

[SV 1] AN AUTO SORTING WASTE DETECTION SERVICE SYSTEM FOR GREEN SOCIETY

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ABSTRACT

From the macro perspective, we can see waste as phenomenal volume of mixed complex materials and become a useless output if we do not put it into the step of circular solution which is recycle, reuse and reduce (3R). However, before that it must be in under process of sorting the waste by separating them into organic, inorganic and recyclable, unrecyclable to make the process of 3R more effective. Usually most of people are less awareness or not more knowledgeable to sorting their waste at source and there are no space as well as time to do sorting. This study proposes an effective and prominent system to sorting and detecting trash which is a modern sorting trash detection machine. The study planned to acquire by qualitative method, and obtain information through interview with the expertise of solid waste management. This research helps to improve the realization of the mandatory source separation from Malaysia government and the implementation of Act 672 about waste separation at source and recycling in Malaysia.

Keywords: *solid waste management, separating waste, sorting waste, automatic, detection*

INTRODUCTION

Waste as a number of garbage or refuse or other discarded material including solid, liquid, semi-solid, or contained gaseous material that come from domestic, community, industrial, commercial, institution, agricultural or human operations (Jayarama Reddy, 2011). Despite of that, all of those types of waste are the general problem in this universal (Arebey, Hannan, Basri, Begum & Abdullah, 2010). Other things that also consider as waste is the sludge from treatment plant as well as the air pollution control facility.

Our waste is a massive problem. Szaky (2014) explained, over the 100 years, the amount of waste that people produces has risen by almost 10,000 percent. Especially, in developing country, they are still lacking of waste management system, such as generating and composing the waste. Unlike developed countries, where per capita income is high like the cities in Japan, the average rate of waste generation can be high as 1.64 kg per capita per day, whereas in the cities where the capita income in the middle rate like in Thailand or Malaysia, average rate of waste generation is about 0.74 kg per capita per day (Jayarama, 2011). Environment issues of solid waste problem are being serious problem in Malaysia (Hassan, Chong, & Rahman, 2005).

In this era of modern lifestyle, there are lack of public conscientious which has resulted to increase the amount of waste generated and waste disposed to the landfills. Dealing with waste issues is a challenge for globally area, including in Malaysia, with the annual increase in solid waste generation that rely on landfills that bear the issues of space limitations, public health and environmental issues. Therefore, increasing in recycling at household might reduce this problem of increasing solid waste generation (Moh & Manaf, 2016).

However, one of the most critical challenges in source separation and recycling practice are public attitude toward doing source separation and recycling separation become a habit of public. There is lack of awareness among people to separate their waste into organic, inorganic, recyclable and unrecyclable waste.

Therefore, in this research, we would like to propose an auto sorting waste detection service system named “modern trash detection machine”. The idea is originally designed by us.

The objectives of this paper are;

1. To identify solid waste (example glass, can, paper, food, etc.) easily and make green and healthy society.
2. To help the company of solid waste management for separating many kinds of municipal solid waste that will be recycle.
3. To improve the quality of sorting waste management in effectively and efficiently.

LITERATURE REVIEW

Malaysia has increased their generation of municipal solid waste (MSW) in more than 91%. It becomes the biggest problem of environment in Malaysia (Samsudin & Don, 2013). In the capital city of Malaysia, which is in Kuala Lumpur, there is uncontrolled consumption due to increasing the population that makes waste generation rate in Malaysia has growing fast in every year. Moreover, solid waste generation increases at uncontrollable rate due to the dispensable of utilization of plastic and paper material that used for packaging (Jalil, 2010).

The problem of this case may occurred because Malaysia still have lack of public awareness, environmental education and technical skill regarding on the importance of involvement in recycling program (Samsudin & Don, 2013). This is shows in their previous campaign with the motto of “Kembalikan Sinar kepada Pulau Mutiara” (Restore the Shine to the Pearl of the Orient), exactly this motto was create for Penang’s people to raise the awareness of recycling waste, but it is not successful to make the motto come true. About 40-60% of waste that could not be recycling was found in the recycle bins (Meen-Chee & Narayanan, 2006). That is a proof that Malaysian people still lacking of awareness in recycling of waste.

