



Recycle Helper: An Application for Serving and Managing Recycle Guides in Sophisticated Way

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Abstract

In recent years Indonesia is struggling with their waste. Every day, Indonesia generates around 175,000 tons of waste. Some waste takes a lot of time to decompose normally and even though many people know this fact, there are still a lot of people still throwing their waste without giving a second thought. This problem has not been solved yet and it's because people in Indonesia don't know how to recycle their waste properly. In order to solve this problem, a platform is needed to provide information on how to recycle waste, for example Recycle Helper (a web application that provides guides on how to make useful items out of waste to reduce the amount of waste thrown and let users create and share their own guides with their own recycle idea). The questionnaire result that has been collected proves that people are still having a recycling motivation, hence *Recycle Helper* application is compatible with the current situation.

1 Introduction

In this current situation around the world, waste has been an important matter that is still not going to end. Most of them still have a negative impact on humans or the environment, particularly plastics. An significant cause of air pollution is the incineration of plastic waste in an open environment. Plastic burning leads to significant health threats such as heart disease, worsens respiratory conditions such as asthma and emphysema, and causes rashes, nausea or headaches, damage to the kidney or liver nervous system, reproductive system and growth (Ackerman, 2009). Furthermore, there is no

small amount of such waste in general. In 2015, plastic waste was produced in 192 coastal countries, with a total of 275 million metric tons (MT), with 4.8 to 12.7 million MT entering the ocean (Jambeck et al., 2015).

The behavior of people in treating waste could have a relation with the problem above. The absence of reliable recycling facilities is one of the barriers that prevent Chinese people from processing and reusing most recyclable waste, based on the research of people in China (Zhang et al., 2016). It shows that effective recycling facilities are needed by most people to motivate their recycle activity.

The authors provide an idea to facilitate recycling activities by making a software product. The product must be giving an ease on finding or managing recycle guides. By that, people do not have to think harder and thus give them efficiency.

Our inspiration comes from the food recipe management application which is giving the user knowledge of cooking with ease by just typing its ingredients or exploring unexpected recipes. Recipe on how to cook something is just the same as recipe on how to recycle something. So that the authors try to make an application with the same concept but different product.

The authors take the base inspiration point from a paper written by (Punamiya, 2018) from Vidyalankar Institute of Technology, Mumbai. The paper was published in 2018 in the International Journal of Advanced Research, Ideas and Innovations in Technology, and talks about food recipe

application. Their result is a recipe management application developed with essential features such as search by ingredient, find recipes, add new recipes, and add favourites.

The *Recycle Helper* application that the authors built will consist of some similar features such as search by material, find guides, add more guides. However, it will be improved by adding some advancements and refinements. The target will be a complete application of *Recycle Helper* that will be able to solve several problems regarding recycling knowledge, and also to facilitate recycling activities in a sophisticated way.

2 Concepts And Theories

2.1 Waste

Rubbish is a derivative of human activity). Physically, it incorporates materials that are used in useful products; it varies only in its lack of value from useful production. Waste can be categorized by a number of systems: by physical state (solid, liquid, gaseous) and then by solid waste: by original use (packaging waste, food waste, etc.), by content (glass, paper, etc.), by physical properties (combustible, compostable, recyclable), by origin (domestic, commercial, agricultural, industrial, etc.) or by level of protection (hazardous, non-hazardous (McDougall et al., 2001).

Waste has been a nuisance since the middle ages. Waste was often thrown onto the streets causing smells and encouraging vermin and disease. The amount of rubbish keeps increasing throughout the time. In Europe, the industrial revolution led to a further move from the population of the rural areas to the cities, bringing a massive expansion of population in cities, and further made the volume of waste arising (William, 2005). It did not stop just right there. Certain pollution, such as municipal solid waste, has also seen annual volumes rise in contemporary Europe for many decades and represents. Waste generation is a symbiotic, tragic, and likely harmful result of the production and use of material products and services in the world today (Persson & Münster, 2016).

