# THE DEVELOPMENT OF GO GO GREENLAND EDUCATIONAL ENVIRONMENTAL GAME BASED ON ANDROID

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## ABSTRACT

The environment is the most-needed thing to all living creatures on earth, they bound to each other. Because of that, it is our responsibilities to make sure that we are always protect and take care of it. But as the time goes on, human continuously damaging the environment every day. People also still do not understand and applying the concept of sorting waste, like organic, anorganic, and dangerous and toxic in their daily life, so that it was built an educational game with environmental themed based on an android. The learning method used in this research using the CMI (Computer Managed Instruction) Method with the model of tutorial and interactive game, and the software development method that is used in this research using Luther Method with the following steps: concept, design, material collection, assembly, testing, and distribution, with an Object-Oriented Program (OOP) based model. This system is develop using Construct 2 and Paint Tool SAI as main tools and Adobe Photoshop as the second tool. According to the research, the conclude is with this system the counseling may become more attractive and also helping people in introducing and knowing the kind of trashes.

**Keywords:** Environment, Trash, Waste, Organic, Anorganic, Dangerous and Toxic, Education game, CMI Method, Luther Method, OOP.

## 1. PRELIMINARY

### 1.1 Background

BPLHD (Badan Pengelolaan Lingkungan Hidup Daerah) is an organization of government agencies working in managing the environment in West Java, especially Bandung. BPLHD or also known as DLH (Dinas Lingkungan Hidup) West Java is intensively engaged in researching waste and its impact affecting the quality of the river and the air contained in the area of West Java.

In Indonesia itself recorded by the Ministry of Environment in 2012 the average population in Indonesia produces waste of approximately 2 kg per day, in the same year the Ministry of Environment also stated that the volume of waste in Indonesia has increased in the last 3 years. Also known in 2010 there are 200,000 tons of waste per day and in 2012 there are 490,000 tons of waste per day, if the amount of waste products in one year can reach 178.850.000 tons. Of this amount more than half is waste from household waste, if the waste is not treated properly it can cause various natural disasters and diseases for humans.

Based on the results of questionnaire given to 95 respondents [1] it is known that 58 respondents (62.3%) still throw garbage indiscriminately, and 84 respondents (88.4%) stated that the environment where they live the community has not sorted out the organic and inorganic waste properly. So it can be concluded that the community is still not very understanding and concerned with the problem of waste due to the lack of effective media extension and learning about waste to the community, especially in remote areas to date.

After conducting an interview with Mr. Efrizal as the staff of DLH said that the problem of budgetary constraints, human resources, wide area coverage, and conventional campaign formulation are the main reasons the lack of effectiveness of DLH socialization media has been done.

The game is a media of information delivery that can be used as a substitute for the pattern or way of socialization about the environment to the community, because of the results of questionnaires conducted showed that 77% of respondents claimed to love playing games and spend an average of 4-6 hours in doing these activities. With the popularity of games in the community can be used as a media of socialization even to remote areas though.

From the background, it is necessary to have intensive efforts in the form of a new style of media extension to the community, it is then built an educational style game that is expected to introduce and teach the community to care more about the surrounding environment. So it was appointed for this final project a title of "The Development of Educational Game Go Go Greenland with Environmental Themed Based On Android".

### 1.2 Problem Identification

Based on the description of the background, it can be conclude a problem that is how to make an interactive game so that people in the future could

know, and sorting the waste well and know the impact resulting from littering of garbage in order to create a clean and well-groomed environment.

### 1.3 Purpose and Objectives

Based on the studied of the problems, the purpose of writing this final task is to build an educational game for the media introduction of the environment based on Android. The purpose of this research is as follows:Menjadi sarana penyampaian informasi mengenai pendidikan lingkungan hidup yang menarik dan inovatif.

1. To introduce the impact of garbage disposal indiscriminately to the community.
2. To introduce to the community about the trash's properties.
3. To help the community to sort trashes according to its nature well.
4. To build a media counseling about learning to the community in a new way.

