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Ultima InfoSys : Jurnal Ilmu Sistem Informasi is a Journal of Information Systems Study Program at Universitas Multimedia Nusantara which presents scientific research articles in the field of Information Systems, as well as the latest theoretical and practical issues, including database systems, management information systems, system analysis and development, system project management information, programming, mobile information system, and other topics related to Information Systems

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FOREWORD

Greetings!

Ultima InfoSys : Jurnal Ilmu Sistem Informasi is a Journal of Information Systems which presents scientific research articles in the field of Information Systems, as well as the latest theoretical and practical issues, including database systems, management information systems, system analysis and development, system project management information, programming, mobile information system, and other topics related to Information Systems. ULTIMA InfoSys Journal is published regularly twice a year (June and December) by Faculty of Engineering and Informatics in cooperation with UMN Press.

In this June 2023 edition, ULTIMA InfoSys enters the 1st Edition of Volume 14. In this edition there are seven scientific papers from researchers, academics and practitioners in the fields covered by Ultima Infosys. Some of the topics raised in this journal are: Analysis and Design of Revival TV Shop Mobile Application, Educational Game Design Sorting Waste Android Based, User Experience Analysis from User-Centered Design Approach in Marketing Website, Implementation Weighted Product Method for the Best Carrot Seed Recommendations, Evaluation of Information System Management Security Using Indeks KAMI and Recommendation Based on ISO 27001:2013 at PT XYZ (Travel Agent), Web-based Decision Support System for Characters Selection in Game Genshin Impact with SAW Method.

On this occasion we would also like to invite the participation of our dear readers, researchers, academics, and practitioners, in the field of Engineering and Informatics, to submit quality scientific papers to: International Journal of New Media Technology (IJNMT), Ultimatics : Jurnal Teknik Informatics, Ultima Infosys: Journal of Information Systems and Ultima Computing: Journal of Computer Systems. Information regarding writing guidelines and templates, as well as other related information can be obtained through the email address ultimainfosys@umn.ac.id and the web page of our Journal here.

Finally, we would like to thank all contributors to this June 2023 Edition of Ultima Infosys. We hope that scientific articles from research in this journal can be useful and contribute to the development of research and science in Indonesia.

June 2023,

Fenina Adline Twince Tobing, S.Kom., M.Kom.
Editor-in-Chief

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Analysis and Design of Revival TV Shop Mobile Application

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***Abstract*— Mobile phone technology has undergone developments which makes it can provide a variety of facilities to support productivity and efficiency in the form of smartphones. Emarketer digital marketing research institute estimates that in 2018 there will be more than 100 million active smartphone users in Indonesia. In early 2019, the number of smartphone users reached 355 million, which is more than 33% of the total population of Indonesia reaching 268.2 million. With the large number of smartphone users, the number of mobile application downloads will also increase. This phenomenon is accompanied by Esports (Electronic Sports) development in Indonesia. The RevivalTV as one of Esports companies in Indonesia will develop a mobile application to help the company to sell game merchandise, and the application will be accessed and downloaded by mobile users so that people can still carry out daily activities without opening a browser or devouring a lot of internet data. The method used for designing systems in RevivalTV is the SDLC (System Development Life Cycle) method.**

***Index Terms*- Esport; Mobile Application; Smartphone.**

I. INTRODUCTION

Technology is a facility that is made to ease all things related to the continuity and comfort of human life. Smartphones, iPads, tablets, and personal computers are now easier to carry around. It can be concluded that smartphone technology is a mobile phone that has undergone the latest (present) transformation and provides a plethora of content that supports the sophistication of the device.

Indonesian smartphone users are growing rapidly. The digital marketing research institute Emarketer estimates that in 2018 the number of active smartphone users in Indonesia is more than 100 million people. With such a large number, Indonesia will become the country with the fourth largest active smartphone users in the world after China, India and America. Data from the We Are Social website shows that smartphone users in Indonesia in January 2019 were 355 million users, 33% greater than Indonesia's total population of 268.2 million.

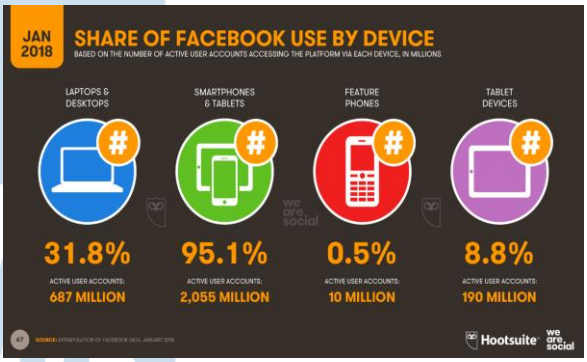

Fig. 1. Comparison of App Users on All Devices (Source: We Are Social 2018)

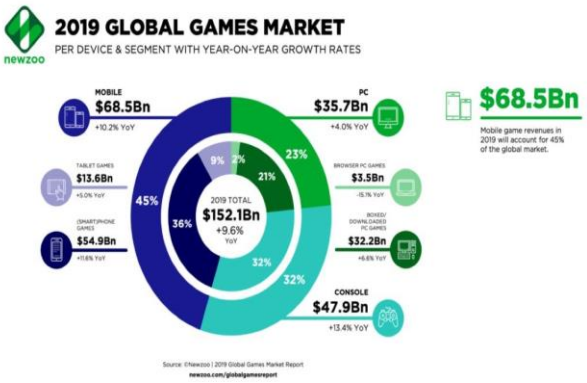

Fig. 2. Game Development Globally (Source: Newzoo 2019)

Data from We Are Social shows that the use of mobile applications outperforms website access. For example, Facebook application users on mobile show 95.1% or about 2.055 million, while for website usage it is only 31.8% or about 687 million of the total Facebook users. It can be concluded that the use of mobile applications is preferred over website access.

This phenomenon is accompanied by the development of Esports (electronic sports) in Indonesia. Some people quell their boredom by playing games on smartphones. However, it is not uncommon for some people to make esports a profession, not just a hobby. Based on the Newzoo report, as quoted from techinasia, in 2019 the global game market value will reach US $ 152 billion (around Rp. 2.15 quadrillion), an increase of 9.6 percent compared to the previous year. This shows that the trend of esports in the global market continues to increase. This is due to the ease of use of gadgets that are more compact to carry or use than PCs, laptops, and others.

Exhibit: Global mobile games revenue by region, 2017-2019

Region	Mobile games revenue 2019 H1	Mobile games revenue 2018 H1	Mobile games revenue 2018	Mobile games revenue 2017
	USD million	USD million	USD million	USD million
Global	33,453	28,650	60,786	51,134
Asia (excluding China)	11,321	10,134	20,901	18,643
North America	8,547	6,999	14,850	12,487
China	8,318	7,032	15,627	12,127
Europe	3,474	3,088	6,391	5,307
Oceania	515	489	1,012	916
Latin America	442	293	665	528
Middle East	341	268	566	490
South America	299	196	446	346
Central America	139	95	214	178
Africa	57	56	114	112

Source: Sensor Tower, Niko Partners 2019

Fig. 3. Global Games Revenue by Region, 2017-2019

Esports or Electronic Sports is a term for video game competitions between professional teams, video game genres that are usually symbolic of electronic sports are real-time strategy, fighting, shooter games, and multiplayer battle arenas. For esports fans, there are many websites that provide information about match schedules, player transfers, information about teams, information about players, and so on. However, it is very rare to find developers who think to make the website into a mobile application.

By considering the opportunities regarding technological developments and internet users with the potential for downloading applications on smartphones. The RevivalTV mobile application can be accessed and downloaded by mobile users so that people can still carry out daily activities without opening a browser or devouring a lot of internet data, and battery. The RevivalTV application will help gamers to buy game merchandise via the mobile application because the current company website does not support for shopping game merchandise. The RevivalTV application will help the company to increase revenue from selling game merchandise.

II. Theoretical Basis

A. *Mobile Application*

According to the Mobile Marketing Association [1], the mobile application is software that is operated on mobile devices including smartphones or tablet PCs. The Mobile application itself is known as an application that can be downloaded and has certain functionalities in accordance with the content that has been provided by the application to support the performance of mobile devices. The Mobile application is a software unit created to serve the needs of several activities such as commerce systems, games, public services, advertising, or all processes needed by humans on an ongoing basis.

B. *Esports*

Esports is an abbreviation of Electronic Sport [2]. Electronics has something that works by using many small components, especially microchips and transistors, that control an electric current. Sport means an agility competition activity between individuals or groups that is not limited to physical activities.

It can be concluded that Electronic Sport is a form of sport in which the main aspects of sports are facilitated by electronic systems [8-11]. “In more practical terms, Esports is usually a video gaming competition which is often organized by various event organizers, player levels, and types of tournaments (major/minor), where players are usually in teams or “games” community forums. Even though Esports is called a sport only because there is the word 'sport' in its use, the categorization of Esports as a sport is still debated until now [6]. This is in contrast to the existing ecosystem, with esports athletes, spectators, sponsors, and even esports championships.

C. *SDLC*

SDLC consists of 4 main stages, namely planning, analysis, design, and implementation [3]. Each phase consists of a series of stages, which rely on techniques that produce results. The 4 stages are:

1) Planning,

A basic process for understanding why a system should be built. In this phase, a feasibility analysis is needed by looking for data or requirement gathering for users.

2) Analysis

A process of investigating an ongoing system with the aim of getting answers about system users, how the system works, and when the system is used. This

analysis process will produce an appropriate way to build a new system.

3) Design

A process of determining how the system works in terms of architecture design, interface design, database and file specifications, and program design. This design process will produce system specifications.

4) Development

The process of developing and coding the system application based on user requirements.

5) Testing

The process of finding the error and bugs in systems, and fixing them. The process will continue until the software is completely free of bugs, works stably, and functions as expected.

6) Implementation

The process of implementing the new system development.

7) Maintenance

The process of system installation, and system support plans.

This paper uses Waterfall SDLC model, this framework emphasizes moving from one stage to the next. So we must complete one stage before moving on to the next stage. This framework is suitable for small projects with an end result that is easy to define from scratch.

D. UML

Unified Modeling Language (UML) is a set of structures and techniques for modeling object-oriented programming OOP (object-oriented programming) designs and their applications [4]. UML is a methodology for developing OOP systems and a set of tools to support the development of these systems.

III. METHOD

The method that will be used in the design and manufacture of a mobile application information system in this thesis is the SDLC (System Development Life Cycle) method [5]. Due to various limitations, this paper only carry out several stages of the SDLC method, including:

A. Project Initiation

Identifying problems and designing new mobile application systems.

B. Project Planning

A basic process for understanding why a system should be built. In this phase, a feasibility analysis is needed by searching for data or conducting an information gathering process for users. As well as organizing and scheduling projects.

C. Requirement Analysis

A process of investigating an ongoing system with the aim of getting answers about system users, how the system works and when the system is used. Looking for the needs of users or gamers to build a mobile application system.

D. Design

A process of determining how the system works in terms of architecture design, interface design, database and file specifications, and program design [5]. The process of designing a mobile application includes the following diagrams:

1) Activity Diagram

a diagram used to describe the sequence of business process activities from start to finish.

2) Use Case Diagram is a diagram that is used to describe anyone who interacts directly with the system that has been designed.

3) Class Diagram is a diagram used to describe the structure of the system in the form of objects.

4) Sequence Diagram is a diagram used to describe a sequence or flow system based on the cases contained in the Use Case diagram.

5) User Interface is a system interface that facilitates the user to interact with the application.

6) Implementation phase

At this stage we do not carry out the implementation stage directly to the company because the design of the mobile application is only in the form of a prototype.

IV. RESULT AND DISCUSSION

The following are the business processes and systems that run on the RevivalTV website before creating a mobile application.

A. Analisis Sistem Saat Ini

1) Website RevivalTV

For now RevivalTV has a website that is useful as a medium of information about games, a lot of information provided by this website is the correct playing tricks in the game, the currently popular team, team player info and also player development. RevivalTV also has a website shop, where RevivalTV sells merchandise, such as clothes, jackets, lanyards, and collaborative shoes with today's famous brands.

2) RVL(Revival) by RevivalTV

Currently, the sales process on the RVL (Revival) by Revival website is only for display and for orders via the WhatsApp application. The sales business process can be described as follows:

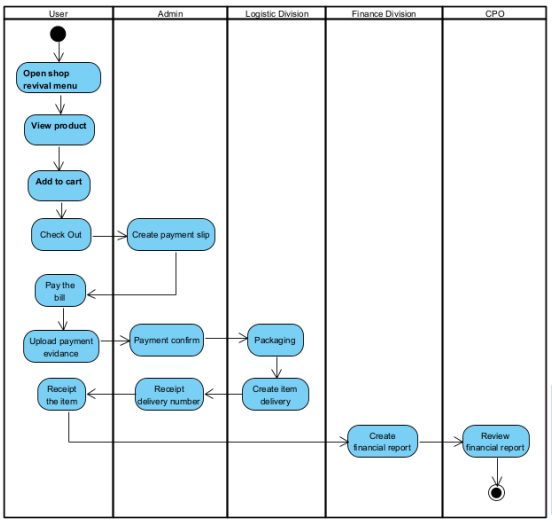

Fig. 4. Activity Diagram For Current Business Process

B. Problem Identification

3) Interview

Interviews were conducted with resource persons to find out more fully the problems faced and also the desired solutions to solving these problems.

