengikut jenis bahan yang terdapat pada sampah tersebut secara automatik. Setelah konsep yang direkabentuk itu menjadi konsep utama, ianya akan diteruskan ke peringkat seterusnya untuk menjadikan rekabentuk itu lebih optimum dan efisien. Lakaran dengan menggunakan data CAD juga bertindak untuk menjadi konsep itu supaya lebih terperinci. Di situ boleh diletakkan maklumat secara terperinci mengenai sistem operasi tong sampah yang dapat mengasingkan jenis sampah secara automatik. Selain itu, komponen-komponen yang digunakan di dalam sistem itu juga dapat dikelaskan mengikut penggunaan dan aplikasinya terdapat sistem operasi tersebut.

ABSTRACT

There are various methods used to measure the capacitance of a material. However, what is emphasized in this project is the use of capacitance sensors to determine the capacitance value of a certain type of material available in our country. This process is very important to develop the working concept. This is because, by determining the capacitance of a material, we can find out what type of material contained in a trash as emphasized in the project. For example, there are different types of rubbish in our country such as wood, plastic, metal, paper, polystyrene, glass and so on. Therefore, the process of determining the value of the capacitance of each of these is very important to serve as a design concept that will serve as the operating system for this project. This project aims to design a concept where it is able to separate garbage according to type of material found in the trash automatically. Once the concept was designed to be a key concept, it will continue to the next level to make the design more optimal and efficient. Sketching using CAD data will also make the conceptual design more detail. From there, detailed information about operating systems that is able to isolate the trash according to its types automatically can be applied. In addition, the components used in the system can also be classified according to the use and application of the operating system.

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LIST OF SYMBOL

k	=	dielectric constant
F	=	Farad

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NO. **TITLE**

LIST OF ABBREVIATION

DC	=	Direct current
FYP	=	Final Year Project
SATC	=	Smart Automated Trash Can
CAD	=	Computer Aided Drawing
QFD	=	Quality Function Deployment
HOQ	=	House of Quality

CHAPTER 1

INTRODUCTION

1.0 Introduction

The recycle process is very important for our humankind. This process is important and necessary in order to keep the earth from various problems and pollutions produced from time to time. Indirectly, the recycle process can reduce pollution as uncontrolled waste produced, air pollution caused by unpleasant odours and various more. The waste has various types and comes from various sectors such as industry, neighbourhood residence, institutions, hospitals and others. Among the materials which can be recycled are paper, metal, glass, aluminium and plastic. Recycle process can also reduce the impression of greenhouse which gives negative effects to our health. For example, the paper comes from wood which the origin is trees. If the amount of trees is decreasing, the oxygen contained in the air would also decrease and photosynthetic systems cannot be perfectly balanced and would lead to levels of carbon dioxide in the air increase. When the air is not very clean, it is not safe for human to live on the earth and the various problems will arise such as various illness. By recycling paper, we are able reduced the used of trees. According to the advanced technologies now, there are a lot of methods to do the recycling process. Among the basic concept is sorting the waste manually at waste disposed area according to the type of trash. The waste then will be sent to the facilities and proceed with the recycling process.

1.1 Problem Statement

Nowadays, there are a lot of things changed due to the passage of time that we do not realize such as rapid human population, the technology used and many more. These differences also change the cultural in the world that forces us to moving forward parallel with the used of the technology. This affects how human lives now according to the rapid population increased. However, there are a lot of things that make people lives in the world easier because of changes of the technology used now. Otherwise, this modern age change a lot of things such as the system of transportation, education, communication, trading system, and so on. People now can be connected from anywhere just by connecting online and can interact with more than one person. The used of internet change a lot of things in this world because it makes all the matter become globally. For example, a (Computer Aided Design) CAD data of a certain product can be accessed by anyone at anywhere when they are connected online. All the communications will become easier for example when a group of people want to interact with each other but at different location. They can develop a video conference to hold a meeting or discussion online when all the people stay in connection simultaneously. The system of transportation also change quiet a lot such as the use of public transport. There are so many type of public transport now such as taxi, bus, airplane and ship. So, what we can see is all the processes happen in this world become easily done and it gives human beings a lot of advantages in working on their daily routine.