## 2. CONTENT

### 2.1 Theoretical Base

Here are the theories that is used and related to the research of developing the system.

#### 2.1.1 Multimedia

Mulitimedia are applications that use various elements in their utilization, including text, photos, images, animations, video, sounds, and some kinds of interactivity. In this scenario, PC (Personal Computer), DVD, games, digital TV, interactive website, wireless network and so on can be called as part of multimedia products. Multimedia is one of the most interesting projects in the world of computer science. Graphics, visualization, HCI, computer vision, data compression, graph theory, crawl, and database systems; They all have an important role in making multimedia today. [2]

#### 2.1.1.1 The Component of Multimedia

Merging of writing, sound, photos, images, animation, and video in multimedia is used in various: [2]

1. Video teleconferencing.
2. Learning media for higher education.
3. Telemedicine.
4. High-quality video and image search as visual objects.
5. Augmented reality.
6. Voice recognition.

#### 2.1.2 Environmental Education

Environmental education is a process that aims to develop human consciousness of the environment with all the problems contained within it. [3]

Environmental education plays an important role in the preservation and improvement of the environment in the world, in realizing a sustainable life. A basic aim of environmental education is to make individuals and communities understand the complexity of nature and the building environment also generated from their interactions from biological, physical, social, economic, and cultural aspects, and acquire knowledge, values, attitudes, and skills Practical to participate in a responsible and effective manner in anticipating and solving environmental problems, and in managing environmental quality. [4]

#### 2.1.3 Waste

Waste is discharged both from an industrial process and home / domestic. Meanwhile, according to Law No. 18 of 2008 on Waste Management, it is mentioned that waste is the residual daily activities produced by humans or through natural processes in the form of solid or semi-solid in the form of organic substances or inorganic substances that are biodegradable and not considered useful again and be thrown into the environment. [5]

The types of waste that exist in the environment is very diverse, there is a household waste, industrial waste, market waste, hospital waste, agricultural waste, plantation waste, farm waste, waste institutions / offices / schools, and so forth. By its nature, waste is divided into 3 types, namely: [5]

1. Organic Waste

A type of rubbish which is derived from natural and biological materials that can be broken down by microorganisms, this type of waste is very easy and quickly broken down by natural processes. This type of waste is dominated by household waste and market waste, this waste will rot and decompose on its own in nature.

2. Anorganic Waste

A type of waste which is derived from synthesis and processed materials, in other words a waste that is not natural. The best known examples are plastic bags and metal cans, in contrast to organic waste, inorganic waste is very difficult and long to be decomposed by nature, so it takes a separate method to reduce the impact of this type of waste, such as recycling and so on.

3. Dangerous and Toxic Waste

This type of waste is an abbreviation of Dangerous and Toxic waste, so it can be concluded that this waste is a waste material with a concentration of harmful and toxic materials that potentially harm the surrounding environment. Examples of this waste are wastes from factories, hospitals, etc.

#### 2.1.4 Game

Game is a kind of game activity, which provides an unreal context of reality, and brings its players to complete at least one goal or mission by playing a role in the rules of the game. Game is a type of media that can be a means to train and develop thinking power such as sharpened the concentration, strengthen memory and train logic to solve a problem, and as a container to convey the

information to the players in an interesting way. Because based on the results of research conducted by the University of Rochester in New York mentions that learning through games is very easy and quickly absorbed by someone. [6]Some experts have different definitions of the game, as quoted through the book The Art of Game Design. [7]

Elliot Avedon and Brian Sutton-Smith say the game is "An exercise of voluntary control systems," which according to Greg Costikyan's game is "An interactive structure Of endogeneous meaning that requires players to struggle toward a goal ". Another case with Tracy Fullerton, Chris Swain, and Steven Hoffman who has the definition of "A game is a closed, formal system, that engages players in structured conflict, and resolves in an unequal outcome". [7]

So that got a few points about the nature and terms of the game based on the notions that is: [7]

1. Game gives a sense of desire to play it
2. Game has a purpose
3. Game has a conflict
4. Game has a rule
5. The game can be won or beat the player
6. Game is interactive
7. Game is challenging
8. Games can create their own internal values
9. Game menarik bagi pemainnya
10. Game is a closed formal system.

