Design of Smart Trash Bin

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Abstract. The purpose of this study is to identify the effect of high-tech bins on people's interest in disposing trash. The method used in this study is a quantitative descriptive method and literature study to analyses community perceptions of smart trash bin. The results of this study state that the mind-set of the community in disposing trash increased after the existence of smart trash bin project. These results were obtained because the community became more interested in disposing trash in the presence of unique designs and diverse functions of these high-tech bins. This study concluded that smart trash bin can increase people's interest in disposing garbage in its place.

1. Introduction

At this present time, the condition of the people's mindset about disposing trash is fairly sad, especially in Indonesia. In fact, there are still many people who don't care about the environment, for example by littering in everywhere. This is based on two things. The first one is the condition of the garbage facility which is lacking in terms of quality and quantity, and the second one is the mindset of the people who still consider the most practical waste disposal by letting it lie on the roadside or dumped it into the river. Therefore, many researchers conducted research and writing on solutions to increase people's interest in disposing trash to the right place. One of them is by upgrading ordinary trash bin into trash bins with advanced technology called Smart Trash Bin as a form of effectiveness and efficiency in disposing and managing waste. One of the articles which discuss about the trash bin technology came from Japanese authors, Fujii, Fujita, Ohnishi, Yamaguchi, Yong, and Park, which resulted in expenditures in the form of recycling bins (called smart recycling). Its technology reduces carbon dioxide emission and lower the overall costs [1]. The other finding about high-tech trash bin is the form of trash bin with a waste sorting from Sinha & Couderc [2], also there is similar research from Lee & Wu [3]. Both of these papers discussed about the technology of bins with a waste sorting system. Even Indonesian writers, Prengky, Bayu, Steven & Julyar wrote a similar paper about an intelligent automatic waste sorting tool that can separate metal and non-metal types of waste [4]. These findings are useful for optimizing waste collection and management. But the findings are still less of effective in attracting the public's interest in disposing garbage into the trash bin.

The next findings are occurred in 4 articles that discuss alike research. There are came from (Folianto, Low & Yeow), (Ramson & Moni), (Aazam, St-Hilaire, Lung & Lambadaris) and (Mustafa & Azir) whose discussing about monitoring systems in trash can [5,6,7,8]. By using certain indicators, the system will alert users when the capacity of the trash bin is full so there is no need to check into the trash bin every time. And now the most common research is about smart trash bin which can open and close the cover automatically. One of them is written by Fukuizumi [9]. A similar study also came from Madya, revealing that smart trash bin uses a microcontroller and infrared light to make the cover do the function automatically [10].

So far, the research that has been carried out has resulted in effective expenditure to optimize waste collection and management. According to the author, there is one of the most sophisticated findings...
about smart trash bin. It is the discovery of smart bin robots from Umam that have complex features that allow robots to choose the type of garbage and navigate it [11]. This robot uses two cameras and ultrasonic sensor, so that it can detect trash around the robot and collect them itself. Besides that, this robot can open and close the cover with the help of microcontrollers and infrared rays. Among these studies, the author will conduct research about the mindset of the community in disposing trash with the existence of smart trash bin project. However, the smart trash bin does not make as sophisticated as the robot written by Umam but has several combinations of functions from previous researches [11]. One of them is the research done by Michael, Otaru, Liman, Bomoi & Awotoye who suggested smart trash bin which has several features like automatic opening and closing of the bin cover, voice recognition module and monitoring system features [12].

A similar tool will be designed and linked to the people's mindset about disposing garbage into the trash bin after the existence of the tool. As the purpose of this study, this tool is used to identify the influence of high-tech trash bin on people's interest in disposing trash. The method used in this study is descriptive method, literature study, and observation/survey which is used to analyze community perceptions of smart trash bin.

2. Method
Specifically, the methods used in this study are literature studies and quantitative descriptive studies. The literature study is conducted by examining similar studies that have been done before or research that is close to the similarity with this study. There were twelve studies that the authors quoted to complete this paper consisting of 10 international studies and 2 local studies. The quantitative descriptive study was carried out with a survey instrument in the form of a questionnaire aimed at the community in the Universitas Komputer Indonesia. The respondents are the people from UNIKOM campus including students, lecturers and staff from every ages and sexes. However, the author does not take the entire population at the Indonesian Computer University, the authors only take samples from several representatives of groups which the total is 30 samples. The questionnaire technique uses Likert Scale. It is the bipolar scale which is used to measure perceptions, attitudes or opinions of a person or group regarding an event or social phenomenon. The Likert scale works by responding to multiple statements with diverse choices (usually 5 options) in the form of qualitative and then converting the answers into quantitative data. In this study the questionnaire was the most important tool for measuring changes in people's mindsets about disposing trash in its place after the existence of smart trash bin project (See Figure 1).
The table above is a design of questionnaire used by the author to be distributed to respondents. There are two parts to the questionnaire that will be filled by the respondent. The first one is existing conditions (before the existence of smart trash bin project) and the second one is conditions after the smart trash bin project.

3. Results and Discussion
As explained in the previous section this study is discussing about people's mindsets changes about disposing trash in its place after the existence of smart trash bin project. The smart trash bin which mentioned is a smart trash bin with the automatic opening and closing of bin cover, voice recognition module and monitoring system features. The features of the smart trash bin use several important components including power supply, PIR sensor, Controller (Arduino Uno), voice recognition system, servo motor and ultrasonic sound sensor. Power supply is used as a generator that functions as the main energy source. PIR sensors is used to detect infrared radiation as a result of heat generation from humans. The controller is used to move and integrate sensor components (Ultrasonic sensors, PIR, voice recognition modules). All of the components work together and form a lid of the bin opening system. The mind map and the design of the project can be seen in the Figure 2 and Figure 3.
However, this study does not focus on designing smart trash bin. The author rather analyses the changing mindset of the community about disposing trash in its place with the condition of before and after the existence of smart trash bin project. After distributing questionnaires to 30 samples, the next step is processing data from each questionnaire (scoring). The following are the final processed of the questionnaire (See Figure 4).
The table above is the calculation results of Point A and Point B. The total score of point A is 519, while the total score of Point B is 575. It means that the mindset of the community in disposing trash is increased from the existing condition (Point A) to the condition after the existence of smart trash bin project (Point B).

To find out the detail about change of people's mindsets the author covert the scores above into a scale and percentage like the calculation below.

| Higher Score (Max) = Higher Value x Total of Sentence x Respondents |
| 5 x 5 x 30 = 750 |

| Lowest Score (Min) = Lowest Value x Total of Sentence x Respondents |
| 1 x 5 x 30 = 150 |

| Index Percentage (%) |
| Total Scores A / Max x 100 |
| 519/750 x 100 = 69.2% |

| Total Scores B / Max x 100 |
| 575/750 x 100 = 76.6% |

It is known that the percentage of people's mindset in the point A is 69.2% while the point B is 76.6%. It is state that the mindset of the community in disposing trash to the right place has increased by 7.4% after the existence of smart trash bin project. Even though the change is not significant, the community more interested and enthusiastic to disposing garbage into the trash bin after the existence of smart trash bin project. It means that design and function of smart trash bin can influence people's mindsets in disposing trash to the right place (trash bin).
4. Conclusion
This research concluded that smart trash bin can influence the mindset of the community in disposing trash to the right place. There is a perception change of people in disposing trash from existing condition (69.2%) to the condition after the existence of smart trash bin project (76.6%). Smart trash bin is one of the many solution to overcome people who still have the littering mindset.

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