4) Observation

Based on the results of observations, the problems that occur. The following is an analysis of the problems that occur on the RevivalTV website:

- The display of the RevivalTV website is less catchy and the shop page is less presentable.
- The features on the RevivalTV website are still lacking and many don't work. Especially features (login, payment, wishlist). There are still many features on the RVL(Revival) by RevivalTV website, such as the login page that doesn't work with minimal validation and the lack of payment processing. As well as wishlist pages that cannot be accessed or redirected to other features.
- The shop's business process is still not yet helpful enough for the user to operate. There should be information about the availability of items on the website.

C. Troubleshooting Solution

There are several problem solving proposals from the analysis of the problems faced by the company:

1) The design of the appearance of the mobile application is designed to make it easier for the user to use the application. And modify the appearance to make it look more attractive than before
2) Added a new feature, namely livescore. This feature provides a schedule of previous, present and future multiplayer matches.
3) Creating a shop feature in the RevivalTV car application, making it easier for users to buy RVL (Revival) by RevivalTV merchandise and products from the user's favorite team or gamers.
4) Design shop business processes to be more efficient and increase sales of RevivalTV products, being able to collaborate with well-known brands today.

D. System planning

The purchase and registration process will be carried out through a system. Users must download the RevivalTV mobile application. Furthermore, in the application the user can use the features that have been provided such as livescore, news, tournament, team profile, and if the user wants to buy RVL (Revival) by RevivalTV merchandise or his favorite team, the user can directly buy it in the shop feature. In the shop feature, users can immediately see the choice of clothes, sweaters, lanyards, and other catalogs. After the user has determined the items he wants to order, the system will display a basket page where the user can view and update the ordered items, then the user will enter the payment details page where the system will display the total price of all the products to be ordered, and the system will display the total price of all the products to be ordered. automatically displays the payment method along with the invoice for the user. If the user does not pay within 1x24 hours, the transaction will be automatically canceled by the system. After the user makes the payment, the admin will confirm the payment and delivery of the goods and input the receipt number which will be sent to the user in the registered email. At the end of each month the admin will report on the results of sales and orders. This report will be a monthly sales evaluation and order data to be provided to the CEO.

1) Activity Diagram

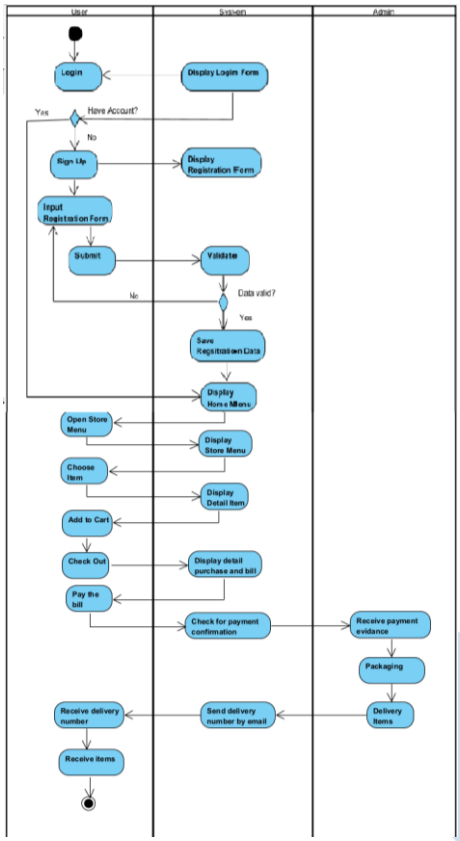

Fig. 5. Activity Diagram New System

2) Use Case Diagram

Fig. 6. Use Case Diagram

3) Class Diagram [7]

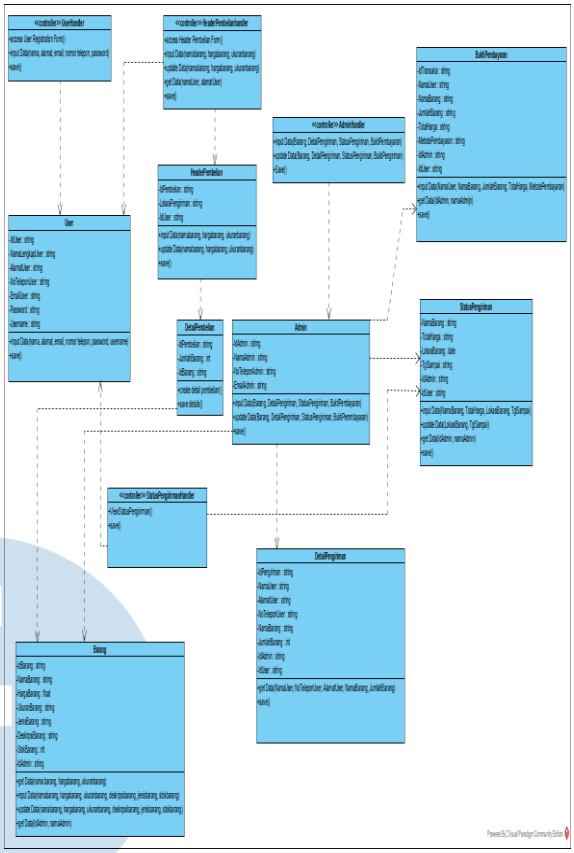

Fig. 7. Class Diagram

4) Sequence Diagram

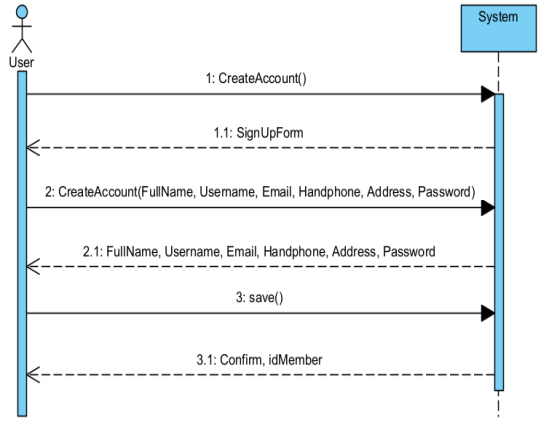

Fig. 8. System Sequence Diagram Create Account

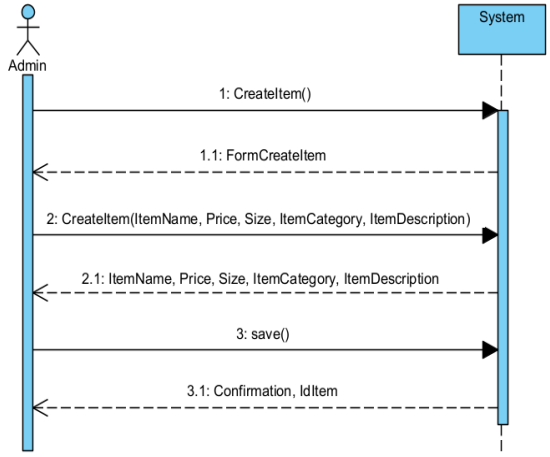

Fig. 9. System Sequence Diagram Input New Item

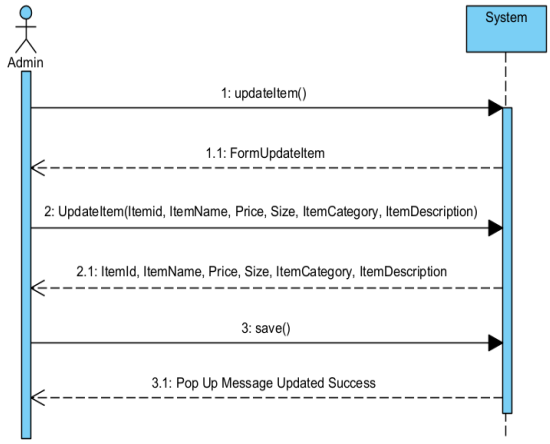

Fig. 10. System Sequence Diagram Update Item

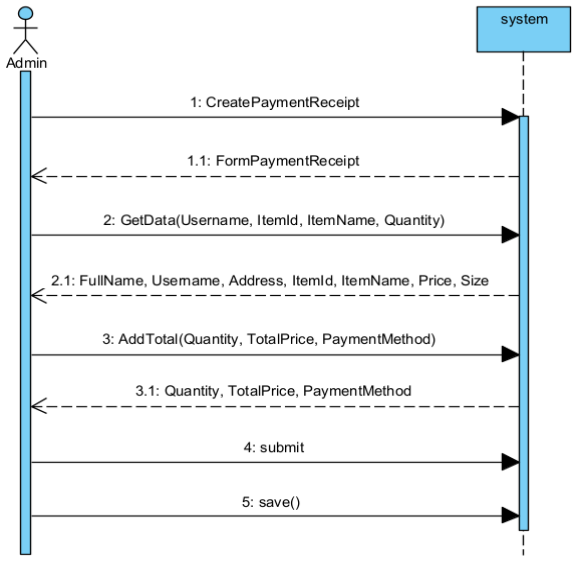

Fig. 11. System Sequence Diagram Create Payment Receipt

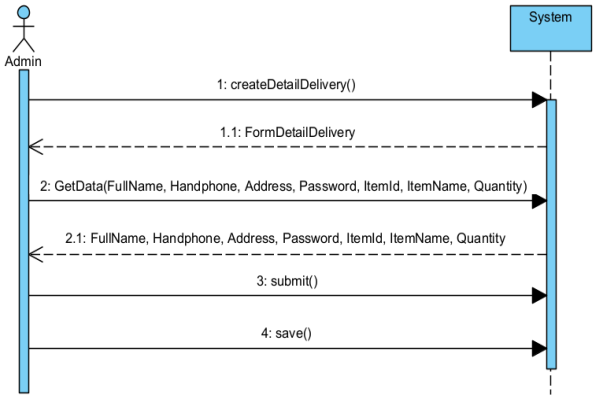

Fig. 12. System Sequence Diagram Create Delivery Detail

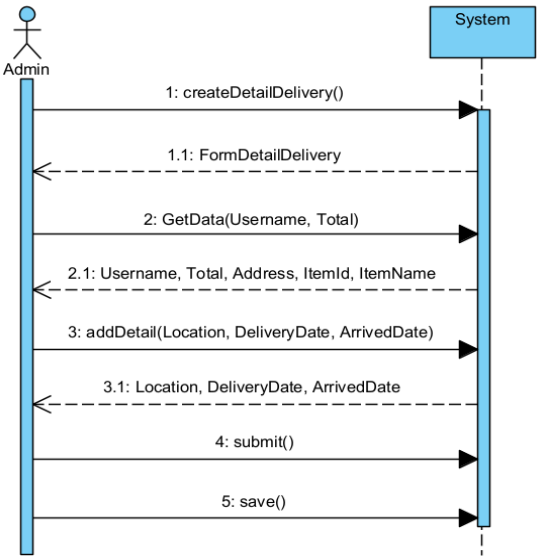

Fig. 13. System Sequence Diagram Create Delivery Status

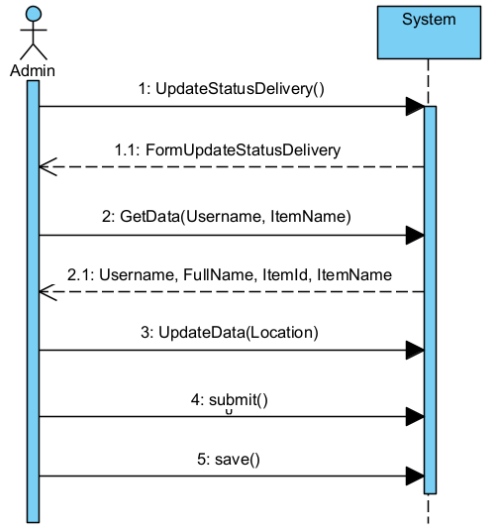

Fig. 14. System Sequence Diagram Update Delivery Status

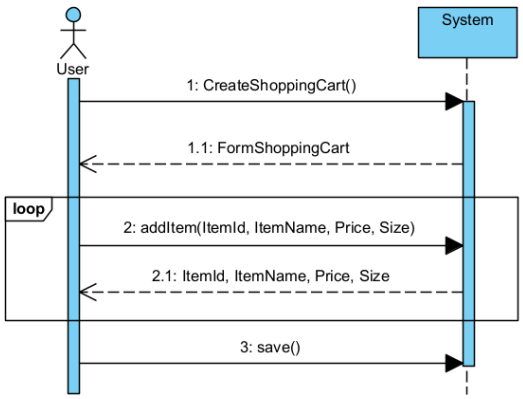

Fig. 15. System Sequence Diagram Create Shopping Cart

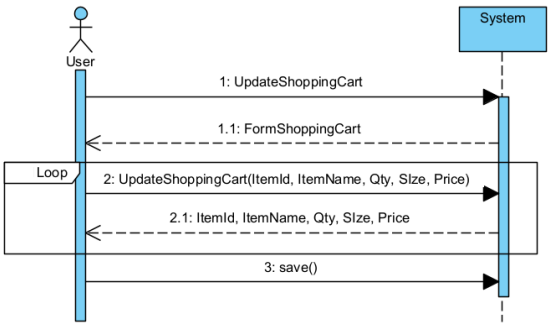

Fig. 16. System Sequence Diagram Update Shopping Cart

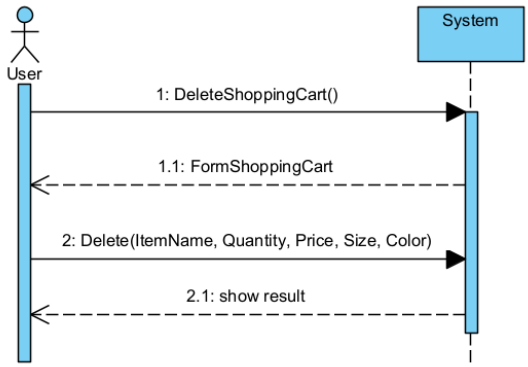

Fig. 17. System Sequence Diagram Delete Shopping Cart

5) Site Map

Fig. 18. Site Map User

6) User Interface

- Login

This page contains the RevivalTV mobile application login form. Users are required to log in before being able to access the RevivalTV mobile application via the email and password that was registered during Sign Up.