The most important elements in the game are the rules, goals, games, and elements of pretense. Games are interactive media, they need active players who participate in changing events in the game's story. [8]

Based on its genre, it is divided into several kinds, such as: [8]

1. Action Games
2. Strategy Games
3. Role-Playing Games (RPG)
4. Sport Games
5. Driving Simulation
6. Construction and Management Simulations
7. Adventure Games
8. Artificial Life and Puzzle Games
9. Online Games

While according to its platform, the game is divided into: [8]

1. Home Game Consoles
2. Personal Computer
3. Handheld Game Machines
4. Mobile Phone and Wireless Device
5. Arcade Machines

## 2.2 Problem Analysis

Problem analysis that arises in this research is:

1. People who have not applied the concept of environmentally friendly in everyday life due to not yet innovative means of delivering information about environmental education to the community.
2. People who still do not understand the impact of littering the garbage, with 62.3% of respondents still throwing garbage indiscriminately into sewer, river, roadside, and so on.
3. People who still do not apply the concept of waste separation when they dispose of garbage, because the majority of households only collect garbage into one dikantong plastic and immediately throw it away.
4. Ineffective extension media distributed by institutions working in the field of environment to the community, especially in remote areas, with limited budget, human resources, wide area coverage, and conventional campaign formulation.

Game-shaped technology can be used as a tool to convey information about the importance of managing waste properly. Expected to be delivered to the community in an interesting and innovative way.

### 2.2.1 Analysis of Current System

Current system analysis describes the current phenomenon in the research environment. There are two processes that are currently occurring, ie:

1. Society: about how people dump garbage, how the waste is transported, and how the waste is processed in the landfill.
2. Agency: on how the extension or socialization process is currently being conducted to the community.

Here are the procedures that are happening in the community, along with which shows the activity diagram, shown in Figure 2-1:

1. Residents collect and dispose of household waste in front of their homes.
2. The transport officer will pick up the trash and take it to the Temporary Storage (TPS).
3. Officers in the TPS will collect all the garbage from people's homes that have been taken by the transport officer, then will sort and separate the garbage.
4. The transport officer will collect and carry all the waste to the Final Disposal Site (TPA).
5. TPA officers will receive and process waste according to their type, through various recycling processes.




**Figure 2-1 The Current System in Society**

Here are the procedures DLH does in public education, DLH uses GreenMobile in the form of cars that come to the extension and do the socialization. Described by Figure 2-2.

1. Socialization organizers send letters of need for socialization to the office.
2. The office receive and reply letters of need.
3. The office shall issue a socialization travel warrant.
4. *GreenMobile* prepares departure planning.
5. *GreenMobile* checks the completeness or media of socialization.
6. *GreenMobile* travel to socialization sites.
7. *GreenMobile* meet people in need of socialization.
8. The organizer prepares the target of socialization.
9. Implementation of socialization by *GreenMobile*.
10. After the event is over, *GreenMobile* returns and reports to the office.

