

Android-based Social Media System of Household Waste Recycling: Designing and User Acceptance Testing

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Abstract. This paper is to design Android-based applications that can be a media of household recycling waste information and to know the level of user acceptance on Android-based social media system of household waste recycling (Pilah Matur App). To measure user satisfaction in user acceptance test, authors used the survey method. The problem of waste, especially household waste, has not been handled properly including in urban areas. The addition of landfill sites cannot directly solve urban waste problems, because the volume of waste at the landfill is very large and mixed with dry and wet wastes, also organic and non-organic wastes. Separation of household waste is a very important part of the effort to reduce the garbage disposed to the landfill. Information technology can take a role in facilitating the waste sorting process. Pilah Matur App can be used as a media for sharing the recycled waste information so that household waste can be interchanged by urban residents who might be needed it to be reused. Sharing the recyclable material information using Pilah Matur App is expected to reduce the amount of waste disposed to the landfill. The application design such as user interface and application prototype is introduced to the users in order to obtain feedback and measure the level of user acceptance. In general, Android-based social media system of household waste recycling can be accepted by users, there are 12 indicators that show positive results and 2 indicators that show negatives. The negative results caused by users expect more various features and users expect the application to be faster in the process of sending or uploading data. Furthermore, authors have to improve the speed of uploading process of a large photo of household waste recycling. Available features should also more added to increase user acceptance levels.

1. Introduction

The separation of household waste is classifying waste piles into different elements, such as organic and non-organic waste, wet and dry waste. Organic waste is material that easy to decompose like kitchen waste such as vegetables, fruits, or food scraps, and garden waste such as leaves, grass, twigs, and others. Non-organic or solid waste such as plastic, glass, paper, cardboard, and metal. Solid waste that is not treated properly, contains many components that have the potential to cause infectious diseases and harmful to citizens and the environment [1].

Thousands of tons of waste produced by households in cities and settlements must be managed on a daily basis. Cities that are central to economic development and rapid population growth face various problems such as low waste collection capabilities, lack of sewage treatment facilities, unsatisfactory solid waste management can cause water, soil and air pollution, and harm communities and the environment [2]. According to the information of Bandung municipal government in 2017, the volume



of waste generated by the population of households Bandung municipal, about 1,600 tons/day [3]. If it is not immediately handled properly, then the city of Bandung will be immersed in a pile of garbage along with all negative impacts such as environmental pollution of water, air, soil, and become the source of disease. In the waste processing, there is no zero-residual technology.

Accumulation of waste in the landfill as a result of waste reduction method only focusing to on the transport of waste to the landfill. A sanitary landfill requires a very expensive cost for investment, construction, operation and maintenance. Local governments should begin the concept of integrated waste management by minimizing waste disposal to landfills, and increasing environmentally friendly recycling or composting. Therefore, a new concept is required in the management of household waste by reducing, the amount of waste is disposed to landfills through household waste recycling activities [4].

Household waste is a growing problem at the city, regional and global levels. Household waste management can be defined as a discipline related to control, store, collect, transport, and dispose of waste to the landfill. Effective household waste management requires detailed spatial information. This information is related to the geographical background of the area under investigation, and specific data related to the waste collection procedure [5].

Therefore, aims of this paper are to design the user interface of Android-based social media system of household waste recycling (Pilah Matur App) and to measure user satisfaction in user acceptance test authors using the survey method.

2. Method

User acceptance testing is performed by users who have worked with a developer to know clearly how the software that has been created works before the software that is created is disseminated. Keep in mind that user acceptance tests should be done gradually from the beginning of the stages of system development life cycle (SDLC) shown in Figure 1, if the test is only at the end it can be ascertained the result is unsatisfying.

Authors use quantitative and qualitative data sourced from primary and secondary data to design Android-based social media system of household waste recycling (Pilah Matur App) and create user acceptance test. There are 8 parameters used in the assessment to measure the level of user acceptance such as relevancy, accuracy, efficiency, simplicity, features, fineness, safety, and attractiveness. Explanation of these parameters with the sequence as follows:

- Relevancy factor is related to the suitability of applications with activities to reduce the volume of household waste disposed to landfill.
- Accuracy factor is related to the accuracy of applications in processing data and displaying recycled waste information.
- Efficiency factor is related to the time required to use the application.
- Simplicity factor is related to the ease of operating the application the first time, and the ease of exploration of the available menu.
- Features factor is related to the features that can improve the basic function of the application.
- Fineness factor is related to a display that has an appeal to the user so it creates fun when used, and the icon is displayed in an interesting way.
- Safety factor is related to user security when using the application and the user's security from negative impacts when using the application.
- Attractiveness factor is related to the willingness of users to use application that require internet charges when using the application.

User acceptance test begins when the application requirement has been written [6]. It is the contrast to the general opinion that user acceptance test is performed at the last stage before the application is distributed to clients. Authors use the user acceptance test as a tool for recording and correcting error found. Those are to give users a chance to find out if everything works as it should if features have been

overlooked, to interact with the application and to avoid miscommunication with users, and so on (Figure 1) [7].