Current practice of waste management in Malaysia

In present, there is other problem as well that causes the increasing of generation rate in Malaysia was their current solid waste management that still using landfilling and most of sites are open dumpling area (Samsudin & Don, 2013). Moreover, in the year of 2001, incineration is not new technology in Malaysia to dispose the hazardous waste, it has been implemented in some island in Malaysia such as Langkawi, Patong, Tioman

and Labuan, but now this project already terminated because the issue of pollution in the incineration area, it burden to the environment (Manaf, Samah, & Zukki, 2009). Table 1 shows the percentage of waste treatment method applied in Malaysia.

Table 1
Waste treatment method practice in Malaysia (Samsudin & Don, 2013)

Treatement Methods	Percentage (%)		
	2002	2006	Target 2020
Recycling	5.0	5.5	22.0
Composting	0.0	0.0	8.0
Incinerating	0.0	0.0	16.8
Inert landfill	0.0	3.2	9.1
Sanitary landfill	5.0	30.9	44.1
Other disposal sites	90.0	59.4	0.0
Total	100.0	100.0	100.0

In order to achieve genuine progress toward sustainability, Malaysia proposes their future prospect and potential on municipal solid waste management in Malaysia. There are seven targets that can be an impulse for municipal solid waste management improvement: (i) improve public behavior, awareness, and education (ii) waste prevention and minimization (iii) waste recycling and composting (iv) energy recovery from municipal solid waste (v) improve on landfill system (vi) role of non-government and, (vii) integrated approach (Samsudin & Don, 2013).

In 1991, Malaysia has goal to become a developed nation by 2020 (Vision 2020, <http://www.wawasan2020.com/vision/index.html>) and also sign a commitment into the principle of sustainable development in Rio Declaration. The government of Malaysia is committed in improving their solid waste management to achieve their Vision 2020 (Moh & Manaf, 2016). So, National Strategic Plan (NSP) for solid waste management become the plan guideline that consolidate economic development and all stakeholders' needs in set the improvement of solid waste management system (Moh & Manaf, 2016).

One of the NSP frameworks is Waste Minimization Master Plan (WM-MP). WM-MP committed to introduce the minimize consumption of natural resource and minimize the reduction of environmental load. WM-MP target to the government level, private sector level and public level as their stakeholder that form the basis of WM-MP, which are (i) enhancement of awareness on waste minimization; (ii) strengthening of partnership for 3Rs activities (iii) enhancement of institution to strengthen government policies on waste minimization (Moh & Manaf, 2016).

By those frameworks, Malaysia formulated the Solid Waste and Public Cleansing Management Act 2007 (Act 672 and Act 673). Act 672 is about the standardize solid waste management and public cleansing service in Malaysia that ensure the proper municipal solid waste particularly household waste management with a promotion of waste separation at source and recycling throughout Peninsular Malaysia. Therefore, from that issue, innovation to make improvement by using advance technology is needed to reach the goal of Act 672 which is to ensure the proper waste management system by increasing the number of people are doing separation at source regarding to make recycling more effective and efficient.

METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of this study. The research methodology is the general strategy of the research, describing how the research should be undertaken and among other things, identifies the methods to be used in it. The primary method that use in this research is qualitative one. This research conducted by getting information from the expertise of solid waste management in process separation and process recycling. This study focused on 2 types of data collection, which are primary data and secondary data.

Primary data

Interview method

The aim of interview session is to get more useful information from expertise of solid waste management perspectives and experiences in conducting recycling process. The purpose of this interview is also to achieve the objectives of study that can help the company of solid waste management for separating many kinds of municipal solid waste that will be recycle and improving the quality of sorting waste management in effectively and efficiently.

Interviews will begin with identification of the expertise to get his background and his main source of engaging in solid waste management company. The expertise also addressed the question in their knowledge and perspective about process separation waste. After that, the main topic will be addressed and ask their opinion about the installation of our modern trash detection machine.