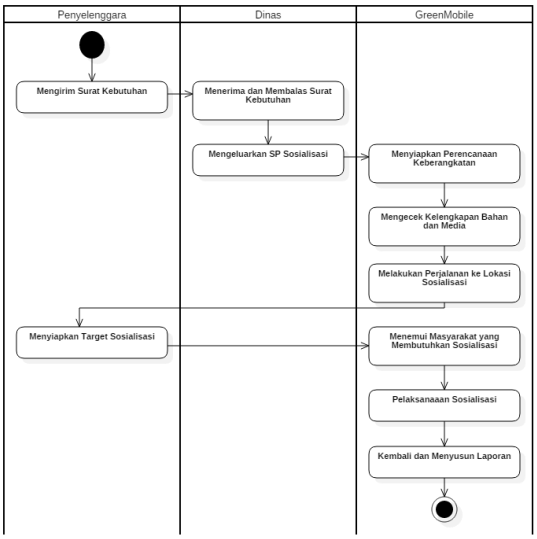



**Figure 2-2 The Current System in DLH**

### 2.2.2 The Needs Analysis

Needs analysis is part of the software needs process that plays a role bridging the gap that often occurs between the level of engineering needs and software design. [9] Meanwhile, according to Wiegers needs analysis aims to refine the existing needs to ensure the stakeholders in understanding and finding errors, omissions, and other deficiencies if any. [10]

#### 2.2.2.1 A Non-Fungsional Needs Analysis

Non-functional requirements analysis is the analysis needed to determine the system requirement specification. This specification also includes elements or components of what is required for the system to be built up until the system is implemented. This needs analysis also determines the input specifications required by the system, the output to be generated by the system and the process required to process the input to produce a desired output.

In this phase of analysis consists of software analysis and hardware analysis.

##### 2.2.2.1.1 Software Analysis

The software requirement analysis in games that explains the minimum specifications that developers must have in building this system, described in Table 2-1:

**Table 2-1 The Analysis of Software Needs**

| No | Perangkat Lunak | Spesifikasi |
|---|---|---|
| 1 | Sistem Operasi | Windows 7 64 bit |
| 2 | Tools Utama | Construct 2 |
| 3 | Tools Pendukung | SAI Paint Tool |
| 4 | Tools Pendukung | Adobe Photoshop |

##### 2.2.2.1.2 Hardware Analysis

Analysis of hardware requirements in the game to be built describes the minimum specification that must be owned to play this game. That is explained on Table 2-2:

**Table 2-2 The Analysis of Hardware Needs**

| No | Perangkat Keras | Spesifikasi |
|---|---|---|
| 1 | Processor | Dual Core 1.20 GHz ARM Cortex, GPU Mali-400 |
| 2 | RAM | 512 MB |
| 3 | Sistem Operasi | Android 4.2 (Jellybean) |
| 4 | *Space Requirement* | 35 MB slot kosong |
| 5 | Ukuran Layar | 4.0 inch |
| 6 | Resolusi | 480 x 800 pixel |

#### 2.2.2.2 A Fungsional Needs Analysis

System analysis is done using Object Oriented Analysis approach by using UML model. Stages in the analysis of this system consists of *Use Case Diagram* and *Class Diagram*.

##### 2.2.2.2.1 Use Case Diagram

Use case is a situation where a system is used to fulfill one or more needs of the user; A use case captures some of the system-provided functionality. [11] Here is the use case of the built game described by Figure 2-3.

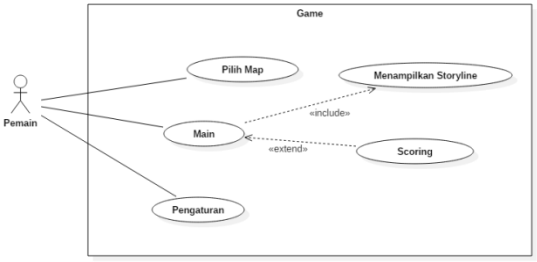



**Figure 2-3 Use Case Diagram System**

##### 2.2.2.2.2 Class Diagram

Class is the heart of object-oriented systems; Therefore, it is followed by the recognition of class diagrams as the most popular UML diagrams. The structure of a system is made up of a collection of sections called objects. The class describes the different types of objects that the system has, and the class diagram shows the classes and their relationships. [11]

Figure 2-4 shows a class diagram of the built system.