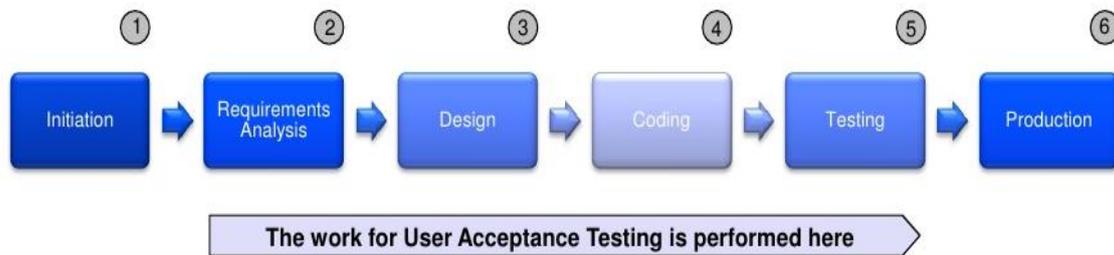


Figure 1. Software development lifecycle [6].

The author measures user satisfaction using user acceptance test with survey method. A Survey is a method used to describe or analyse a research result but not used to make wider conclusions. The survey aims to collect perceived and expected data from users within a period of a week. Respondents who were sampled are; residents of the household, students and workers, so the sample has different characteristics of age shown in (Figure 2), and gender shown in (Figure 3).

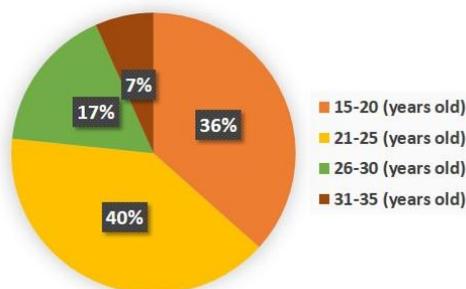


Figure 2. Age distribution of the respondents.

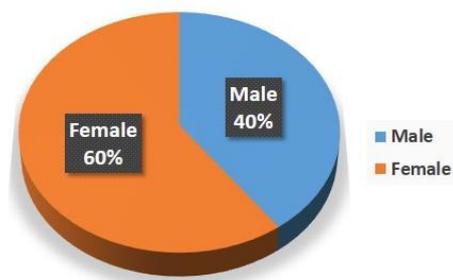


Figure 3. Gender distribution of the respondents.

3. Results and discussion

The user interfaces design of Android-based social media system of household waste recycling (Pilah Matur App) for smartphone user needs to consider the layout and colour composition that users can be comfortable using the application. The implementation of household waste recycling social media system in Figure 4, using an Android operating system. Android Smartphone is widely used by the people of Indonesia because it is open source, easy to develop applications in it, and the price is relatively affordable. Android smartphones generally have been equipped with camera and GPS making it easier in the operation of the application. Different from another research that focuses on waste management using IoT to perform waste collection and dynamic route optimization [8], the design of Pilah Matur App is actually try to reduce the amount of household waste disposed to the landfill through how to distribute recycled waste to users who need it.

Survey data collection is obtained by filling out the questionnaire, which has been distributed to respondents through online or offline. There are 30 respondents completed the questionnaire data within a period of a month in September 2017 in Bandung city. The respondents were first given an expectation questionnaire in order to get information about user expectations when using social media applications of household waste management. Then the respondents started using household waste recycling social media system to input recycling waste data owned at home. The respondents also explore the menus and features available in the application. Finally, the respondents completed the perceived questionnaire to obtain the user perception information after using the application (Figure 4).



Figure 4. Design of Pilah Matur App user interface.

The mean values of P2 in Table 1, shows the relevance of household waste recycling android-based social media system with the reduction of household waste disposed to the landfill. The mean values of P3 in Table 1, shows that the application can be used as a means of supporting household waste management. The mean values of P5 in Table 1, shows that the information has illustrated the conditions of recycling of waste exchanges among households. The mean values of P6 in Table 1, shows that the information has been processed and displayed correctly and the user is satisfied with the information.

The mean values of P11 in Table 1, shows that the user is satisfied with a relatively small degree of application error. The mean values of P1 in Table 1, shows that the application can facilitate data collection activity of household garbage. The mean values of P7 in Table 1, shows that the user expects the application to be faster in the process of sending or uploading data, so it can save more time in data input. The speed at which data is sent to the server is affected by the carrier network coverage conditions used in the application, and the size of photos uploaded to the server in kilobytes, the size of the image file that can be sent up to 1000 kilobytes.