However, due to the passage of time also, there is also a drawback that comes in many ways. First thing that can be said is the lack of raw material in this world such as petroleum and gas. Insufficient of this material changed a lot to the global economy. The price of petroleum is increasing because the number for the amount of this material is decreasing than before. Due to the rapid population also give rise to other problems such as the number of residence increased, an opportunity to work also become less because of higher competition with each other.

Although there are a lot of disadvantages happen due to this rapid population, just one problem will be focused upon which is related to the waste. When the number of human being increased rapidly, wastes been produced would also

increasing and solutions need to be figured out on how to dispose the waste. This is because; the system used to manage the waste need to be renewed to keep this earth safely from pollution and other problems that will rise because of waste. The problems that need to be considered are for example the size of the area to dispose the waste. This location need to be placed far from the neighbourhood to avoid problems such as smelly, dirty places, diseases and many more. That is why we need to start from the beginning of the problems to overcome it.

Among the things to note is the method to do the recycling process to reduce the effects of pollution in our country. Therefore, the waste must be separated by type of material such as plastic, glass, metal and paper. Vulnerability of the system in Malaysia is that the sorting of the trashes is still done manually. Basically, this separation process is normally carried out in the trash collection area. This is because there is not yet exist a system that can isolate these materials automatically which can facilitate the separation of waste.

1.2 Objective

The objective of this project is to develop conceptual designs of a smart trash can which able to automatically sort the different trash.

By the problem statement that was mentioned before, a system need to be developed to be applied at the beginning of the problem to overcome it. Thus, a working concept will be figured to solve the problem and it will start with a working conceptual design of a smart trash which can be applied at the source of the problem as a solution. The point that will be focused is related with the capacitances. All type of things have it is own core material. This material has its own capacitance value. The value of the capacitance can be determined by using proper equipment to classify the capacitances it by their ranges. By using this process, we can know what type of material consist in the trash.

1.3 Scope

The scopes of this project are:

1. Design using several concepts in order to achieve the optimum design.
2. Draw the conceptual designs using CAD software.
3. Determine different capacitances between trashes to develop several working concept.

The main course of this project is to design the conceptual design of the smart trash can which has a system to sort trashes according to different capacitances of the material. Several working concept can be develop related with the operation system to solve the problem base on the problem statement mentioned before. Each type of material has its own value of capacitances.

By designing using the several concepts also can obtained the complete solution to solve the problem. This process is important because the several concepts have been created can be selected for the best concept that suits with the requirement of the problem in order to achieve the optimum design.

After developing the working concept, then proceed to the next process which is drawing the conceptual using the CAD software such as CATIA, Solidworks and AutoCAD. By this process, the operation system can be figured out and the working concept in details would be shown by drawing the conceptual using CAD software.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Literature review is a study based on information currently available to be used as a reference and guide to a new research study. Literature review consists of previous studies with respect to the research study. The result of the study from the information will be used to provide additional value or reference of the research which will be used for the conducted research. Information can be obtained from various types sources for example from books, internet, journals, papers, news and so on. Besides, the originality of this research will be assured to become the evidence of the existed information.

2.1 Recycle

Recycle is the process of changing the material into its raw material and then using it again as a supplement in manufacturing process of the new product development (Carless, 1992). The process consists of few steps, first separating the materials from the waste stream, collects the material, processed them, and reuse. The product may be a new product or as part of new product. It can be truly recycle when the recycle materials have been into another product. In addition, recycling also means simply putting something for a good use after have been thrown away.

Recycle is very important because it gives profits to everyone either directly or indirectly. The most clearly way about the advantages to human being is recycling saves landfilling space, which is certainly significant (Carless, 1992). However, recycling does much more thing that we can consider. It helps us in many factors such as environment, local communities, individuals, and industry. Recycling is easy and also provides better results.

2.2 Sorting System

There are various methods used for recycling. But mostly still done manually when collecting waste by using vehicles such as trucks and then all the trash that have been collected will be send to factories which carry out the recycling process. In addition, employees who work in waste dispose area also separate the trash by manually to easily dispose the waste. Therefore, what is emphasized in this project is to develop a system to assist the isolation process to separate the trash according to its material. With this system, it can reduce the use of labour as it does apply at the early stage of the recycling process. Separation process is carried out automatically by an electronic system that can detect the type of material from the trash. The concept used is to determine the value of the capacitance for the trash by using sensor.