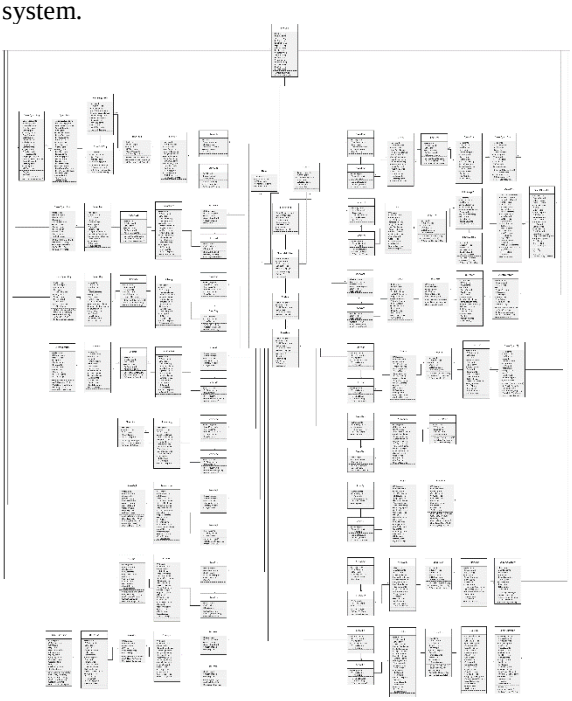


**Figure 2-4 Class Diagram System**

## 2.3 System Design

System design is the next stage of system analysis, by describing clearly what will be done on system analysis, then proceed with how to build the system.

At this stage will be described interface design, semantic network, and menu structure.

### 2.3.1 Interface Design

The interface design is a rough description of the initial design of the display that will be created on the system to be built aims to facilitate the implementation and create the application. Here Figure 2-5 is the mock up of the built game described below.

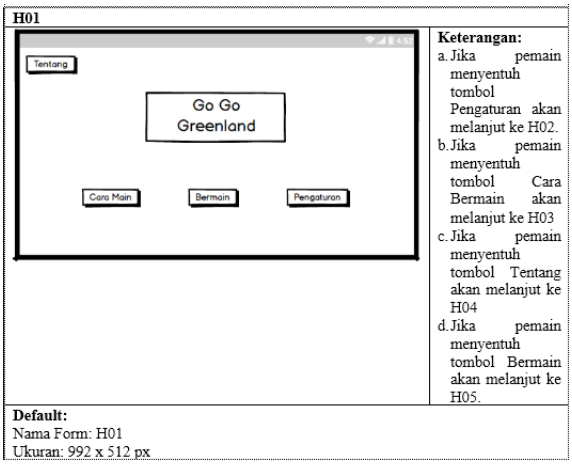



**Figure 2-5 Main Menu Interface**

### 2.3.2 Jaringan Semantik

Semantic networks describe the interconnectedness of each view that has been described in the interface design. The following Figure 2-6 is the semantic network description of the built game.

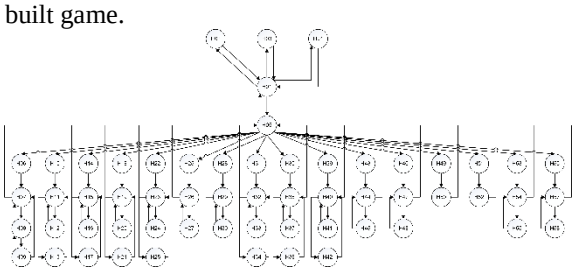


**Figure 2-6 Semantic Network of System**

### 2.3.3 Struktur Menu

The design of the menu structure is a description of the interconnected menus in system development. The menu structure of the built game is described in Figure 2-7.