Structure of interview question

These questions are dividing into three aspects as shown in Table 2.

Table 2
Interview question structure

Demography aspect	Separation waste aspect	Modern trash detection machine aspect
a. Introduce yourself; i. Name; ii. Age; iii. Position in organization; b. How long have you involved in the organization;	a. What do you know about separating waste process? b. Is separating waste process done continuously before the waste dumped into landfills? c. Is there any certain processes that take place in separating this waste? Such as using some machine or manual? d. Is there any waste that you get from household is that has been separated? Approximately is that in the big amount or just a little? e. What do you think about people awareness of separating their waste in source?	a. What do you think about this modern trash detection machine? b. What do you think about the challenge if this machine is going to be installed in many places especially in household? c. What do you think about the positive and negative impact of this machine in social aspect, economic aspect, and human life quality?

Secondary data

Online source

This study collected data from online sources, journals and articles. Gaining more knowledge of information based on the scope of research can be applied to help the analysis of the research and literature review more effective and get view from many angles. More information that we use in this study, such as from the journal of “*Solid waste management transformation and future challenges of source separation and recycling practice in Malaysia*” that revised on 22 April 2016 and many other journals.

Books

This study also gets the information from books that have been published. The information from the books are needed to gain the knowledge about solid waste management. There are the titles of the book that we used, which are *Municipal Solid Waste Management: Processing Energy Recovery Global Examples and Outsmart Waste*.

Newspaper

This study also gets data from newspaper. We get the data from *Metro newspaper* that released on 6th of November 2016. The data are shown and to be analyze in the result of this study.

RESULT

Demography aspect

We have conducted interview with three respondents to share their knowledge and their experience. We met and interview all of respondents. In collecting of data, the authors ensure all of our respondents are expert in solid waste management aspect. And the age of three respondents was between 28 to 59 years old.

Two of them are from Green Resource Recovery Sdn. Bhd. which private company that going to do in waste management and recycling area. We identified that, in general background of Green Resource Recovery Sdn. Bhd. is to provide the facilities of recycling and waste management service, such as collecting waste in certain area (especially in Kedah and Perlis area), separating waste into plastic, paper, and metal or tin, and shipping waste that have been separated to another company to be recycle. In addition, another one respondent is from UUM lecturer that knows about solid waste management.

Separation waste aspect

All respondent have the same opinion about separation of waste. Government of Malaysia has implemented the mandatory of separation waste since September 2015, separating the waste by four categories, which is food waste and domestic waste (we used to put in the green container that company provide in each house) and the recyclable waste such as plastic, paper, as well as metal or tin material. People need to separate the recyclable waste in each of plastic and just put it beside the green container that we have provided to them. Then, they will collect the domestic waste two times per week to each house and they carry that waste directly dump into landfill. They also collecting recycle waste in one time per week; they call it 2+1 formulation (means 2 days for collecting the domestic waste and 1 day to collect recycle waste in a week).

Then, in certain public area they also provide a 3R cage where public can store the waste that has been separated by them in that 3R cage like in Picture 1.



Picture 1

Retrieve from Green Resource Recovery Facebook page (*link;*
<https://www.facebook.com/Green-Resource-Recovery-Sdn-Bhd-731782796933932/>)

Until now, the separation waste process that people do in the household is only by manually, but separation waste process in the recovery company done by using semi-automatically. In the recovery company they use conveyor machine but still need human resource to separate the waste into plastic, paper and tin. By semi-automatic they also divide plastic and paper in some categories. Plastic divide into PET, HDPE, LDPE, PVC and mix plastic. Papers divide into A4, black and white paper, newspaper and mix paper.

It has been one year after the mandatory of separation waste already implemented by Malaysia. From there, we also get the newest data from Solid Waste Corporation (SWCorp) with the amount of 1.56 million ton of waste dumped in between January 2016 until June 2016 compare to the amount of 1.79 million ton in the same period of year 2015 (Zulkipli & Dawum, 2016). In here, we can see the decreasing of waste that dumping into the landfill is about 237,230 tan or 13,21% is because the mandatory of separation an act 672 are going success. As we can see in this situation might save the cost of dumping in landfill with approximately cost by RM7.12 million based on budgeted cost rate of dumping in landfill is about RM30 per ton. It proved that only 13.21% of people that doing separation their waste. It is because the people still lacking of awareness in doing separation waste at source.