Fig. 19. User Interface Intial Display

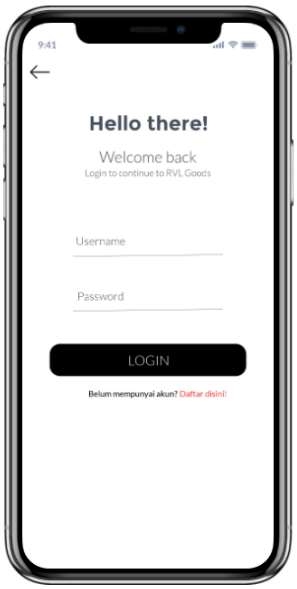

Fig. 20. User Interface Login

- Sign Up Menu

This page contains a registration form for users who do not have a RevivalTV mobile application login account. Users are required to fill in data such as username, email, phone number, address, and password.

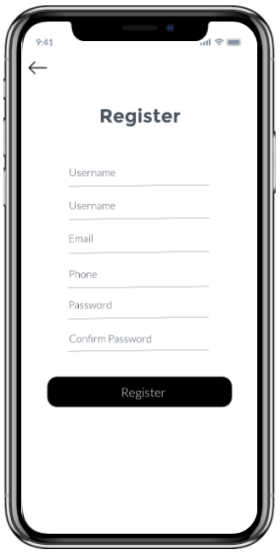

Fig. 21. User Interface Sign Up

- Main Menu

The Main Menu feature displays the schedule of matches between teams that have taken place, are currently in progress, and will take place. This page also displays the name of the team playing, and the result of the match score. Has a tournament game schedule filter feature, which only displays 1 type of match game.

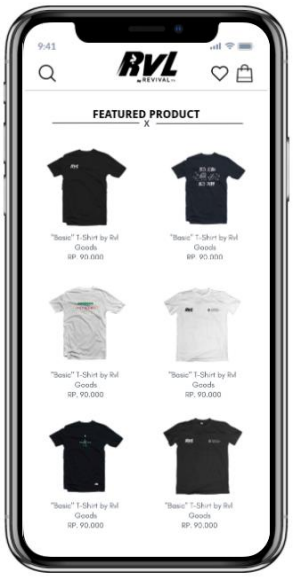

Fig. 22. User Interface Main Menu

- Search

The Search page displays a column where the user can search for the desired item or catalog.

Fig. 23. User Interface Search Menu

- Shopping Cart Menu

The Shopping Cart page displays data for each item that has been added to the shopping cart, such as the product name, total price and delete items or add to favorites.

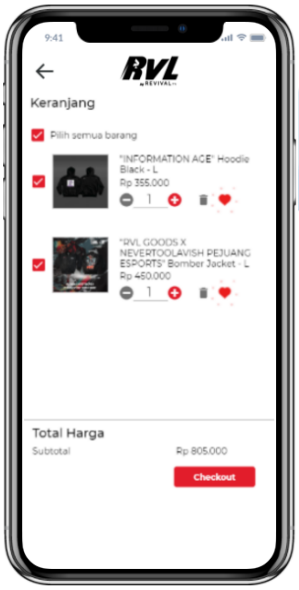

Fig. 24. User Interface Shopping Cart

- Payment Detail

The Payment Details page displays Order No, Order Name, Item Name, Size, Order Quantity, then shipping options, Payment Method, Virtual Account No, and Total Payment.

Fig. 25. User Interface Payment Detail Menu

- Invoice: this invoice page contains order data information, payment amount and receipt number to track goods.

Fig. 26. User Interface Invoice

- Delivery Status: the delivery status page displays order data and details of orders that have been delivered or are being shipped.

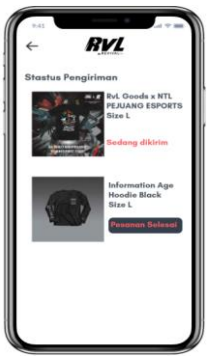

Fig. 27. User Interface Delivery Status Menu

V. CONCLUSION

Based on the discussion that has been carried out, it can be concluded that there are several advantages provided by the RevivalTV mobile application information system:

1) Users or gamers can search for information about games, tricks, and tips, as well as pro player profile info.
2) Users or gamers can search for RVL (Revival) by RevivalTV merchandise as well as merchandise for users' or gamers' favorite teams.

With the shopping cart menu and payment menu to help users in the buying process

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Educational Game Design Sorting Waste Android Based

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***Abstract*— Waste management in Indonesia is still quite far from good, this is still happening due to a lack of public awareness of the management and processing of waste around the community environment. Indonesia is estimated to produce 64 million tons of waste annually. Referring to data from Sustainable Waste Indonesia (SWI), only 7% of this figure is recycled, while 69% of it accumulates in landfills (TPA). With this situation, learning media that are educational are needed starting from Early Childhood (PAUD). Educational games are used as learning media which are very interesting to be developed as a learning tool for early childhood to introduce waste and sorting organic and non-organic waste. The educational game created is based on Android with the waterfall development method. The purpose of this research is that it can be used as an alternative learning medium in Children's Education (PAUD) in changing conventional learning methods into game simulation learning methods, so that it can educate children (PAUD) in the introduction of types of waste and waste management. Based on the results of functionality testing, the application game has run well and passed all test scenarios using the black box method and can run on smart phones with the Android operating system.**

***Index Terms*- Educational games, waste, Early Childhood Education.**

I. INTRODUCTION

Environmental problems are issues that cannot be avoided. At present waste is a very serious environmental problem faced by Indonesian people in general. It can be said that housewives produce waste every day, both organic and inorganic waste. But what is worrying is the garbage that The products produced are instead disposed of carelessly in various places, and the effect will damage the surrounding environment. The amount of waste produced every year will increase in line with the increase in population. The current government has tried in various ways to overcome the waste problem. Especially the problem of inorganic waste. However, it has not yet reached the point of perfection. This is because the amount of waste in Indonesia is very high. So that the government has difficulty determining the right way to solve it.

Garbage is an object or material that is no longer used by humans so it is thrown away. The social stigma associated with waste is that all waste is disgusting, dirty, and so on, so it must be burned or disposed of properly. All community activities always generate waste. This is not only the responsibility of the local government but also of the whole community to process waste so that it does not have a negative impact on the environment. The waste problem includes 3 parts, namely downstream, process and upstream. On the downstream side, waste disposal continues to increase. In the process section, there are limited resources from both the community and the government. In the upstream section, it is in the form of a less optimal system that is applied to the final processing. Most people consider burning waste as part of waste management. however, such things can cause pollution to the environment and interfere with health. Attitudes like this are probably influenced by knowledge and age maturity. Building public awareness is not as easy as turning the palm of the hand. It needs cooperation from all parties, both the

community, government and third parties as supporters. It took quite a long time to build that awareness. Positive examples and role models as well as consistency from the policy makers in Indonesia are also needed a certain area. Direct outreach activities about waste management can encourage community participation in waste management. At this time and from day to day it is increasingly unavoidable that waste problems will occur, the problems that will be found will be more complex if this is allowed to continue without a solution then it will become a big problem. The problem that will occur is the amount of garbage that will be scattered and will disturb the view and can also block the flow of the river and eventually cause flooding. This problem can occur due to a lack of concern for waste and also a lack of education and awareness related to waste.

According to the definition of the World Health Organization (WHO) waste is something that is not used, not used, not liked or something that is thrown away that comes from human activities and does not happen by itself [3]. Waste Management Act No. 18 of 2008 states that waste is the residue of daily human activities and/or from natural processes in solid form. Garbage is now a serious threat to the survival of children, if waste is not managed properly and children do not get good educational resources about waste, then in the next few years around 250 million Indonesian people will live together with piles of garbage and will incur a lot of losses.

One alternative is to conduct education about knowledge in waste management which can be done by early childhood by sorting organic and inorganic waste, but sorting waste is a new behavior in children, therefore a study of children's knowledge and attitudes needs to be done. Knowledge studies can be carried out with learning media and children's attitudes can be carried out by instilling the behavior of sorting organic and inorganic waste from an early age in children so that later they will be carried over when they grow up.

The fact of handling the waste mentioned above also shows the behavior of children who do not care about their household waste, especially the environment. This is reflected in the culture of our children who are still very fond of littering. Therefore there must be efforts to prevent and instill a caring attitude towards the environment from an early age.

Meanwhile, what is currently happening is that the existing educational/knowledge media on waste management are lacking in number and unattractive. Materials and methods for implementing Environmental Education that have been used so far are felt to be inadequate so that the target group's understanding of environmental preservation is incomplete. In addition, materials and methods for implementing Environmental Education that are not applicable do not support the resolution of environmental problems faced in their respective regions. Given the rapid development of current technology, researchers are trying to solve this problem through software engineering that is considered cheap, popular and popular with children. As technology develops, smartphones have become children's daily needs, there are many applications that can help children carry out their activities more easily. Currently smartphones are also equipped with many new facilities that allow users to perform many activities. Smartphones are also late equipped with Operating Systems such as Android, IOS.

Mobile application comes from the word application and mobile. Application means application, application, use. In terms of application is a ready-to-use program that is designed to carry out a function for the user, while mobile can be interpreted as moving from one place to another. As reported by gs.statcounter.com, Android is the most widely used operating system in Indonesia, with a percentage of 75.27%. In second place is IOS with a percentage of 22.74%. Judging from the facts above, researchers are innovating to provide environmental learning features, especially in relation to the introduction and processing of waste for children. The application created will be packaged in the form of an Android-based interactive game made using Unity. This educational game hopes to provide knowledge and create

awareness to children of the importance of protecting the environment, especially regarding waste, as well as the ability to process waste so that it can be managed properly and efficiently.

II. THEORETICAL BASIS

A. Garbage

Waste is a material that is wasted or disposed of from sources resulting from human activities or natural processes that do not yet have economic value. Waste is classified into 2 categories, namely organic and inorganic waste. Organic waste is waste that is easily recycled such as dry leaves, vegetable scraps, food

scraps and others. While inorganic waste is waste that is not easily decomposed such as plastic, paper, bottles, glass, cans, electronic waste and others.

B. Android

Android is an operating system for mobile devices that is open and based on the Linux operating system. Android can be used by everyone who wants to use it on the device. Android provides an open platform for developers to create their own applications that will be used for various software [6].

C. Mobile Application

Mobile Applications are applications specifically designed for smartphone or cellular platforms such as iOS, Android, Harmony OS, or Windows Mobile. Then the advantages of the mobile application are that there is permanent storage space on the device and it is easy to use anytime and anywhere [10].

Mobile application is a type of software in the form of applications that are created and run on mobile devices such as smartphones and tablets. Generally, mobile applications aim to provide services that are almost the same as PC devices but with a smaller size [13].

D. Waterfall

Waterfall is a software development framework in which the development process is completed sequentially one by one. The phases in the waterfall are divided into analysis, design, implementation, testing, and maintenance. In the waterfall model, requirements must be defined in advance so that there can be no changes in the middle of the process [17].

- **Analysis**
  The Analysis phase is also known as the software requirement specifications (SRS) phase. which is the phase where all requirements in software development will be described and analyzed in detail. From the analysis carried out, it will produce functional and non-functional requirements. Functional requirements include objectives, scope, perspective, functions, software attributes, user characteristics, and database requirements. On the other hand, non-functional requirements include constraints, limitations, design and operating requirements of the software.

- **Design**
  The Design phase is a phase that includes planning and problem solving processes for software solutions. The planning process carried out in this phase is the design for software to solve the problems found in the previous phase, the design can be in the form of algorithm design, software architecture design, logical diagram scheme, and data structure definition.

- **Implementation**
  The Implementation phase is a phase that refers to business needs and design into an execution program, database, website through programming and deployment. This is where the original code is written and compiled into operational applications, where databases and text files are created. In short, this means the conversion process from the process phase to the production phase.

- **Testing**
  The Testing phase, which is commonly known as verification or validation, includes the process of checking that the expectations for the software meet the performance and specifications and the completion of the intended goals. Verification refers to the process of software evaluation carried out to determine whether the product at a certain phase meets the initial conditions. Validation refers to the process of evaluating software during and at the end of the development process with the aim of finding that the software meets specified requirements. Of course in this process bugs and system glitches are found and fixed, then redefined accordingly.