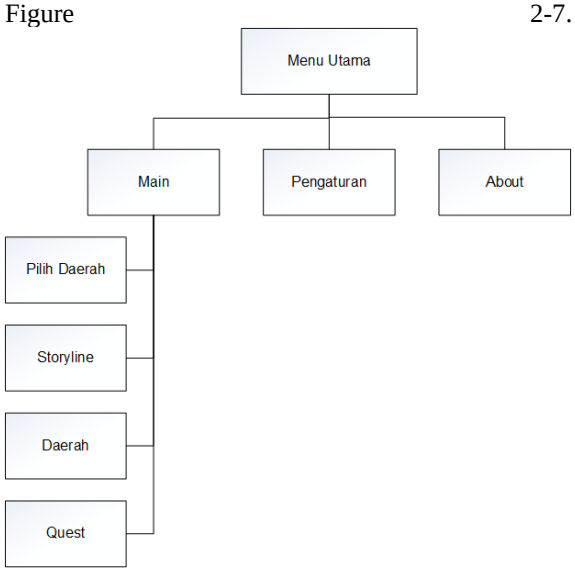



**Figure 2-7 Menu Structure of System**

## 2.4 System Testing

System testing is the stage to find errors or deficiencies in the system built and tested. Testing is done to determine whether the system has been built to meet the requirements and work according to functions that have been designed previously, and achieve the purpose of building the system. The test is done using black box testing technique and UAT (User Acceptance Test).

### 2.4.1 Black Box Testing

Black box testing is a test conducted to test the system in terms of functionality that has been built, to find errors and rejection shown system.

Based on the results of Black Box testing, the built system has fulfilled all functionality and runs well, described on Table 2-3.

**Table 2-3 The Black Box Testing of Main Manu**

| Kasus dan Hasil Uji | | | | | |
|---|---|---|---|---|---|
| **No** | **Aksi** | **Deskripsi** | **Yang Diharapkan** | **Hasil Yang Keluar** | **Keterangan** |
| 1 | *On Touched Button* | Pemain menekan tombol Main | Pergi ke halaman Pilih Daerah | Pergi ke halaman Pilih Halaman | [√] Diterima [] Ditolak |
| 2 | *On Touched Button* | Pemain menekan tombol Pengaturan | Pergi ke halaman Pengaturan | Pergi ke halaman Pengaturan | [√] Diterima [] Ditolak |
| 3 | *On Touched Button* | Pemain menekan tombol Tentang | Pergi ke halaman Tentang | Pergi ke halaman Tentang | [√] Diterima [] Ditolak |
| 4 | *On Touched Button* | Pemain menekan tombol Cara Main | Pergi ke halaman Cara Main | Pergi ke halaman Cara Main | [√] Diterima [] Ditolak |
| 5 | *On Touched Button* | Pemain menekan tombol reset | Menghapus progress permainan | Progres permainan dihapus | [√] Diterima [] Ditolak |

### 2.4.2 *User Acceptance Testing* (UAT)

UAT testing is done by distributing questionnaires to the community as well as interviews to the agency, this test is done to determine the response of users to the system has been built, whether the system has overcome all the problems contained in the background research. UAT testing conducted through interviews and questionnaires.

#### 2.4.2.1 Interview Test

Testing conducted by doing question and answer to the target users in this case to the staff of DLH to find errors and non-conformities not found by the builder. This test is also to determine whether the system has fulfilled its purpose. Explained on Table 2-4.

**Table 2-4 UAT of Interview**

| Objective | Question | Answer |
|---|---|---|
| Become a means of delivering information about environmental education that is interesting and innovative. | 1. Does this game make it easy in the process of delivering material to the public?<br>2. Is the delivery of material in this game easy to understand ?<br>3. Is the interface in this game looks interesting?<br>4. Is the missions in this game is easy to understand ?<br>5. Is the mission in this game looks interesting ? | 1. This game is easier to understand for children to adults in the process of delivering material to the community, because it is more facilitated in the delivery.<br>2. Understood once, because of a conversation with the person in the game (npc). As soon as the player approaches the npc the conversation instantly appears.<br>3. For me it's interesting, it's nice and very interesting.<br>4. I think it's easy to understand, because each region provides info about its mission.<br>5. It's interesting, from segment to segment to another. So in the game there has been a sorting system to complete a missions. |
| Building an educational media about learning to the community in the new ways. | 6. Can this game help in extension activities?<br>7. Is the display in this game suitable for use as an extension media?<br>8. Does this game extension activities become more interesting? | 6. Oh very helpful because it has been made into such an application, indirectly provide extension through this game.<br>7. When viewed in appearance the community has been getting counseling indirectly in the game tesebut.<br>8. More interesting because if the mission is not done the player will repeat from the beginning so that the player is able to evaluate the mistakes made when lost, making it more challenging. |