In this study, we also identified the opinions of respondent about the people awareness to the action of separation waste. All respondent agreed that people still not aware about this regulation because the mandatory still new and the knowledge of separating waste still not spread evenly in every people in Malaysia. First respondent think that spreading the knowledge of separation waste must be doing continuously to every people, for example by giving talks in an event or in social media as well as making a policy and enforcement to do separation waste in every house. Hopefully, it might increase the awareness of separating waste among all people in Malaysia.

Modern trash detection machine feature

In this feature, we explain to the respondent that we are going to develop an advance technology that can help others to separating their waste and might be improve their awareness to separate their waste at home. Hence, we ask them several questions about this machine and how is their opinion. First and second respondent stated that, if there

is a technology for separating waste automatically, it cannot be installed in every house because of the budget term, the technology are expensive, however if there have the cheapest technology, that will be fine. Additionally it might installed by centralization, for example; we install five technology in a city especially in public area, that technology only become our checkpoint only to store the recycle waste. Third respondent thinks that, machine will help because a lot of works can be done by machine instead of manual, but if the machine together with the awareness and knowledge, it is more helpful. If the machine is going to be implementing in many household, it will be good but unlikely it has a big challenge because of the cost.

The positive impacts of this machine are;

1. In general, if the separation process is going well, it can be extend the age of the landfill. Normally, the duration of landfill going to be full is around 20 years. But if this machine makes people to separate their waste more, it will be reduce the waste that directly going to landfill, because the waste will be recycle and can be used again to make any useful resource. And because of that, it will make our society more green.
2. In social aspect, this machine can create a new business. There will be many entrepreneurs that interest to make a business into this recycling area.
3. In economic aspect, it will make government to reduce the import of the raw material that can or cannot be renewable, such as paper and plastic (renewable) as well as fuel, oil, coal, etc. (non-renewable).
4. In human life quality aspect, if we can handle the recycle waste properly with the awareness and technology machine, it increases our quality life.

The negative impacts of this machine are;

1. In price aspect, if the machine is in high cost, then it requires more budgets to install.
2. If people are still don't have awareness even the machine already implemented. It still not make any sense to that machine unless if the machine going to be use effectively.

IMPLEMENTATION

The modern trash detection machine

We use the AutoCAD software to design this machine. In design, the modern trash detection machine is divided into three bins, which are for plastic bin, paper bin, and metal bin. This machine are designed with the simple and unique model to make people attracted into our design of machine and make people more attracted to use this machine.

As we can see in the Figure 1 is the finishing model that done by us. In the purple side (top side) we call it sensor area, where the waste are put in there, and there is a sensor that can detect whether the waste are paper, plastic, or metal. The bins (blue side) are quite big enough to store the waste where in the top of bins there are cover bins (top yellow side) that can be open to clear the bins after they already full. And the bottom side (bottom yellow side) is to make the machine are standing strongly and ready.