- **Maintenance**
  The Maintenance phase is the phase after the software has been developed, where in this phase there are several things, such as correcting errors encountered during use, improving the performance and quality of the software, and accommodating changes needed in the software [14].

E. Unified Modeling Language (UML)

Unified Modeling Language (UML) is a visual language for modeling and communicating about a system using diagrams and supporting texts [15]. In developing applications, the authors use several Unified Modeling Language (UML).

Use Case Diagram is a model for the behavior of the information system to be built. Use case diagrams describe an interaction between one or more actors with the information system to be built. Use case diagrams are used to find out what functions exist in an information system and who has the right to use these functions [16].

III. METHOD

In this study using the waterfall method. The waterfall method is a structured system design process with a systematic approach. This method runs sequentially through several stages where the output from one stage will be used as input in the next stage. The following is an elaboration of the development stages adapted to the research. The main thing in using this paradigm is to determine the steps for making the right game in accordance with software engineering rules to get games that suit your needs, as shown in Figure 1.

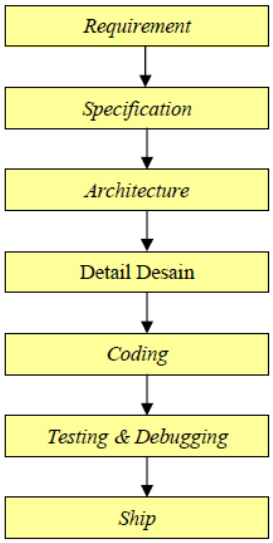

Figure 1 Research Methodology

Analysis and Design

Application analysis and design using UML diagrams which is a standard language for modeling applications built with an object-oriented methodology. The system overview is described by a Use Case Diagram.

A. System Analysis

The system design that will be made requires several input data requirements, output data requirements and interface requirements. The purpose of the needs analysis is to determine the function specifications, capabilities and facilities of the program. Needs analysis is also useful as a basis for evaluation after the program has been compiled.

B. System Design

The system design is described using a Use Case Diagram, which is intended to form an explanation of the main functions and application behaviors in an outline with the hope that the processes that occur in it can be easily understood. The following is a description of these functions as shown in Figure 2 below:

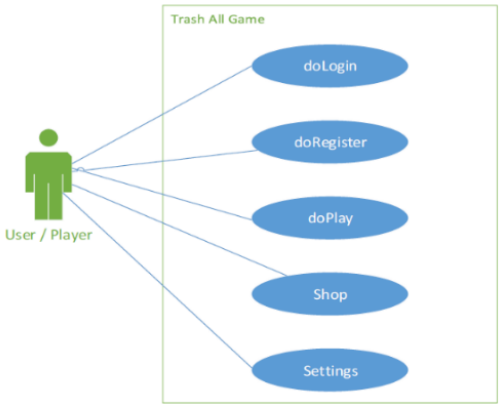

Figure 2 Use Case Diagram of an Educational Game to Sort Waste.

IV. RESULT AND DISCUSSION

The results of the analysis of the materials that have been collected are then formulated game product specifications according to market needs (in this case PAUD children). The game's initial design emphasized:

A. Game Description Design

The game that will be made is a learning game to get to know waste and good waste management. It is hoped that this research can help children (PAUD) to understand and know the types of waste and their processing, in this case changing conventional learning methods into simulation learning methods with mobile-based educational game media and helping children (PAUD) develop children's creativity, because in educational games has elements of challenge, accuracy, reasoning and ethics. This game contains learning for children (PAUD), where learning will be given through games which are one of the media for playing while learning, especially for PAUD children. We hope that the use of games as an educational medium can become a new technique that can make children enjoy learning more.

B. Scenario Storyline

The game scenario is used to find out the flow of the game that will be made, as shown in Figure 2. Where

the Player who will play this game is Children (PAUD). There are 2 (two) games to choose from, namely waste recognition and waste management.

C. Game Rules

The rules of each game are used to limit what players can do and what players cannot do when playing the game. Rules can be in the form of lives, points, stamina and so on for the main support of the game. The rules contained in this educational game Players at the beginning of playing this educational game get a point 0 (zero) and have to play in waste management to increase the points obtained. Players also won't die or run out of lives while playing, but the points they get will decrease due to mistakes in sorting and processing waste. There is a time in the game so that if the allotted time runs out, the player will be considered wrong in playing the game and return with the points that will be obtained reduced.

D. System Implementation

The design of the application screen is a display design that will later be applied in the game application as an interface display. Screen design stages are very important in the development of application games in the application of making displays using Adobe XD in designing application game screens. The following is the display design of the garbage sorting educational game:

- **Game Main Menu**

Figure 3 Game Main Menu

The main menu in Figure 3 is the initial appearance of the game trash, in this view there is a start button to start the game and a settings button to change according to the existing functions. Users can start the game by taking action on the start button then the game will start.

- **Settings page**

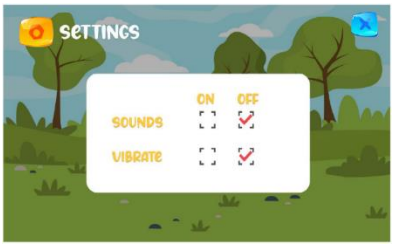

Figure 4 Settings page

The settings menu shown in Figure 4 has the function of selecting or setting defaults for display, sound, and vibration when playing Game Trash. Settings can be made by the user to determine the comfort level when playing the trash game.

- **Page Leveling Mode**

Figure 5 Page Leveling Mode

The display in Figure 5 from Game trash where the page can monitor the user's level, Game trash is a level/challenge based game where you have to get 3 stars on a challenge to open a new challenge, the higher the user level, the the more types of trash that will be played and known and the more scores that will be obtained.

- **Information page for types of waste**

Figure 6 Information Menu for Types of Trash

The information menu for the types of waste that is displayed in Figure 6 contains various types of waste and how it is processed. This view will open after clicking the Start button on the Main menu in Figure 3, then after that all types of garbage will be displayed accompanied by an explanation and also followed by a voice that will explain it. This voice function makes it easier for children (PAUD) to capture the information conveyed because at the age of PAUD children there are still those who cannot read information in the form of text.

- **Garbage Processing Mode page**

Figure 7. Waste Treatment Mode Menu

On the display of Figure 7 is the process of implementing the game. In the game process the user can sort waste according to its type, separate the types of waste based on the color of each available disposal site, if the player puts the wrong trash in the wrong place then points will be reduced so that if you do it continuously the stars on the challenge will reduced to 2 until it runs out so it can't continue to the next stage and can't go up to the next level.

E. System Function Testing

Testing in this game is done by using black box testing. Black-Box Testing is a software testing method that only focuses on functional specifications without testing the code and software design sections. In Black-Box Testing, the tests carried out are only to find out whether the functions, inputs, and outputs of the software being tested comply with the specifications [17]. Black box testing is carried out to test the software in terms of functionality in applications developed with a given scenario. The results of functionality testing using the black box method show that all functions and features in the application for the community from the first time it is run to completion can run well according to what has been planned. There are 5 features that have been tested, **Table 1** shows the results of testing the game application.

Table 1. Application Game Testing Results

No	Testing	Information	Status
1	Main Menu	Displays the main menu	Passed
2	Leveling Mode	Goes Well	Passed
3	Garbage Treatment Mode	Displays the Garbage Treatment Mode	Passed
4	Setting Page	Can do Settings	Passed
5	Waste Type Information	Displays information on the type of waste	Passed

F. Evaluate the 8 Golden Rules

In the process of developing Educational Games, refer to the principles of 8 (eight) golden rules. Following are the results of the evaluation of the application developed against the 8 (eight) golden rules:

- **Strive for consistency**
  The Educational Game developed has a consistent interface design in terms of color, uniform font type, consistent navigation, the use of images in the form of flat icons of the same size and type, the sequence of actions for similar functions has a consistent sequence.
- **Cater to universal usability**
  In educational games, the language used is English because it is a universal language and can be understood by many people.
- **Offer informative feedback**
  The Educational Game that has been developed has provided a response/feedback to the crucial actions taken by the user, such as when the user wants to close the game, the system will display a confirmation pop up to ensure that the user wants to close the game.

Design dialogs to yield closure
The Educational Game developed has provided the appropriate end function for each action.

Offer simple error handling
The Educational Game developed has provided informative and easy-to-understand error handling for every action, such as when the user selects a level that is not yet accessible, the game will display a message informing an error.

- **Permit easy reversal of actions**
  In the Educational Game developed there is a mechanism to cancel the actions taken by the user. For example, when the user wants to close the game, the system will display a confirmation pop up. And if the user wants to cancel the process, the user can press the cancel button to cancel the close game process.

- **Support internal locus of control**
  The Educational Game developed provides a simple and functional display, because this display is preferred by early childhood, which provides information in the form of easy-to-understand visualizations.

- **Reduced short-term memory load**
  The Educational Game developed has designed an interface that is easy to recognize and users have no difficulty in remembering the purpose of information.

G. Multimedia Evaluation

The following is an evaluation of the application of multimedia elements to Game Trash.

- **Text**
  In Game Trash, text elements play a role in giving instructions to players so they can run game programs correctly. Apart from giving instructions, text also plays an important role throughout Game Trash where this educational game really needs text. With text, this game can be used correctly in terms of writing.

- **Picture**
  Image elements in Game Trash can be seen in the buttons, logos, and menu displays. Images play a role in making the game less boring and attracting player attention. This image element is also very important when playing different types of waste.
- **Voice**
  In the Trash game there is the use of sound which is an important element in the game where the use of sound can increase understanding of the information conveyed and increase children's interest in operating the Trash game.

- **Animation**
  Game Trash doesn't use any animation elements in its application to the game.

- **Videos**

  Apart from animation, the game Trash also doesn't use video elements

V. Conclusion

The conclusion that can be drawn from the program that has been made is that this educational game can help children (PAUD) understand waste and how to sort waste according to its type, learning is provided by simulation with game media and makes it easier for children (PAUD) to learn to know how to understand waste , how to dispose of trash properly, and make habits to dispose of trash in its place. The developed Game Trash can meet the needs of garbage education, Game Trash is in great demand by users because of its attractive appearance, In terms of the user interface, the appearance of the game is designed in a clear, concise and orderly manner which makes users understand how to use the application properly. In the evaluation results, this game has been able to achieve the initial goal of being able to make Early Childhood Children (PAUD) aware of the importance of sorting waste. The application of gamification to Game Trash supports learning content to distinguish types of waste, which makes it more attractive to players. Children who play online games are proven to be able to socialize well in the gamers' environment and also expand their social networks through cyberspace. Children or gamers are proven to have the ability (skill) and knowledge (knowledge) in the use of internet technology.

Suggestions for development that can be carried out in this study are that the object of research can be made more varied and the discussion in Game Trash is more general as well as the environment the game is made in more detail and made with an even more attractive appearance so that users can use and increase knowledge about the types of waste and their management patterns

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User Experience Analysis from User-Centered Design Approach in Marketing Website

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***Abstract*— To create a marketing website that is right on target as product market fit, it is necessary to do a user experience analysis. User Experience analysis using the User Center Design approach is carried out by prioritizing user-oriented design. A website based on the UCD process will generate high satisfaction levels for its users. In this research, user experience analysis was conducted using a User Centered Design approach with Product Market Fit concept orientation. This concept is often ignored so it becomes a major factor in the failure of a business start-up. The collection was carried out through several processes, namely in-depth interviews and the distribution of questionnaires to a total of 30 respondents. The questionnaire results can be used as a reference to find out which aspects are good and which are still lacking. The element of displaying information on the monitor screen when opening a website gets the highest score of the other aspects with a percentage of 93% user satisfaction. The conclusion for each element states that the curious websites that are being analyzed get a decent title.**

***Index Terms*- User Experience (UX), User Centered Design (UCD), product market fit.**

I. INTRODUCTION

A. Background

In a website, the role of User Experience is very important. User Experience plays a role in determining user assumptions and feedback on brand producers. In other words, User Experience is also part of the branding of a product. So do not be surprised if the development of User Experience gets more attention from the company.

User Experience analysis needs to be carried out to provide input to the UX design process and provide product designs that are from the perspective of its users. So the product can be enjoyed by users and prevent creating designs that only suit the designer's wishes.

The design and development of the Atap Bukit Coffee marketing website are carried out using a User Centered Design (UCD) approach with a Product Market Fit concept orientation. On the other hand, UX analysis was chosen considering the purpose of designing a marketing website as a service that wants to achieve Product Market Fit from coffee shop visitors in Salatiga and its surroundings. Product Market Fit needs to be prioritized because the business world has an understanding that it must be able to touch the market segmentation level. What components or elements must be provided to the business can be known through direct communication with product users [1], [2]. Thus this research comes to answer these problems.

The User-Centered Design (UCD) approach was chosen to be used in this study because this UCD approach involves the user directly. In the system development process, the main thing is the participation of system users. Active user involvement is decisive for the process of improving design implementation on marketing websites [3].