Based on the result of interview test in Table 2 4, it is concluded that the built system has fulfilled the objective of number 1 and number 5, that is the built

system can become an interesting and innovative media of information delivery and the built system can be used as a media of counseling to society in a new way.

#### 2.4.2.2 Questionnaire Test

Testing is done by giving a questionnaire to the community to try the system and know whether the system has met its objectives well. In this test the questionnaire was given to 35 respondents. The percentage of each question given to the respondent has 5 scales using Likert scale. With the score criteria described in Table 2-5 the following:

**Table 2-5 Likert Score Criteria**

| Skala Jawaban | Keterangan | Skor | Persentase |
|---|---|---|---|
| SS | Sangat Setuju | 5 | 100% - 80% |
| S | Setuju | 4 | 79% - 60% |
| C | Cukup | 3 | 59% - 40% |
| TS | Tidak Setuju | 2 | 39% - 20% |
| STS | Sangat Tidak Setuju | 1 | 19% - 0% |

Here is the result of the percentage of answers obtained from the questionnaires which are then calculated using the above formula, described in Table 2-6.

1. Do you agree the mission in this game allows you to understand the impact of littering?

**Table 2-6 Table Result of Questionnaire**

| Pertanyaan | Keterangan | Skor | Frekuensi | S |
|---|---|---|---|---|
| 1. | SS | 5 | 13 | 65 |
| | S | 4 | 18 | 72 |
| | C | 3 | 4 | 12 |
| | TS | 2 | 0 | 0 |
| | STS | 1 | 0 | 0 |
| | | Jumlah | 35 | 149 |

$$\frac{149}{175} \times 100\% = 85\%$$

Based on the result of the percentage of values on, it can be concluded that the assessment of the questions about the respondents if the in-game mission built facilitate to understand the impact of littering is 85% of the expected 100%, it can be categorized as strongly agree.

Based on the tests that have been done using questionnaires to 35 respondents, obtained conclusion form:

1. The mission in this game allows respondents to understand the impact of littering.
2. The material presented in this game allows respondents to understand the disasters that can be caused by waste.
3. The mission contained in this game is quite difficult to complete.
4. The mission contained in this game makes the respondents aware of the impact of waste.
5. The material contained in this game is able to introduce respondents to the trash properties.
6. Views contained in this game can make respondents able to distinguish trash properties.
7. After playing the mission respondents become aware of the trash properties.
8. The material contained in this game helps the respondents in sorting out the garbage.
9. Views contained in this game make the respondent can distinguish the trash that suits its nature.
10. The mission contained in this game helps respondents in knowing the appropriate places to dispose of waste according to its nature.

So it can be concluded that the system built has fulfilled its development goals to the community.

## 3. CLOSING

### 3.1 Conclusion

After the analysis, design and testing, it can be concluded as follows:

1. The system can be used as a means of delivering information to the community in an interesting and innovative way.
2. The system was able to introduce to the public the impact of littering.
3. The system is able to introduce to the public the nature of waste.
4. The system is able to help people to sort waste properly according to their nature.
5. The system can be used as a counseling medium in a new way.

### 3.2 Suggestion

Suggestions for Go Go Greenland game development for better future are as follows:

1. In-game design is made more real and clarified.
2. Added a more diverse quest in each region.
3. Multiplied animations and effects on the game.

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