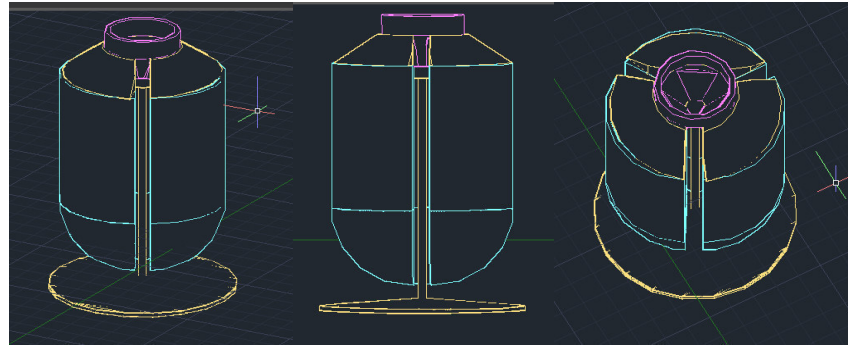


Figure 1
Design of the modern trash detection machine

The system of machine

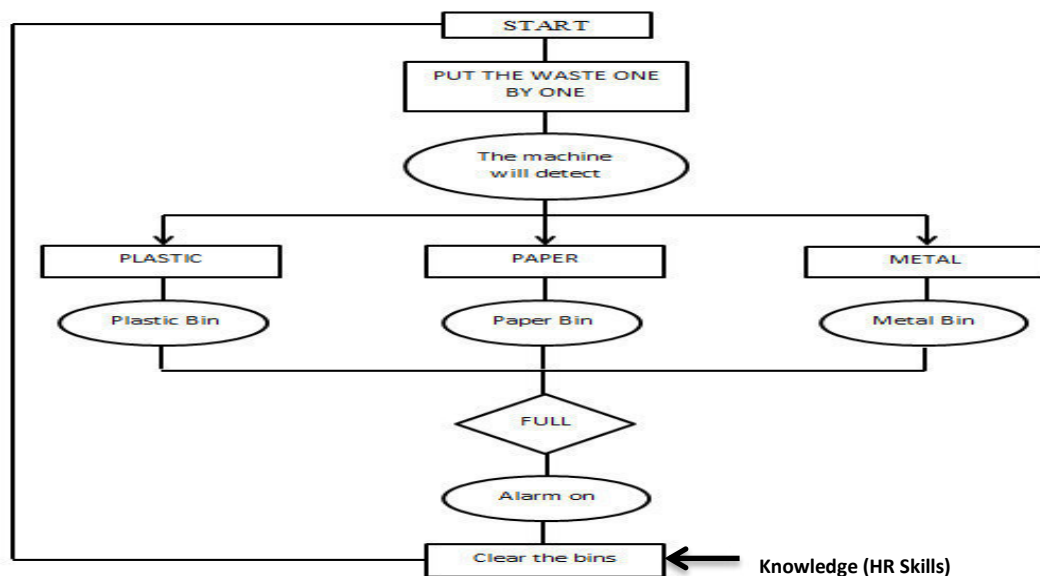


Figure 2
The system of how the machine works

We develop the modern trash detection machine to detect the trash or waste that we put on the machine. In figure 2 the system as shown, first, we put the waste into machine, and then the machine will detect whether the waste are plastic, paper or metal, because the sensor will be put inside this machine to make this works. When the waste is plastic, it will go through to the plastic bin, and same goes to the paper and metal. And when the bins are full, the machine will turn on the alarm automatically, in order to someone realize that the bins already full. Lastly, clear the waste on the bins to makes the bins are empty and can be use it after that, this process is need assisting by human knowledge because the process of taking out the waste from the bins are not automatic, means need someone to take it out.

CONCLUSION

Environment problem is the general things that faced by every country, especially in developing economy such as Malaysia. In a few years ago, Malaysia got uncontrolled consumption due to increasing the population that makes waste generation rate in Malaysia has growing fast in every year. Moreover, solid waste generation increases at uncontrollable rate due to the dispensable of utilization of plastic and paper material that used for packaging. The problem of this case may occurred because Malaysia still have lack of public awareness, environmental education, technical skill, and appropriate technology regarding on the importance of involvement in recycling program. The government of Malaysia is committed in improving their solid waste management to achieve their Vision 2020. Waste Minimization Master Plan (WM-MP) committed to introduce the minimize consumption of natural resource and minimize the reduction of environmental load by enhancement of awareness on waste minimization, strengthening of partnership for 3Rs activities and enhancement of institution to strengthen government policies on waste minimization. Therefore, from that issue, innovation to make improvement by using advance technology is needed to reach the goal of Act 672 which is to ensure the proper waste management system by increasing the number of people are doing separation at source regarding to make recycling more effective and efficient. Hence, we developed an auto sorting waste detection service system for green society. Future researches are needed to make this technology are being implemented in the real life to make environment to the green society.

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