The mean values of P8 in Table 1, shows that the ease level of the application usage matches the user expectations. The mean values of P9 in Table 1, shows that the level of ease in the exploration of the available menu is considered satisfactory. The mean values of P4 in Table 1, shows that the user expects more various features, thus providing more benefits for household waste management activities. The mean values of P10 in Table 1, shows that the user is satisfied with the display of the application and icon displayed. The mean values of P12 in Table 1, shows that the security from the negative impact in using the application is in accordance with the needs of the user. The mean values of P13 in Table 1, shows that users are willing to pay internet access when the application is used. The mean values of P14 in Table 1, shows that the user is satisfied with the rate of generous fees when using the application.

Authors summarize the results of surveys that have been done in the form of tables and graphs, to see the user's tendency towards perceived and expected comparison. If perceived > expected then it can be concluded the user is satisfied, if perceived < expected then it can be concluded the user is not satisfied, whereas if perceived = expected then user think neutral and need to be reconfirmed [9].

Users are not satisfied with the efficiency factor and features as shown in Table 9, P7 and P4 parameters are negative. These are due to the size of the recycled waste photo data that is too large, which causes the data transfer to the server is slow. Users expect that recycled waste photographs or images can be compressed before they are sent via the internet. Therefore, it can speed up the process of data transfer to the server.

Users want more features to be provided by the household waste recycling Android-based social media system, one of them that can provide is a notification when there are new data coming in. Features

that can help users to find the nearest household waste recycling from their current location are also needed by users [10, 11]. Available features in an application are still less because the application is still in prototype stage. In general, Pilah Matur App can be accepted by users as shown in (Figure 5). There are 12 indicators that show positive results and 2 indicators that show negatives, so the positive results more than negatives (Table 1).

Table 1. Summary of result of questionnaire survey.

Parameters	Indicators	Means		Results
		Perceived	Expected	
Relevancy	P2, the application is relevant to the reduction of household waste disposed to the landfill	4.17	4.03	Positive
	P3, the application can be a media for sharing recycled waste information	4.37	4.33	Positive
Accuracy	P5, the information shows the conditions of recycled waste exchange among households	4.3	4.03	Positive
	P6, recycled waste sharing information can be displayed properly	4.3	4.17	Positive
	P11, error rate / error occurred	4.4	3.73	Positive
Efficiency	P1, the application can facilitate household waste management activities	4.63	4.13	Positive
	P7, the application can save time in performing recycling waste information	4.6	4.73	Negative
Simplicity	P8, the level of ease of using the application the first time	4.27	3.5	Positive
	P9, the level of ease in the exploration of available menus	4.37	3.87	Positive
Features	P4, the available features can help in household waste sorting	4.4	4.53	Negative
Fineness	P10, the application interface and icons are displayed well	4.23	4.03	Positive
Safety	P12, the security for users from the negative impact in using the application	4.2	3.67	Positive
Attractiveness	P13, the willingness of users to spend internet access fees	4.17	3.47	Positive
	P14, the cost efficiency of application usage	4.57	4.2	Positive

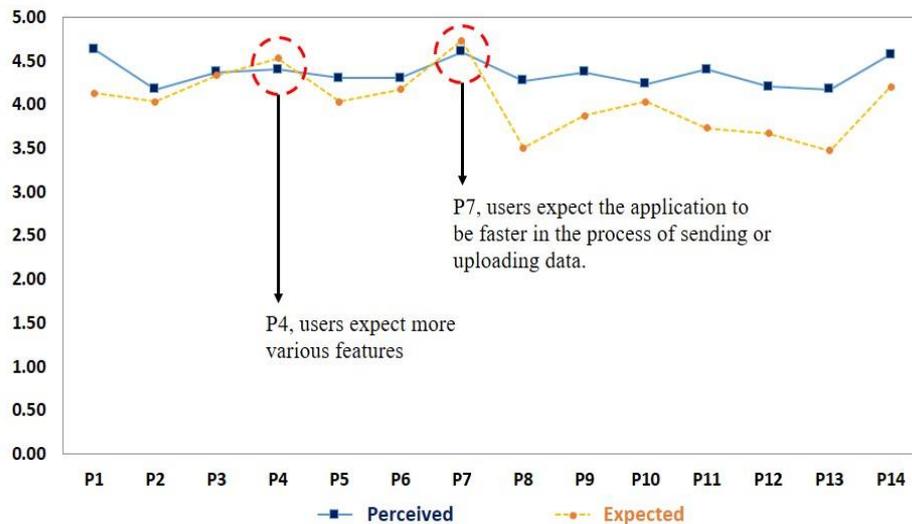


Figure 5. Comparison perceived vs. expected.

4. Conclusions

Household waste recycling Android-based social media system (Pilah Matur App) is an information media application to share information about recycling waste among households. The process of designing applications, referring to the analysis of user needs regarding the technical aspects and functional aspects of the application, and consider the cognitive aspects, which focus on user interaction. Pilah Matur App provides facilities such as; 1) data input or recycled material sharing information; 2) to locate recycled material information at the nearest location of the residence; 3) data input of required recycled materials; 4) to send a message to the recycled material owner; 5) to receive messages from recycled material seekers, 6) user assistance features.

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