As a marketing website, it will have competitors in the future, so it is important to make big changes that will make this website different and better than its competitors. Even though there are several other aspects such as business processes and so on, UX is also the main thing that must be considered when designing a website. By defining user requirements with high precision, including the design process, initial prototyping, and testing, building sound systems

using the UCD approach produces systematic results that benefit all target users.

B. Research Question

- What are the factors considered by marketing website users so that marketing websites are said to be efficient and effective?
- How much influence does the evaluation of User Experience analysis have on the development of a business?
- What are the positive impacts of evaluating User Experience analysis on the development of a business?

C. Benefits of Research

- Provide a product design that fits the perspective of the user.
- Make it easier for businesses to achieve their long-term goals because consumer loyalty is maintained.

Save costs because companies can create solutions based on consumer problems.

II. THEORETICAL BASIS

Web pages that are related to each other contain a collection of information on the same topic and are provided by individuals, organizations, or groups, often called websites [1]. Currently, the website is used by almost all business activists because the use of this digital facility makes it easier for customers to access stores anytime and anywhere. On the other hand, websites are also considered to be able to show profiles and achievements to increase the level of consumer confidence in using the services and goods offered.

The user's experience when using the website for the first time, from the initial entry to exit will determine whether or not the user returns. The experience and feelings of interacting with the website are said to be User Experience. There is a term that says the loyal customer is the key. With the visualization, if the User Experience provided is good, the user will be satisfied and return to using the website and then become a loyal customer. After a user becomes a loyal customer, they will become a treasure for the website or business because it will provide regular traffic for the website [4], [5].

User Experience (UX) is a person's view and response based on participation and use of a system product and service (ISO, 2010) [1]. Simply put, UX is how one feels when interacting with an object. A website is said to be successful when it is accompanied by a successful existing UX design. Another factor that must be considered in the UX design process is the level of user satisfaction the first time they use the web system.

Meanwhile, User Centered Design (UCD) is an approach by placing the user as a source of system development that is made, which aims to increase user comfort in using the system. The User-Centered Design approach is a process that requires repetition from the initial stage to the final stage or implementation in a system design process [1], [6]. The UCD approach can be implemented through several stages with direct users that are consultative. Making the user a cooperative design partner through surveys or interviews, so that a detailed description of the user's experience is obtained which is the output of this stage.

Users are expected to be able to provide an evaluation of the initial design of the website system so that the designer can understand the steps that must be taken in updating the system. The creation of a system aims to create various kinds of convenience for its users [7]. It is hoped that the implementation of UCD in this analysis can create a relationship between the designer and the user so that a good system oriented to the needs of the user can be created without taking a long time.

In addition to the User Centered Design approach, there is also a Human-Centered Design approach which is essentially the same. The very significant difference between the two methods is that HCD focuses on all users, potential or not, all of whom will be the object of research. Meanwhile, UCD only focuses on specific users.

This design process is crucial because it aims to create the best impression from users. User-Centered Design and Human Centered Design are widely used to replace each other in different contexts but are considered the same. Although these two terms have the same roots, the ideas present are viewed from a slightly different perspectives [8].

User-Centered Design is a design designed with a more in-depth analysis of the target audience. It concentrates not only on general human characteristics and perceptions but also on the specific traits and features of the target users. User-Centered Design pays attention to details about the target user, such as taking into account age, gender, potential educational level, professional background, product usage environment, emotional characteristics and physical perceptions, and level of technology awareness and other factors. [9], [10]

Therefore, it is important to determine the UX factors related to the user so that the UCD approach the authors consider is a relevant approach. By continuing to develop the existing UX system, in the future, it is hoped that Atap Bukit Coffee will have a significant difference from its competitors.

Given the growing development of digital systems, more and more competitors will use a similar product marketing approach [11], [12].

III. METHOD

In this study, the main topics include business process analysis and stakeholder interviews. Apart from the business owner, it is important to know the user's point of view. After conducting a literature review, in this study, the authors decided to use User Centered Design (UCD) in analyzing and collecting data [13].

Data collection using UCD must focus on user needs so that the output generated through this approach will be optimal for end-user needs. This study implemented the following activity steps to analyze and collect data using the UCD approach [14].

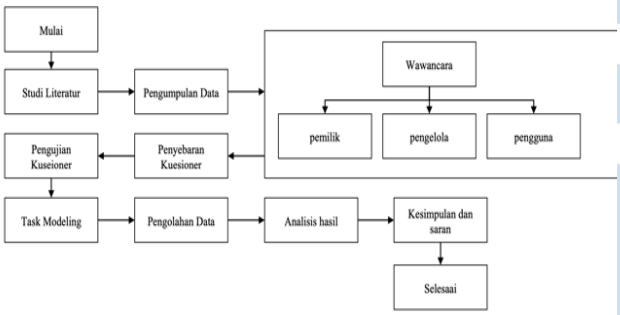

Figure 1. Research Path

After formulating the problem, a literature study related to the topic of wetting is carried out which supports solving the problem in this study. Literary instructions are obtained through articles, journals, and books that discuss User Experience [14], [15].

A. *Data Collection*

In this step, a detailed needs study is carried out regarding the questionnaire information to be used. The questionnaire is a combination of the statements needed to represent variables in UX. The next step is to determine the right respondent and the number of respondents required in testing the research instrument. Two stages of instrument research were carried out, validity test and reliability test. The validity test used 10 respondents, and 20 respondents for the reliability test. Respondents were selected from representatives of Atap Bukit Coffee marketing website users.

B. *Interview*

Interviews with the in-depth interview process were carried out face-to-face to support preliminary studies looking for details of the problem to be studied [17]. This stage also intends to interact directly with website users to find out what is needed from the existing system. Interview questions are distinguished based on the role of the source, including:

The owner (owner) :

- How do you market Atap Bukit Coffee?
- In your opinion, are the current business and marketing processes effective and efficient enough?

Manager (management):

- How to communicate with consumers?
- In your opinion, are the current business and marketing processes effective and efficient enough?

User :

- How do you find information related to Atap Bukit Coffee?
- How to communicate with Atap Bukit Coffee? Have you done it before?
- Is the current marketing process effective and efficient?

C. *Distribution and testing of questionnaires*

A questionnaire was distributed containing statements regarding User Experience to 10 respondents. After that, the first testing stage was carried out, namely validity testing. This test was carried out to determine the validity of the statements submitted to the respondents. The second testing stage, namely testing the respondents' answers, is carried out to ensure that the respondents' answers are reliable. The second test was carried out on 20 website user respondents.

D. *Task Modeling*

At this stage, analyzing and describing the results of the interviews were carried out. As a result, it will be known how the user completes tasks on the system and what things the user needs to know. Besides that, it also functions to find out how the interface on the website is, whether the user is comfortable using it or not.

E. *Data Processing*

The data is processed by collecting all assessments from the questionnaire on each attribute statement. After that, look for the maximum value for each attribute. This value determines every UX variable that popularizes the website in terms of User Experience.

F. *Result Analysis*

The results of the in-depth interviews that have been conducted, will be concluded into several output statements regarding several things that need to be considered for website marketing. Then the authors

make these points as a reference for determining solutions and making them into the main aspects of the statement in the questionnaire stage. This value will later determine whether each UX variable meets the product market fit factor in a system service or not. Then the value will be visualized using a graph.

IV. Result and Discussion

After conducting in-depth interviews with three types of informants in this study, the authors obtained the output in the form of several statements regarding matters that need to be considered in the design of the Bukit Coffee Roof marketing website, namely that there are many conveniences, especially for prospective visitors to be able to see the menu and condition of the place before visiting. visit Atap Bukit Coffee. The collection of data from in-depth interviews was deemed sufficient, then the next data collection was carried out, namely a questionnaire. The 19 statements will be filed including:

Q1: Overall, I am satisfied with the ease of use of the Atap Bukit Coffee marketing website
Q2: How to use the Atap Bukit Coffee marketing website is very simple
Q3: I can complete my task effectively when using the Atap Bukit Coffee marketing website
Q4 : I can quickly complete my work using the Atap Bukit Coffee marketing website
Q5 : I can complete my tasks efficiently when using the Atap Bukit Coffee marketing website
Q6 : I feel comfortable using the Atap Bukit Coffee marketing website
Q7 : The Atap Bukit Coffee marketing website is very easy to learn
Q8 : I believe that I will be more productive when using the Atap Bukit Coffee marketing website
Q9: If an error occurs, the Atap Bukit Coffee marketing website gives a notification message about the steps I have taken to resolve the problem
Q10: Whenever I make a mistake, I can go back and recover quickly
Q11: The information provided on the Atap Bukit Coffee marketing website is very clear
Q12: It's easy to find the information I need
Q13: The information provided by this system is easy to understand
Q14: The information provided is very effective in helping me complete my work
Q15: The layout of the information on the monitor screen is very clear
Q16: The appearance of the Atap Bukit Coffee marketing website is very satisfying
Q17: I like to use this kind of Atap Bukit Coffee marketing website display
Q18: This Atap Bukit Coffee marketing website provides all the functions and capabilities I need
Q19: Overall, I am very satisfied with the performance of the Atap Bukit Coffee marketing website

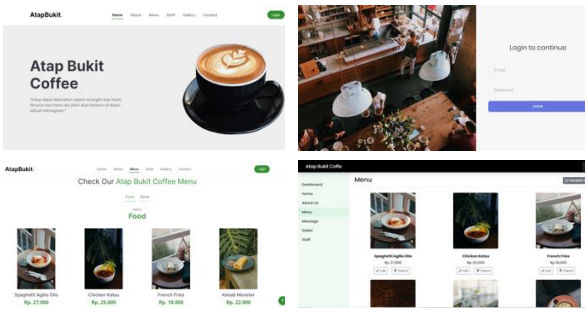

Figure 2. UI Website

These statements were submitted at the questionnaire stage with responses using 5 indicators in each statement, namely, SS for strongly agreeing was worth 5, ST for agreeing was worth 4, RG for undecided was worth 3, TS for disagreeing was worth 2, and STS for very Disagree is worth 1.

After presenting it in percentage form, the next step is to describe and draw conclusions about each aspect indicator using the range of values as follows:

- Very Eligible = 81% – 100%
- Eligible = 61% – 80%
- Decent enough = 41% – 60%
- Not Eligible = 21% – 40%
- Very Ineligible = < 21%

The combination of ratings from the respondents' answers is then processed by the writer in a table to see the collective value of each statement as a variable in UX. This stage is carried out aiming to test the validity of the data that has been obtained previously. This value is then used as a determinant for each UX variable whether it meets the product market fit category or not.

The first assessment is an assessment to test the validity of the statements made in the questionnaire. In testing this validity, the questionnaire was distributed to the initial 10 respondents. The validity test aims to determine whether the 19 statements that have been made and will be submitted to respondents are valid or not. The results of the validity test show that the 19 statements submitted are valid.

Then a questionnaire was distributed to 20 other respondents so that a total of 30 respondents. The assessment this time is the stage in testing reliability, namely how trustworthy the answers from the

respondents are. The final results of these assessments are accumulated and visualized in a graph shown in Figure 2. These results are the final values of the statements which are used as the main aspects of the statements in the questionnaire, namely Q1 to Q19.

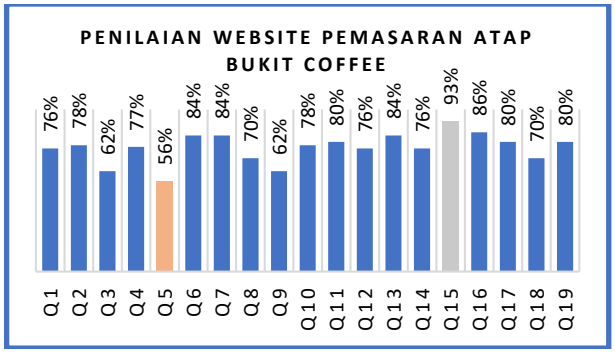

Figure 3. Result of Website Marketing Assessment

Based on the results of the evaluation of the Atap Bukit Coffee marketing website, the score in Q5 was ranked the lowest with a percentage value of 56%. This value is considered very low based on the customer's statement of efficiency in the tasks that must be completed on the marketing website. This explains that the responses from marketing website users conclude that some of the wishes or tasks they want to complete efficiently on the website cannot be achieved. The highest percentage value is in Q15 with a score of 93%. This explains that the Roof Hill Coffee marketing website has an information layout that is very easy for users to understand. Users can easily find the information they want by placing information blocks on the Atap Bukit Coffee marketing website.

Before responding to the results of the user experience assessment in using a marketing website, the author takes a predetermined percentage value range to conclude the feasibility of each aspect of the designed website.

Responding to the results of inferring the value of each aspect of the UX analysis, it was obtained from 19 statements 5 statements received a very proper predicate, 13 statements received a proper predicate, and 1 statement received a fairly decent predicate. From these results, the author concludes by saying that the marketing website from Atap Bukit Coffee is appropriate to be used as a marketing website.

The results and predicates obtained can be very useful when improvements are made to the marketing website. With the results of the analysis, it can be seen which aspects need to be prioritized in the design, as well as the development regarding user satisfaction. Thus, the benefits of many factors can be obtained, for example in terms of time and cost-effectiveness. The time and costs required can be estimated so there is no overtime and over budget.