2.2 Recycle

Recycling is a process to convert old or waste materials into something new that has value in itself. Recycling is one of three main parts of 3R, Reuse Reduce Recycle. The goal of recycling is

environmental sustainability by redirecting waste out of the economic system. There are broadly two categories of what type of wastes that can be recycled, consumer waste and industrial waste which both need different approaches to recycle. For example, plastic and e-waste such as batteries have a very different guideline and outcome.

Once upon a time, recycling was necessary and obvious. The landfill crisis was thought to be inevitable during the 1980s and the beginning of the 1990s. Therefore, recycling was deemed necessary to escape the tremendous cost and environmental burden of additional landfill construction (Ackerman, 2009). To prevent such a problem from occurring again, waste reduction is still needed.

Some researchers found that recycling motivation is important for all social groups). A few have indicated that recycling is more prevalent among high-education households, women, whites and high-income households, whereas the other studies said it was equivalent for all sociodemographic (Ackerman, 2009). Even though the result was controlled by the location of research, the data had revealed the part of the story of recycle.

2.3 Software Engineering

Software Engineering is the creation and use of proven engineering concepts in order to acquire efficiently and effectively reliable software that works efficiently on real machines. The essence of software engineering practice (Presman, 2014):

1. Understand the question (communication and Analysis)
2. Schedule a solution (modelling and software design)
3. Take the plan out (code generation)
4. Check the outcomes for reliability (testing and quality assurance)

Before working on the software, Software engineers have to understand a problem and then they have to think about what requirements the software has to meet in order to solve that particular problem. After knowing the requirements of the software, Software engineers will design an analysis model to represent the system in order to assure that the software has met the requirements. As we can see, there are three research model elements: scenario-based elements (the system is defined using a scenario-based approach from the user's point of view), class-based elements (each usage scenario includes a collection of artifacts that are manipulated when an actor interacts with the system) and behavioral elements (system behavior) (Presman, 2014).

2.4 Web Application

Web applications are generally referred to as web applications that are designed using web technologies and made accessible through web browsers. The difference between web applications and traditional web sites is that traditional websites only provide static content or information, meanwhile web applications lets users do other things than just receiving information from the website. The benefits of web applications are ease of access, ease of development, “trained” user base, maturity and reliability of network connectivity and web technologies (Gomez, 2021).

2.5 Survey Literature

People expect a lot of products to be used these days, the more waste they make. First of all, waste avoidance (e.g. avoiding goods with unnecessary packaging; using less products) is the most efficient method of reducing waste, followed by reusing or seeking new applications for items, while recycling is the least effective waste reduction technique. Those are written on home, job, and holiday waste reduction behaviors: What affects behavioral continuity across contexts?

On the Practice of Household Solid Waste Management Related Factors and Service Delivery Efficiency of Private Solid Waste Collectors in Dire Dawa City, Eastern Ethiopia, it was written that

most developed countries understand that, in addition to ensuring the protection of the environment and human health, solid waste management is very critical for survival. However, for different reasons, developing countries such as Ethiopia are dumping waste in unregulated sites that are easily exposed to severe hazards, such as environmental contamination and health issues, let alone exploit its economic benefits. From February 27 to March 27, 2015, this literature study was aimed at assessing the status of solid waste management, related factors and service delivery efficiency of private solid waste collectors in Dire Dawa city. And the outcome of the literature is that 352 (69 percent) of the majority of households dispose of solid waste in an inappropriate way. In the study area, 7.119, 91 percent CI = (4.328-8.925) was correlated with inappropriate management of household solid waste. That means that if the people in the household could handle their waste and recycle it on their own or dispose of it in a proper way, it would be nice.

These days, recycling is very relevant, we might read that Malaysia should take the example of an advanced country like Japan, which manages to achieve a 40 percent annual recycling rate, written on a study of Malaysia Solid Waste Management Policies to Enhance Household Recycling Practice and Waste Separation.