2.3 Capacitance

Capacitance is a device's ability to store electrical energy into an electrostatic field. A device that can possesses a specific amount of capacitance called capacitor. A capacitor is made of two conductors separated by an insulator. They are called plates and the insulator called dielectric. If capacitor connected to the DC voltage source, a current will flows and charge the capacitor. The capacitor is charged with electrons on one plate for negative charge and the other is plate will charge by positive charge. In fact, capacitance is directly proportional to the area of the plate. For example, expanded the area will increase the capacitance if all other factors

remain the same. However, capacitance is inversely proportional to the distance between the plates. The strength of the electric field will decrease if the plate is moved apart. (Gates, 2011). Figure 2.1 below show the position of the insulator and the conductor of capacitor.

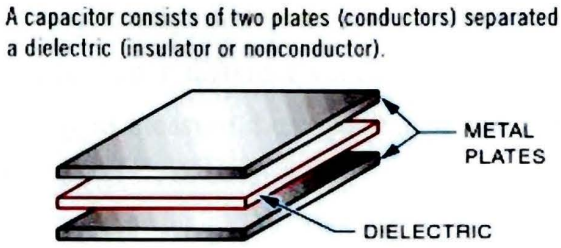

Figure 2.1: The insulator and the conductor of capacitor [source: (Gates, 2011)]

Other sources defined that the electrical charge will determine the value of capacitance after done the separation (Jr. & Tsu, 2007). In addition, the capacitance can be stored in unit change of electric charge. Moreover, capacitance can be determined as the process of storing the electrons and can be considered to be constant related to the shape of the metal (plates) and the size of the system. Although, from the distribution of separation electrons, a three-dimensional surfaces will become more complex if the metal contacts is ignored due to the systems of dielectric. In addition, the total capacitances are required to move into local capacitances of every electron and all cross-capacitance.

In other words also, the determination of capacitance is by charge per volt in term of fundamental definition. It is defined as charges that closed in an equal potential (Tsu, 2011). In case of putting electrons in dielectric, the effect of Coulomb repulsion will forced the N-electrons to the surface. The configuration is changed every time additional charges are added to the system. Besides that, the criteria of the capacitances are monophasic. The charge of a given element will become neutral because it is balanced by additional positive protons.

Capacitance can be defined as an ability of a device to store electrical energy into an electrostatic field. The unit of capacitance is Farad (F). Normally, the value of capacitance is very small that nearly to Nano and Pico Farad for example 0.0048x20nF. That is equal to 0.0048 times $20x10^{-12}$. Moreover, capacitance can be

determined as the process of storing the electrons and can be considered to be constant related to the shape of the metal (plates) and the sizes of the system. The combination of these components called as capacitor. In experiment, capacitance meter is used to measure the value of capacitance of several materials for trash. The material of trash that we normally used to recycle is metal, plastics, glass, and paper. So, each of these materials have different value of capacitance due to its dielectric constant. The simple way to measure the capacitance of these materials is by using the theory of capacitor.

2.4 Capacitor

Capacitor is a device that can possess the specific amount of capacitance. A capacitor consists of two plates which are called as insulator and conductor. The conductors are separated by the insulator (Tagare, 2008). The other name for conductors is plates while insulator is called as dielectric. A capacitor will be charged is if connected to the DC voltage and let the current flows through into it. One plate will be charged with electrons with positive charge while the other will be charged by negative charge. That is how the capacitor works. Capacitor is normally used in electronic component such as board with certain circuit.

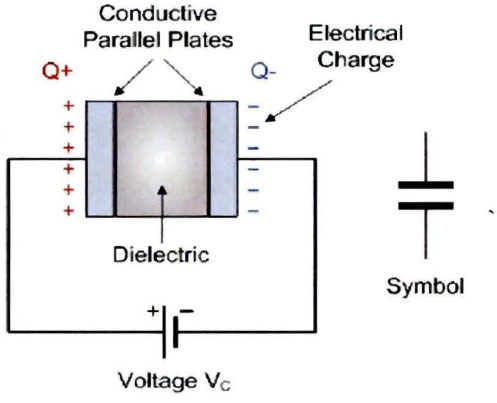

Figure 2.2: The component of capacitor (source from electronic-tutorials.ws)

For this project, an experiment has been executed to measure the value of capacitance for materials used for recycle. The experiment is using the theory of