Table 1. The conclusion of the assessment of each variable in the question

Statement	Percentage	Conclusion
Q1	76%	Worthy
Q2	78%	Worthy
Q3	62%	Worthy
Q4	77%	Worthy
Q5	56%	Worthy enough
Q6	84%	Very worth
Q7	84%	Very worth
Q8	70%	Worthy
Q9	62%	Worthy
Q10	78%	Worthy
Q11	80%	Worthy
Q12	76%	Worthy
Q13	84%	Very worth
Q14	76%	Worthy
Q15	93%	Very worth
Q16	86%	Very worth
Q17	80%	Worthy
Q18	70%	Worthy
Q19	80%	Worthy

V. CONCLUSION

Based on user experience analysis carried out using conventional processes through interviews with 3 informants who have different backgrounds, namely visitors, managers, and owners, raw data is obtained to determine the needs that must be prioritized in website marketing. The results of the interview partially became the source of the questionnaire statements. A total of 19 statements were distributed in the form of a questionnaire to see the direct evaluation of visitors and potential visitors. The value obtained from distributing the questionnaires is then used as a reference for an effective and efficient development process in the future.

The results of the research conducted concluded that several factors from the appearance of the website were satisfactory and some needed to be improved. The survey proves that the appearance the layout of each piece of information from the website is very clear. On the other hand, user efficiency when using the website is still lacking, this means that it is necessary to make

improvements at the stages of completing each task that can be done on the website.

From the research that has been done, it is very important to pay attention to the factors that make website marketing efficient and effective. These factors are completely in the hands of website users. When users can carry out their wishes on the website easily, quickly, and without confusion for users, then it can be said that the website is efficient and effective for users.

After conducting a User Experience analysis, the authors found that the results can greatly influence the development of a business. When we can create a very user-friendly marketing website, users will return and become loyal customers. This is one of the factors that influence the development of a startup business.

The writer's suggestion for future research is to increase the number of quality statements and increase the number of respondents who have a stake in this matter. This can be used as an approach to get the right target and comprehensive output of user needs.

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Implementation Weighted Product Method for theBest Carrot Seed Recommendations

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***Abstract*— Farmers currently lack the proper tools or methods to determine and identify criteria for good/excellent seeds. The selection of good/superior seeds is primarily based on personal experience and perspectives. Even some of the Sinabung refugees who grow carrots are unaware of the seed sources they utilize. There are almost 40 different varieties of carrots, each with distinct growth criteria and requirements. Consequently, this presents an additional challenge in determining the quality of carrot seeds to be planted, which ultimately impacts the harvest production. The production of carrots does not correspond proportionately to the land area used. To address the issues, the search for superior seeds employs a decision support algorithm to provide recommendations. This algorithm utilizes the Weighted Product (WP) method, which offers recommendations based on predetermined criteria. The assigned weights are derived from research findings and expert knowledge. The algorithm's calculations generate several recommendations for potential carrot plants, sorted based on their outcomes. These recommended varieties can serve as superior seeds, leading to increased production. The study aims to enhance carrot production and contribute to the economic resilience of farmers displaced by Mount Sinabung.**

***Index Terms*- Artificial Intelligence; Carrot Seeds; Decision Support System; Mount Sinabung Refugee Farmers, and Weighted Product Method.**

I. INTRODUCTION

Tanah Karo, which is well-known as a vegetable producer,is the main source of vegetable suppliers in North Sumatra, even vegetables are exported to the national region and abroad. Nowadays, many farmers switch to carrot plants for various reasons, such as the planting age of only three months, practical ways of working and the wide export market in various cities in Indonesia, such as Jakarta, Bandung, Surabaya, Bali and even Papua. Based on previous research, farmers can produce Rp. 7,450,500/harvest/ha [1]. The age of carrots until the harvest period is 2.5 - 3 months, judging from the results that can be obtained by farmers in growing carrots, of course this is very supportive of their economic resilience.

Most of the farmers in the land are still farming semi- modern, using tractor tillage, spraying machine showers and mostly with human labor. No one has yet fully utilized modern farming methods such as utilizing an IT system. Thisthe case found in the relocation of karo in the relocation ofrefugees from Mount Sinabung in the village ofNangbelawan. Things that need to be considered in carrot cultivation to get maximum production, is the optimum temperature for carrot plant growth is 15-21oC. This temperature is suitable for the growth of roots and the top of the plant so that the color and shape of the roots can be optimal [2]. Soil that is suitable for growing carrots is soil thatis well drained, rich in organic matter and fertile with an altitude of 1200-1500 m above sea level. Sandy loam soil is suitable for carrot cultivation because it is easy for root penetration so that its growth can reach optimal length and size. This plant can grow well in soil with a pH of 5-8 [3]. Soil moisture is very important for the growth of carrot plants,including during seeding to obtain seeds with uniform growthand fast growth after planting in

the field. Apart from the above requirements, good seeds cannot be separated from thesuccess of obtaining maximum production [4].

The fact that found at the location of this research, generally the farmers follow the correct proceduresin farming, especially in the selection of good seeds. Determining and searching for criteria for good/excellent seeds, the farmers do not have the tools or methods to get them. The selection of good/superior seeds is done based on personal experience and views, even some of the Sinabung refugees who cultivate carrots do not know the source of theseeds they use [3, 4]. This of course affects the production of carrots at harvest.Harvest production is not proportional to the area of land used. Based on the above problems, the search for superior seeds uses decision support algorithms and recommendations. This algorithm will provide recommendations for the quality of superior carrot seedsbased on the criteria or characteristics that must be prepared in the selection of plants. The algorithm developed uses the Weighted Product (WP) algorithm. The WP method is a recommendation method with weighting againstpredetermined criteria [5]. Previous research conducted by for the selection of instant cameras, in this study concluded that the final result of the application evaluation was the overall value of system user satisfaction which obtained a percentage score of 87.98% with a very good predicate [6]. The second research is a study for the selection of ornamentalplants, in this study it was concluded that with a system success percentage of 84,409% the system was considered successful in implementing the WP method and the criteria used in the recommendation system were appropriate. The WP method is used in the design of this recommendation system because it is considered to have fast computing and is suitable for making ornamental plant recommendations. Theadvantages of this WP method provide clarity on the weightsof costs and benefits on each criterion [5].

This study determines the variables or criteria to determinethe characteristics of superior carrot seeds, then the process of determining superior seeds is carried out using the WP method. The results of the recommendations will be used fortrial planting with ordinary seeds, not classified as superior according to the WP system testing with the same land and the same treatment. From the results of trials conducted afterthe harvest period, the production of superior carrot seeds willbe compared with seeds without the WP process. From the results of this trial, it can be seen whether superior seeds canproduce greater production or not [4].

In general, carrot farmers displaced by Mount Sinabung donot have standards in procuring superior seeds in their agricultural business. Most of them get carrot seeds from unknown sources. Usually buy seeds from traders. Some of them also produce their own seeds but do not meet proper standards in producing superior seeds. As a result, crop yieldsare not optimal, the area of land planted is not proportional toharvest production. The crop yields are suboptimal, and the price of the carrots has been negatively affected by the impact o Covid-19. There is a lack of demand both locally and from java. As a result, it greatly affects the economic resilience of theMount Sinabung refugees. One of the appropriate solutions to overcome the above problems is to produce superior seeds from carrots themselves using the WP method, for that it can be stated that the problem formulation of this research is How to Design a System Implementation to Get Superior Carrot Seeds with a Weighted Product Algorithm?

II. THEORETICAL BASIS

A. Carrot Seeds

Basically, the carrot varieties commonly consumed by theworld's population are of many types, both in shape and color, not just one type as we usually find in Indonesia [2]. To get maximum production in planting carrots, it is necessary to know the stages that must be done in planting carrots. First, efforts should be made to use superior seeds. From a land thathas been planted with carrots and before the post-harvest, a search for carrots can be carried out which will be used as superior seeds.

The steps that can be taken in finding sources of superiorseeds are as follows [7]:

1. Age after planting day at least 100 days
2. The tuber texture is straight, dense
3. The thickness of the tuber diameter>=3 cm
4. Glowing bright reddish
5. The shape of the carrot leaves is straight and bright

While the method of seeding carrots, as follows:

1. Carrot leaves cut to about 10 cm
2. Roots that have been selected, cut in thirds
3. The land is loosened, sown with compost
4. Made a bed for planting seeds
5. Plant tubers with about 50 cm

Roots that will be used as seeds must be selected properly; the planting period is at least 100 days. Roots that are not oldenough will easily rot and get disease. To know the planting period of carrots can be known from the date of planting. In addition, from the physical texture, whether it has hardened and looks ripe, it can be a reference that the carrot is old

enough. Physical texture that is straight, dense, and shiny canbe seen after the carrots that are old enough are removed [8].Select from several carrots that have been removed to get thebest tuber texture. Before the carrots are removed, it can be known which carrots can be used as a source of seeds from the texture of the leaves, which are fresh, not dense and decomposed [8].

From several carrot tubers that have met the criteria to be used as a source of superior seeds, the leaves are cut until theremaining about 10 cm and the tubers are cut one third of thelength of the tubers. Then dried for about 24 hours. Cutting the tubers to rejuvenate the carrots and will produce flowers from the growth of carrot shoots. Before planting the roots, prepare enough beds and composted soil to allow good growth and avoid rotting from waterlogging. Normal tuber growth and good if there is leaf growth, new shoots to produce flowers. Soil fertility must be maintained for good flower development. Cutting branches / shoots need to be done to get good flower seeds. It is enough to only use the main branch, about 5-6 branches [7].

Wide petals and large flower seeds will produce superior seeds. Old flowers with brown color can be picked by cuttingthe stems. Then it can be dried in the hot sun until it is completely dry for several days. Flowers that are completelydry when rubbed between dried carrot flowers will easily destroy the outer layer of the flower seeds. It is necessary to clean the seeds with hand friction in order to produce good quality seeds, not fibrous/lots of fibrous roots around the carrot tubers when planted [9].

B. Weighted Product Method

The research model uses the Weighted Product (WP) method in determining a decision based on several attributes.This method requires the decision maker to determine the weight for each attribute. WP evaluates m alternatives Ai (i=1,2,..,m) against a set of attributes Cj (j=1,2…,n) where each attribute is independent of one another [5]. In the WP method normalization is still carried out, where the rating of each attribute must be raised to the first power with the weightof the attribute in question. The normalization formula is as follows

$$S_i = \prod_{j\$1}^{n} = X_{ij}^{Wj} \qquad (1)$$

In performing calculations using the WP method, severalstages must be carried out, including:

1. Define criteria and assign categories to each criterion. The categories in each criterion are cost, and benefit. Then give weight to each criterion.

Table 1. Weight Of Alternative Criteria

ALTERNATIVE	KRITERIA		
	C_1	C_2	C_N
ALTERNATIVE 1	X_{11}	..	..
ALTERNATIVE 2	..	..	..
ALTERNATIVE M	X_{M1}	..	X_{MN}

2. Determine the priority level of weight for each criterion, then correct the weight with the following formula.

$$W_{ij} = \frac{Wi}{\sum Wi} \qquad (2)$$

Description:

Wi = Criteria weight to wij

∑Wj = Total sum of criteria weights

Wij = The final result of the corrected value

3. Calculating the value of the Si vector, the criterion is raised to the power and multiplied by the weight that has been fixed previously.

$$S_i = \prod_{j\$1}^{n} X_{ij}^{Wj} \qquad (3)$$

Description:

Si = Alternative preferences.

Xij = Criteria value.

Wj = Weight of criteria.n = Number of criteria

4. Calculate the vector Vi, then choose the highest value asthe best alternative in making decisions.

$$V_i = \frac{S_i}{\sum_{i\$1}^{n} S_i} \; with \; i = 1,2,\dots m \qquad (4)$$

Description:

Vi = Alternative preferences

Si = Alternative preference on the vector S

n = Number of criteria

m = Number of alternatives

III. METHOD

A. *Research Stages*

The following is the order from the beginning to the conclusion of the research to be carried out.

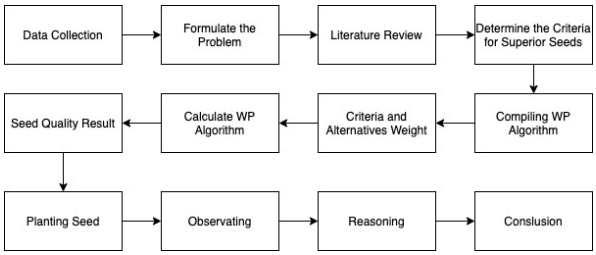

Figure 1. Research Stages

In Figure 1. Research Stages, the first step is to collect initial data. This research is a case study, so we look at the phenomena that occur in the object or place of research. Next formulate existing problems to observe reality with a literature review or actual science and theory. The result of the literature review is to determine the criteria for superior seeds from carrot plants and computer computationalalgorithms that can be used to solve problems.