3 Research Methods

The research methods that are used in this paper are getting information from users using online surveys and by doing literature review. The online surveys are done by using Google Form. There were a total of ten questions and 46 people have filled the form. The questions that was asked on the form are :

1. Do you have a lot of home waste or items that are not being used anymore ?
2. What kind of home waste or unused items do you have ?
3. Do you have any trouble finding a way to make useful items from waste or unused items ?
4. Are you interested in making a new item out of waste or unused items ?
5. Would you find it easy to recycle unused items or waste if there is a guide to make one ?
6. How many recycle ideas do you remember ?
7. Are you hoping to get a new recycling idea ?
8. Are you hoping to have an easier way to search for recycle guides ?
9. Have you ever heard about a website that provided guides to make useful items out of waste ?
10. If there is a website that will make it easier for everyone to know how to make useful items out of waste, would you try it?

As for literature review, all of literature that were used are all available free online and can be search using Google Scholar and ResearchGate.

4 Research Results

There were ten questions on the survey that were filled by 46 people. The first question is, do people have a lot of home waste or items that are not being used anymore?

Do you have a lot of home waste or items that are not being used anymore ?

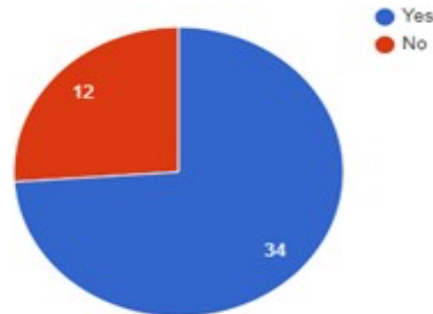


Figure 1: First Question

About 34 people answered “Yes” and the other 12 people choose “No”, which means that there are still a lot of people who have home waste or items that are not being used anymore. It shows that the people out there still have enough materials for recycling. Second, what kind of home waste or unused items do they have?

What kind of home waste or unused items do you have ?

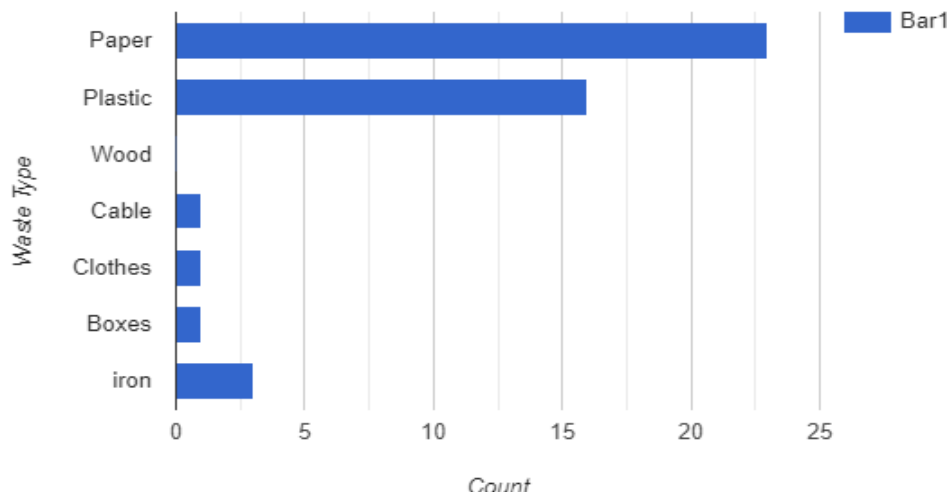


Figure 2: Second Question

There are about 23 people choose paper, 16 people choose plastic, none choose wood, and 7 other people choose other and filled cable, clothes, boxes, none (3 people), and iron. It shows that the majority of people tend to have more paper and plastic waste at their home. The application must put a priority on these categories. Third question is do they have trouble finding a way to make useful items from a waste or unused items?

Do you have any trouble finding a way to make useful items from waste or unused items ?