The next process is to find the value of the criteria for prospective seeds for computational calculations using the WP algorithm to produce recommendations for the quality ofprospective seeds. These prospective seeds will be planted and observed to measure the results of the recommendations.The final stage is to reason about the results of plants that have grown to draw conclusions

B. System Design

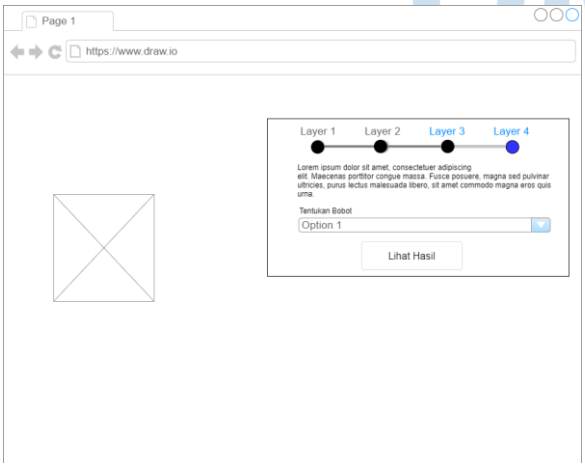

Figure 2. User Dashboard Mockup

Figure 2. User Dashboard Mockup is the initial user interface design when opening the website. On this page thereis a button that functions to start the recommendation process,after the button is pressed, a stepper will appear to guide the user in filling in the desired criteria weights. After allprocesses are complete, the recommendation results willappear to replace the stepper component

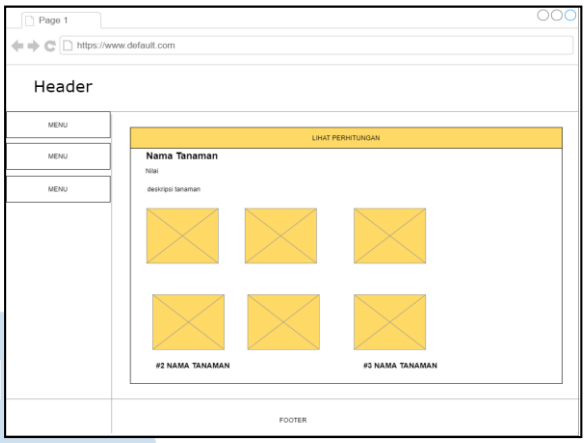

Figure 3. Admin Dashboard Mockup

Figure 3. Admin Dashboard Mockup is an interface design for the results page on the admin dashboard. This page will display the 5 criteria for the best carrot seed varieties, picturesof carrot plants and the final WP weight value of the existing varites. At the top there is a button to display the modal that contains the recommendation calculation process in detail.

C. *Criteria and Weighted Scale*

The following are the criteria and the value of each criterion weight designed in this study:

Table 2. Criteria And Weighted Scale

Code	Criteria	Weighted	Description	Weighted Score
C1	Root Texture	1-5	Benefit	1-5
C2	Root thickness	1-5	Cost	3,8,11,15,18
C3	Root Color	1-5	Benefit	1-5
C4	Leaf Color	1-5	Benefit	1-5
C5	Plant Age	1-5	Cost	59,69,79,90,110

Based on the results of interviews with farmers/experts who have done planting and research for more than 20 years, there are 5 criteria in determining the quality of candidate carrot seeds. C2

and C5 are cost criteria because the root thickness and plant age, the higher the cost for planting and land use. so that the resulting value is higher, but the weight of the criteria is getting lower in the WP calculation [10].

IV. Result and Discussion

A. Implementation of Weighted Product

In choosing the best carrot seed candidate to be the best carrotseed recommendation based on 5 criteria inputted by the user, 10 alternatives were used. One of these alternatives will be selected and then sorted based on the final weighted score ofthe WP. Each alternative is given the necessary criteria and weights in performing calculations so that the results obtainedare as follows:

Table 3. Criteria Description

Criteria	Description
Root Texture	The texture of the tuber is an essential factor for the growth and development of prospective carrot seeds. The texture of the tuber plays an important role in the growth resistance and strength of the carrot plant against pests or temperatures.
Root thickness	The thickness of the tuber affects the nutritional quality of the carrot plant. The thickness of the tubers is proportional to the texture of the tubers to provide strong resistance to the would-be carrot plant.
Root Color	The color of the tubers affects the criteria for carrot plants. A good tuber color is a bright color and reddish or yellow depending on the carrot variety produced.
Leaf Color	Leaf color is an important factor. Leaf color affects the quality of the carrot tubers produced.
Plant Age	Each type of carrot plant variety has a different age to be categorized as mature or old enough.

The selected alternatives from various varieties of carrot plants have the following criteria weights:

Table 4. Weighted Scale Of Each Alternatives

Code	Alternatives	C1	C2	C3	C4	C5
A1	Imperator	5	11	5	5	110
A2	Chantenay	4	8	4	4	79
A3	Danvers	5	5	5	3	89
A4	Mini Carrot	5	5	3	2	59
A5	Nantes	4	11	5	5	110
A6	Hercules	5	15	3	5	69
A7	Oxheart	3	15	1	5	110
A8	Red-cored	2	15	3	2	79
A9	Merida	4	8	1	1	110
A10	Rainbow	3	11	5	4	110

Next, the process of calculating the WP based on the weight of the criteria inputted by the user. From the results of the weights of the inputted criteria, normalization of theweights of each criterion will be sought.

Table 5. Input Level Criteria By User

Code	Lv.1	Lv.2	Lv.3	Lv.4	Lv.5
C1	Branch two	Double bend	One Bend	Not straight	Straight unbranched
C2	1-3 cm	4-5 cm	6-8 cm	9-11 cm	12-15 cm
C3	Pale Yellow	Less bright	Pale red	bright and less red	bright and red
C4	Dark green brown	Dark Green and not fresh	Not Fresh and Dark Green	Not Fresh and Dark Green	Fresh and Light Green
C5	50-59 days	60-69 days	70-79 days	80-89 days	90-110 days

In this calculation simulation, the level value inputted bythe user is:

1. C1: Level 5, straight unbranched
2. C2: Level 4, 9-11 cm
3. C3: Level 5, bright and red
4. C4: Level 5, fresh and light green
5. C5: Level 5, 90-110 days

Then the calculation starts from weight normalization, the first step is to normalize the weights of the criteria that have been entered. The normalization process can be seen in table 6 Normalization Process.

Table 6. Normalization Process

Code	Normalization	Result
C1	5/(5+2+5+5+1)	0.278
C2	2//(5+2+5+5+1)	0.111
C3	5/(5+2+5+5+1)	0.278
C4	5//(5+2+5+5+1)	0.278
C5	1/(5+2+5+5+1)	0.056

Next the normalization process is complete, then the S vector value is calculated. The calculation process is carried out by raising the alternative weight value to the normalized weight value, for the weight with the cost rank attribute to benegative while the benefit attribute to the positive rank. The process of calculating the value of the vector S can be seen in Table 7. Vector Si Calculation Process.

Table 7. Vector V Calculation Process

No.	Calculation Vector S	Result
S1	$(5^{0.278})(11^{-0.111})(5^{0.278})(5^{0.278})(110^{-0.056})$	2.256
S2	$(4^{0.278})(8^{-0.111})(5^{0.278})(4^{0.278})(79^{-0.056})$	1.976
S3	$(5^{0.278})(5^{-0.111})(5^{0.278})(3^{0.278})(89^{-0.056})$	2.162
S4	$(5^{0.278})(5^{-0.111})(3^{0.278})(2^{0.278})(59^{-0.056})$	1.715
S5	$(4^{0.278})(11^{-0.111})(5^{0.278})(5^{0.278})(110^{-0.056})$	2.12
S6	$(5^{0.278})(15^{-0.111})(3^{0.278})(5^{0.278})(69^{-0.056})$	1.94
S7	$(3^{0.278})(15^{-0.111})(1^{0.278})(5^{0.278})(110^{-0.056})$	1.209
S8	$(2^{0.278})(15^{-0.111})(3^{0.278})(2^{0.278})(79^{-0.056})$	1.157
S9	$(4^{0.278})(8^{-0.111})(1^{0.278})(1^{0.278})(110^{-0.056})$	0.898
S10	$(3^{0.278})(11^{-0.111})(5^{0.278})(4^{0.278})(110^{-0.056})$	1.839

After getting the results from the calculation of vector S, the next process is calculating the value of vector V bydividing each vector S by the total sum of all vectors S. The calculation of vector V can be seen in Table 8. Vector V Calculation process:

Table 8. Vector S Calculation Process

No.	Calculation Vector V	Result
V1	2.256/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.13
V2	1.976/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.114
V3	2.162/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.125
V4	1.715/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.099
V5	2.12/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.122
V6	1.94/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.112
V7	1.209/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.07
V8	1.157/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.067
V9	0.898/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0,073
V10	1.839/(2.256+1.976+2.162+1.715+2.12+1.94 +1.209+1.157+0.898+1.839)	0.106

Based on the results of calculations and results of sorting outthe WP method above that carrot seeds which are selected tobe the best carrot seeds is:

Table 9. Weighted Scale of Each Alternatives

Code	Alternatives	Result	Rank
A1	Imperator	0.13	1
A2	Chantenay	0.114	4
A3	Danvers	0.125	2
A4	Mini Carrot	0.099	7
A5	Nantes	0.122	3
A6	Hercules	0.112	5
A7	Oxheart	0.07	9
A8	Red-cored	0.067	10
A9	Merida	0,073	8
A10	Rainbow	0.106	6

B. Implementation of Algorithm on Website

Figure 4. User Dashboard Website

The website page for the carrot seed recommendationsystem is divided into two, namely for users and admins. Theuser only has a feature to search for the best weight of carrotseeds, while the features that the admin has are adding alternative data and seeing detailed calculations fromsearching for the best weight of carrot seeds.

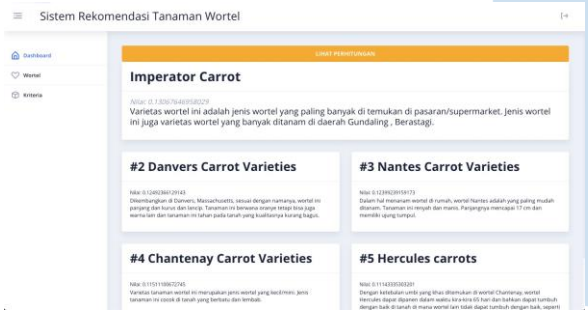

Figure 5. Admin Dashboard Website

V. CONCLUSION

Based on the results of research that has been successfullycarried out, the conclusions of this study are as follows:

1. Implementation weighted product method for the best carrot seed recommendations is determined based on 5 criteria's: root texture, root thickness, root color, leaf color and plant age.
2. The process of selecting carrot plants uses the Weighted Product (WP) method which helps in making decisions from several alternatives that must be taken by considering the criteria.
3. The user satisfaction using EUCS (End user computing System) for the application is 80.5%, which falls under the category of excellent.
4. For further system development, giving weights to alternatives and criteria can use fuzzy values. In addition, the weight of the criteria can also be obtained using the Analytical Hierarchy Process (AHP) questionnaire, not just interviews so that it can consist of several sources people [11].

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Evaluation of Information System Management Security Using Indeks KAMI and Recommendation Based on ISO 27001:2013 at PT XYZ (Travel Agent)

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***Abstract*— PT XYZ is one of the Travel Agent companies in Indonesia that is aware of information security, as shown due to the ISO 27001:2013 certification in 2021. However, there are still areas that must be adjusted to improve the company's Information Security Management System.**

In this study, the CAPD (Check-Act-Plan-Do) technique was used, with the KAMI Index supporting as an information security evaluation tool in compliance with ISO 27001:2013 standards. Check examines the firm's present state, Act evaluates the areas identified in the KAMI Index, Plan analyzes the evaluation outcomes and makes recommendations in accordance with ISO 27001: 2013 and Do offers recommendations to the company.

The results of the evaluation show that PT XYZ received a score of 623 from 645 and the value is in the green area, indicating that it is in the "Good" category. The evaluation findings from PT XYZ's KAMI Index are decent but have not yet achieved the highest rating. To help PT XYZ, maximize the Information Security Management System, its existence is utilized as a finding that is compared to the ISO 27001: 2013 standard and results in recommendations for improvement.

***Index Terms*- KAMI Index, Information Security Management System, ISO 27001:2013.**

I. INTRODUCTION

A new period, the technological age, was founded in the 18th century, marking the start of the industrial revolution 4.0, which profoundly impacted human life [1]. The organization utilizes technology in its operations, which has a favourable effect on the business. One of the advantages is the production of information, which can then be transformed into data and used for decision-making to accomplish a company's objectives [2]. However, there are some things that businesses need to be aware of to maintain stability in data production and remain competitive and develop in the technology era. The issue to be aware of is information risk, that threats are something to keep an eye out for because they might prevent decision-making, and information is a vital asset for businesses [3]. Cybersecurity refers to the measures that can be implemented to protect corporate data and assets. Information security is one of the cyber-security methods used to protect firm information [4]. Information security needs to be implemented by a corporation since it is crucial. Three key goals, namely confidentiality, availability, and information integrity, can be achieved in a corporation by applying information security [3].

Evaluation of the Information Security Management System is one of the applications of information security that companies can implement; with companies conducting evaluations, it can be used as a reference for companies in ensuring information security in their companies [5]. A supporting framework or standard is required to guide or point of reference when evaluating an organization's information security management system. ISO 27001 is one model that focuses on Information Security Management Systems.