Figure 3: Third Question

About 39 people choose “Yes” and the other 7 people choose “No”. It shows that most people need a guide to help them recycle waste. Fourth, are they interested in making a new item from a waste or unused items?

Are you interested in making a new item out of waste or unused items ?

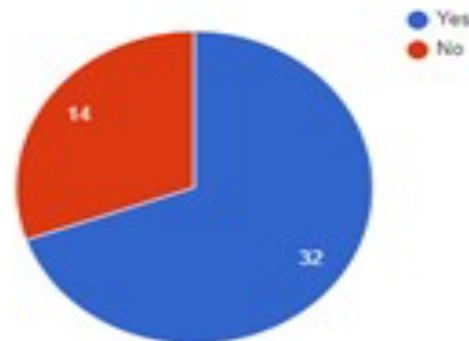


Figure 4: Fourth Question

About 32 people answered “Yes” and the other 14 people answered “No”. People who still have passion for recycling are pretty high. The positive responses are still about two times the negative responses, showing that the recycling motivation among people still exists. Fifth question, Would they find it easy to recycle unused items or waste if there is a guide to make one ?

Would you find it easy to recycle unused items or waste if there is a guide to make one ?

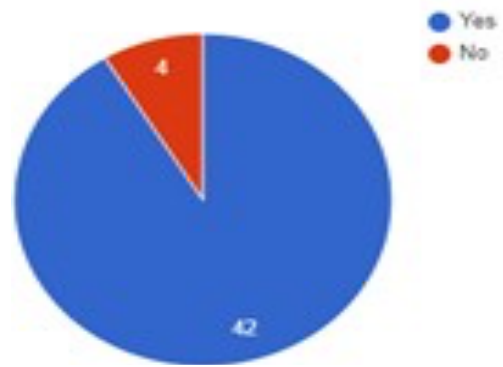


Figure 5: Fifth Question

About 42 people said “Yes” and the other 4 people said “No”. Majority of people are welcoming the existence of guidance to make their recycling activity more easy. But still, there are some people who don’t find it convenient.

Next question, how many recycle ideas do they remember?

How many recycles idea do you remember?

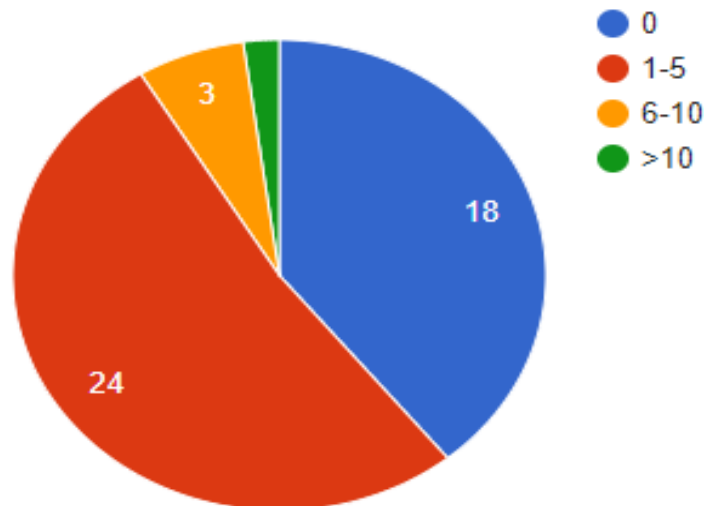


Figure 6: Sixth Question

About 18 people answered 0 (zero), 24 people answered 1 - 5 (one to five), 3 people answered 6 - 10 (six to ten) and there was only one person who answered > 10 (more than ten). It shows that the majority of people still have a little knowledge in recycling. People tend to have 0-5 ideas that

they could remember. The application needs to provide variation of ideas, so that people can improve their knowledge. Seventh, are they hoping to get a new recycle idea?

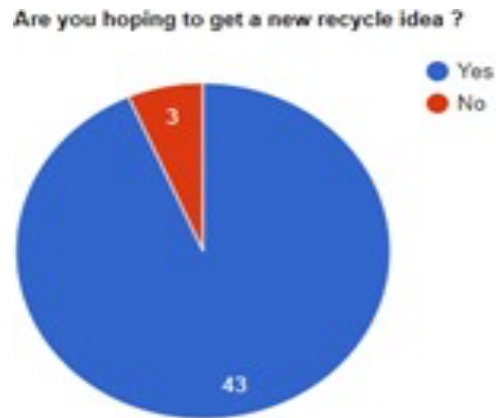


Figure 7: Seventh Question

About 43 people answered “Yes”, the other 3 people said “No”. Most of them are likely to improve their knowledge in recycling, making the Recycle Helper application more welcomed. Eighth, are they hoping to have an easier way to search for recycle guides?

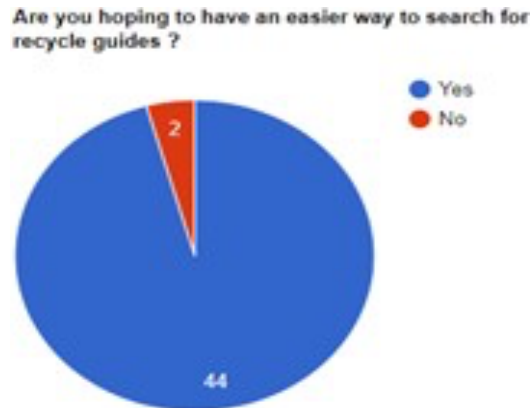


Figure 8: Eighth Question

About 44 people answered yes and the other 2 people answered no. It shows that most people would like to get an ease while searching for a recycle guide. Ninth, Have they ever heard about a website that provided guides to make useful items out of waste?

Have you ever heard about a website that provided guides to make useful items out of waste ?

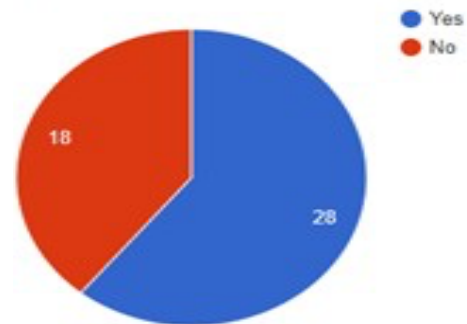


Figure 9: Ninth Question

About 28 people answered yes, the other 18 people answered no. Even though there are some slight differences between people who know such websites and not, the majority of them still do not know such websites. The last question, If there is a website that will make it easier for everyone to know how to make useful items out of waste, would they try it?

If there is a website that will make it easier for everyone to know how to make useful items out of waste, would you try it?

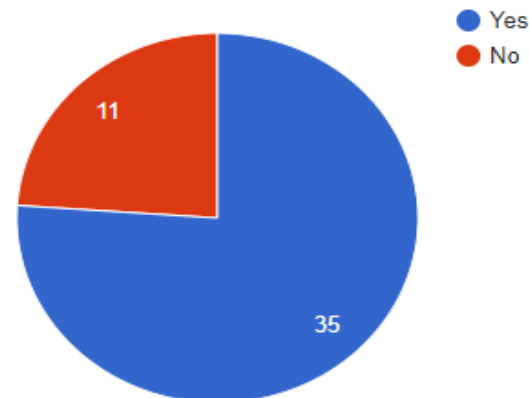


Figure 10: Tenth Question

About 35 people answered “Yes” and the other 11 people answered “No”. It shows that most people still have a willingness to try recycling waste or unused items.

The Survey Literature tells us that there are still a lot of households in some city or nation that can not manage their waste and most of the literature suggests recycling.

With the results of the survey and the literature review, the team agrees that there are still a lot of people who have a lot of home waste or unused items. Not only that, there are a lot of people who are interested in recycling their unused items to make the new item, they are also interested in trying a

website that could make it easier for them to recycle their unused items. Below is the list of requirements for building the application:

Role	Task
Admin	- Manipulating Material Categories (Add, Delete, Update)
	- Manipulating Materials (Add, Delete, Update)
	- Manipulating Own Guides (Add, Delete, Update)
	- Manipulation Own Profile (Update)
	- Change Own Password
	- Show All List User, Material Categories, Materials
	- Search and Filter Guides
Member	- Manipulating Own Guides (Add, Delete, Update)
	- Manipulation Own Profile (Update)
	- Change Own Password
	- Show All List User
	- Search and Filter Guides

Table 1: Requirements

Belows are the more abstract version of page privileges based on the requirements above:

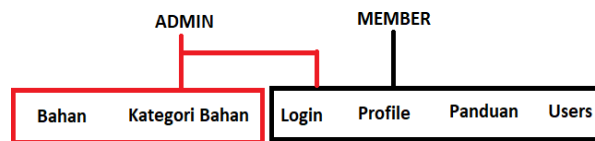


Figure 11: Abstract Page Privileges

Where in English, Bahan = Material; Kategori Bahan = Material Category; Panduan = Guides. After having requirements all complete, the conceptual diagram needs to be built. The conceptual diagram is shown as below:

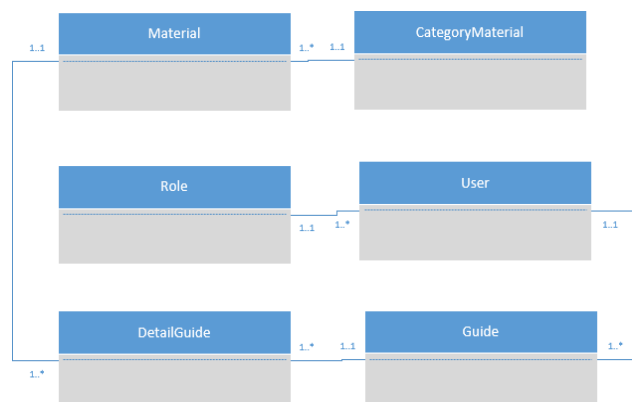


Figure 12: Conceptual Diagram

The development of application then was performed, then the authors did some testing after the completion of application to ensure the quality of software. Finally, the application was made and here is the UI:

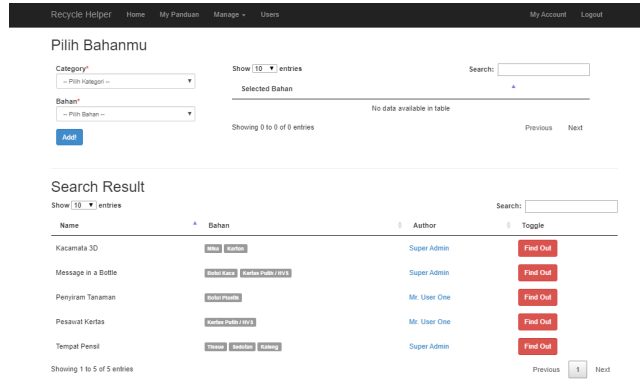


Figure 13: Home Page UI

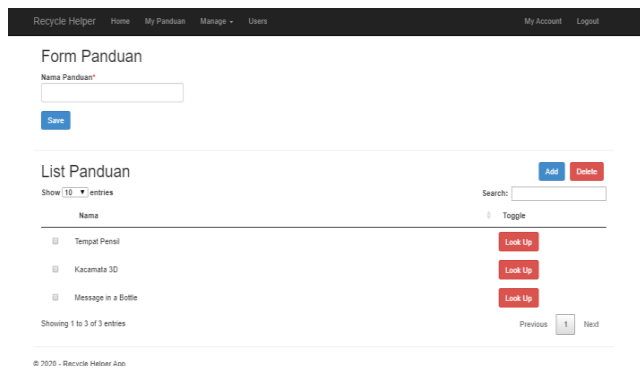


Figure 14: Own Guides Page UI

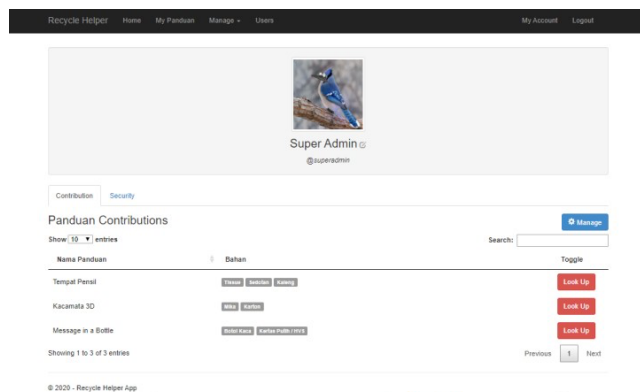


Figure 15: Profile Page UI

Admin Special Page (Material & Material Category Page)

The screenshot shows the 'Form Kategori Bahan' (Material Category Form) and the 'List Kategori Bahan' (Material Category List) in the Recycle Helper application. The form includes a 'Nama Kategori' (Category Name) input field and a 'Save' button. The list displays a table of categories with columns for 'Nama' (Name) and 'Toggle' (Edit). The categories listed are: Kertas, Plastik, Aluminium, Kayu, Besi, Kaca, Busa, and Besang. The list also includes a search bar, 'Add' and 'Delete' buttons, and pagination controls.

Nama	Toggle
Kertas	Edit
Plastik	Edit
Aluminium	Edit
Kayu	Edit
Besi	Edit
Kaca	Edit
Busa	Edit
Besang	Edit

Figure 16: Material Category UI

The screenshot shows the 'Form Bahan' (Material Form) and the 'List Bahan' (Material List) in the Recycle Helper application. The form includes a 'Category' dropdown menu, a 'Nama Bahan' (Material Name) input field, and a 'Save' button. The list displays a table of materials with columns for 'Nama' (Name), 'Kategori Bahan' (Material Category), and 'Toggle' (Edit). The materials listed are: Botol Plastik, Tissue, Suction, Kaleng, Sisk Ekam, Mika, Karton, Botol Kaca, and Kertas Putih / HVS. The list also includes a search bar, 'Add' and 'Delete' buttons, and pagination controls.

Nama	Kategori Bahan	Toggle
Botol Plastik	Plastik	Edit
Tissue	Kertas	Edit
Suction	Plastik	Edit
Kaleng	Aluminium	Edit
Sisk Ekam	Kayu	Edit
Mika	Plastik	Edit
Karton	Kertas	Edit
Botol Kaca	Kaca	Edit
Kertas Putih / HVS	Kertas	Edit

Figure 17: Material Page UI

5 Discussion

After the authors did the survey, either literature survey or google form the result is, it is indeed important to make the *Recycle Helper* application. The reason is, there are a lot of households who can not manage their own household waste. Not only that, there are a lot of people out there who are interested in recycling by themselves with the help of guidance to do it. By creating this web application, the authors hope that most households in Indonesia will be able to manage their own waste and recycle them by following our guides on our web application.

6 Conclusion

The behaviour of people greatly affects the motivation of recycling waste. People tend to have more facilities for recycling so that they can keep up their spirit. So that the authors try to make an application that provides support for waste management. The application mainly focuses on serving a list of guides that can help make a better idea about recycling. People can search easily for some guides, or manage and give guide contributions. The questionnaire also gives a positive result that supports the creation of the Recycle Helper application.

For future works, the authors will keep improving our application's features so that it will keep bringing reliability to users. They also will keep research on the better design and solution so that the application will not only just help recycling in general, but also help every specific part of recycling. The UI design will be improved to a modern and fancy style, so that the RecycleHelper application will not be lame.

7 Acknowledgement

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