One of Indonesia's businesses involved in tourism or online travel is PT XYZ, and it is known that the company has obtained ISO 27001: 2013 certification in the area of the Payment Process. During an interview with the company, it was learned that there were still areas of the ISO 27001 certification that needed to be improved. This topic is covered in Annex 6.1.1 of ISO 27001 version 2013, which discusses prospective employees' background checks. With this in mind, PT XYZ is trying to enhance the company's Information Security Management System by carrying out routine evaluations to get certified in the upcoming year.

This research aims to assess the Information Security Management System to evaluate the company's capability and level of maturity related to information security and to offer recommendations for development by ISO 27001:2013 standard. In order to adapt to company conditions, this research was carried out utilizing the CAPD (Check-Act-Plan-Do) technique and the KAMI Index evaluation tool [6].

II. Theoretical Basis

A. *Information Security*

Information security is the protection of all types of information resources from parties who are not authorized to manage the information, aiming to ensure and guarantee business continuity, lower business risk, and maximise profits or return on investment and business opportunities [7]. According to ISO 27000, three aspects of information security require attention. These aspects are:

Figure 1 Information Security Aspect

a. Confidentiality is an aspect that secures the confidentiality of data or information and restricts access to it to those with the necessary authorization.

b. Integrity is an aspect that ensures that data or information cannot be altered without authorization from the relevant authorities.

c. Availability is an aspect that ensures that data or information will always be accessible and may be accessed without any hassle by authorized users whenever and whenever they need it [8].

B. *Information Security Management System*

Information Security Management System (ISMS) is a management system that implements information security within a business or organization. The Information Security Management System (ISMS) is designed to reduce risk and provide business continuity to lessen security breaches' effects [9].

C. *ISO 27001*

The International Organization for Standardization (ISO) worldwide organizational body created the ISO 27001 standard, which the entire world, including Indonesia, has recognized and adopted [10]. The purpose of ISO 27001 is to guarantee that the chosen security measures can protect information assets from various threats and provide the parties concerned confidence in the degree of security [11]. The ISO 27001 standard itself contains requirements or fundamental prerequisites that must be completed to establish an Information Security Management System (ISMS) within a company. The Plan-Do-Check-Act (PDCA) model, which is utilized as an evaluation method by the Information Security Management System (ISMS), was adopted in the development of ISO 27001 [12].

D. *The KAMI Indeks*

The KAMI index is a tool to measure both the readiness and maturity of an organization's information security. The KAMI index has been established and adapted to international standards, specifically ISO 27001 version 2013. The KAMI index was also developed so that it may be used by any company or agency, regardless of its size, scope, or level of interest in utilizing ICT to assist in the execution of current business operations. [13].

The KAMI Index questions are divided into two categories of needs. The first is based on the readiness level for implementing safeguards by the completeness of existing controls in ISO 27001:2013 and minimal readiness as a requirement for carrying out ISO 27001:2013 certification. After completing the questions that the company's policies must answer, a score will be calculated to identify the Electronic System's level of readiness, which is further divided into three categories: Low, High, and Strategic [14]. The relationship between readiness status and the type of electronic systems is shown in Figure 2.

CATEGORY ELECTRONIC SYSTEMS				
Low		Final Score		Readiness Status
10	15	0	174	Not Worth It
		175	312	Fulfillment Of The Basic Framework
		313	535	Good Enough
		536	645	Good
Height		Final Score		Readiness Status
16	34	0	272	Not Worth It
		273	455	Fulfillment Of The Basic Framework
		456	583	Good Enough
		584	645	Good
Strategic		Final Score		Readiness Status
35	50	0	333	Not Worth It
		334	535	Fulfillment Of The Basic Framework
		536	609	Good Enough
		610	645	Good

Figure 2 Readiness Status Correlation with Electronic System Categories

The second category is based on the maturity level category of security implementation. It includes a category that relates to the level of maturity utilized by the framework or framework that will subsequently be used to characterize the grading of information security readiness inside a firm [13]. To identify the level of maturity in this category, five areas are evaluated by the ISO 27001: 2013 standards for information maturity. The five areas are Information Security Governance, Information Security Risk Management, Information Security Framework, Information Asset Management, and Information Technology and Security.

E. ISO 27001 relationship with the KAMI Index

	Governance	Risk Management	Framework	Asset Management	Technology	Supplement
Security Policies	√	√	√			√
Organisation of Information Security	√	√	√			
Human Resource Security	√		√	√		√
Asset Management		√		√		√
Access Control				√	√	√
Cryptography				√	√	√
Physical and Environmental Security				√		
Operations Security			√	√	√	√
Communications Security	√		√	√	√	√
Systems Acquisition, Development and Maintenance			√	√	√	
Supplier Relationships				√		
Information Security Incident Management	√	√	√	√	√	√
Information Security Aspects of BCM	√	√	√		√	√
Compliance	√	√	√	√	√	√

Figure 3 ISO 27001 relationship with the KAMI Index

Figure 3 is a correlation between each area in the KAMI Index based on ISO 27001 version 2013 [15].

III. METHOD

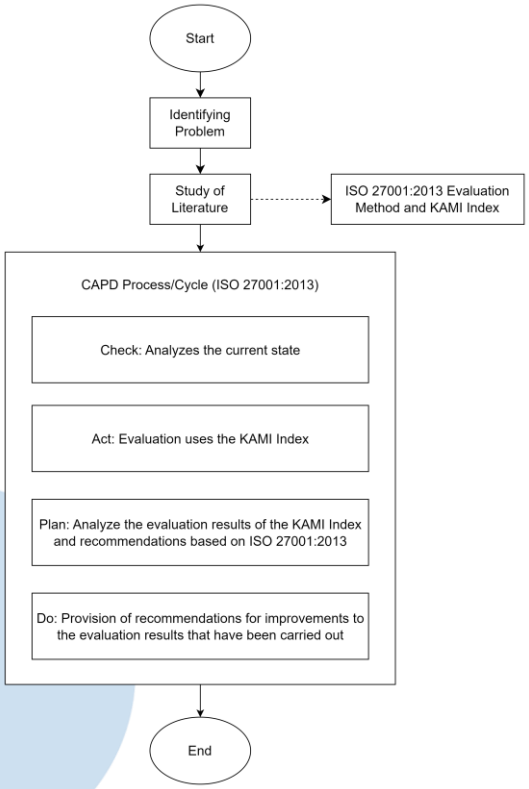

Figure 4 Research Workflow

The research workflow is depicted in Figure 4. The first stage of this research begins with identifying the problem, followed by a literature review with the related topic of ISO 27001:2013 and the KAMI Index. Additionally, this stage employs the PDCA (Plan-Do-Check-Act) cycle that ISO 27001 adopted. However, this study used a cycle that started with Check-Act-Plan-Do (CAPD), as adopting the CAPD cycle allows it to adapt to business conditions.

The first process, called Check, examines the company's existing state by looking at its structure, profile, and other factors. The second process is the Act, which evaluates an organisation's information security using the KAMI Index. After receiving the evaluation results, the process will proceed to the Plan process, where the evaluation outcomes will be analyzed and compared with the framework reference, namely ISO 27001: 2013. The comparison will result in suggestions for enhancing PT XYZ's information security management system. According to the evaluation that has been done, the final process, Do, is a procedure for making suggestions for improvements to firm information security in line with ISO 27001:2013.

IV. Result and Discussion

The company's electronic systems are evaluated under Category I evaluation, which aims to determine the type or level of the company's employed electronic systems. The KAMI Index is used at PT XYZ to determine the outcomes of the Category I: Electronic Systems evaluation. Whereas the overall score is based on the KAMI Index evaluation for Category I: Electronic Systems, PT XYZ has a score of 41, which is included in the "Strategic" category.

The ISO 27001: 2013 Standard Implementation at PT XYZ scored 623 for completeness based on the KAMI Index evaluation. PT XYZ successfully complies with the completeness requirements for maintaining ISO 27001: 2013 certification, as evidenced by the achievement of this score.

A. Information Security Governance

Table 1 Information Security Governance Evaluation

Status	Maturity Level				Total
	II	III	IV	V	
Are not done	-	-	-	-	-
In Planning	-	-	-	-	-
In Application	1	-	-	-	1
Completely Applied	12	3	6	-	21
Total	13	3	6	-	**22**

Table 1 summarizes the conclusions reached during the Category II review. There are 22 questions in Category II, which are broken down into three stages—Stages 1, 2, and 3—and three maturity levels—Stages II, III, and IV. This category has a maximum score of 126.

From a total of 22 questions, at Maturity Level II, there are twelve answers "Completely Applied" and one answer "In Application". At Maturity Level III, there are three "Completely Applied", and at IV Maturity Level, six "Completely Applied" answers.

Based on the evaluation that has been carried out, the company received an evaluation score of 124 which means that the company is at Maturity Level III+ for the Information Security Governance Area. PT XYZ has reached the minimum Maturity Level for Category II: Information Security Governance.

B. Information Security Risk Management

Table 2 Information Security Risk Management Evaluation

Status	Maturity Level				Total
	II	III	IV	V	
Are not done	-	-	-	-	-
In Planning	-	-	-	-	-
In Application	4	1	-	-	5
Completely Applied	6	1	2	2	11
Total	10	2	2	2	**16**

Table 2 summaries the findings from the completed Category III evaluation. There are 16 questions that make up Category III, which is broken down into II, III, IV, and V maturity levels as well as stages 1, 2, and 3. The maximum possible score in this category is 72.

From a total of 16 questions, at Maturity Level II, there are four "In Application" and six "Completely Applied" answers. At Maturity Level III, there is one answer, "In Application," and six answers, "Completely Applied"; at Maturity Level IV, there are two answers ", Completely Applied", and at Maturity Level V, there are 2 "Completely Applied" answers.

Based on the evaluation that has been carried out, the company received an evaluation score of 66 which means that PT XYZ is at Maturity Level V for the Information Security Risk Management Area. This was obtained because the company reached Maturity Level IV on the evaluation even though there are still questions that have a score that is not maximal.

C. Information Security Management Framework

Table 3 Information Security Management Framework Evaluation

Status	Maturity Level				Total
	II	III	IV	V	
Are not done	-	-	-	-	-
In Planning	-	-	-	-	-
In Application	-	-	-	1	1
Completely Applied	11	13	3	1	28
Total	11	13	3	2	**29**

Table 3 summarizes the findings from the completed Category IV evaluation. There are 29 questions in Category IV, which are broken down into four maturity levels (II, III, IV, and V) and three stages (stages 1, 2, and 3). In this category, the highest possible score is 159.

Of a total of 29 questions, at Maturity Level II, there are 11 answers "Completely Applied". At Maturity Level III, there are 13 answers to "Completely Applied". At Maturity Level IV, there are three answers "Completely Applied", and at Maturity Level IV, there are three answers "Completely Applied", and at Maturity Level IV Maturity V, there is one answer "In Application" and one answer "Completely Applied".

Based on the evaluation that has been carried out, the company received an evaluation score of 156 which means that the company is at Maturity Level IV+ for the Information Security Management Framework Area.

D. Information Asset Management

Table 4 Information Asset Management Evaluation

Status	Maturity Level				Total
	II	III	IV	V	
Are not done	-	-	-	-	-
In Planning	-	-	-	-	-
In Application	-	3	-	-	3
Completely Applied	29	6	-	-	35
Total	29	9	-	-	**38**

Table 4 contains a summary of the findings from Table 4 summaries the findings from the completed Category V evaluation. There are 38 questions in Category V, broken down into two maturity levels, II and III, and three stages, namely stages 1, 2, and 3. This category has a maximum score of 168.

Of a total of 38 questions, at Maturity Level II, are twenty-nine answers "Completely Applied". At Maturity Level III, there are three "In Application" and six "Completely Applied" answers.

Based on the evaluation that has been carried out, the company received an evaluation score of 159 which means that the company is at Maturity Level III for the Information Asset Management Area, where Maturity Level III is the maximum maturity level. In addition, the company achieved a minimum score in reaching Maturity Level III in the evaluation even though there were still questions with scores that needed to be more optimal.

E. Information Technology and Security

Table 5 Information Technology and Security Evaluation

Status	Maturity Level				Total
	II	III	IV	V	
Are not done	-	-	-	-	-
In Planning	-	-	-	-	-
In Application	-	1	-	-	1
Completely Applied	14	10	1	-	25
Total	14	9	1	-	**26**

Table 5 summarizes the findings from the completed Category VI evaluation. There are 26 questions in Category VI, broken down into 3 phases (phases 1, 2, and 3) and three maturity levels (Stages II, III, and IV). The maximum score for this category is 120.

From a total of 26 questions, at Maturity Level II, there are 14 answers "Completely Applied". At Maturity Level III, there is one answer, "In Application," and six answers, "Completely Applied", and at Maturity Level IV, there is one answer, “Comprehensively Applied".

Based on the evaluation that has been carried out, the company received an evaluation score of 118 which means that the company is at Maturity Level IV for the Information Asset Management Area, where Maturity Level IV is the maximum maturity level. In addition, the company achieved a minimum score in reaching Maturity Level IV in the evaluation even though there were still questions with scores that were not maximized.

F. Suplemen (Additional Category)

Table 6 Supplement Category Assessment

Status	Supplement			Total
	Third-Party	Cloud *Service*	Personal Data	
Are not done	-	-	-	-
In Planning	3	1	-	4
In Application	21	4	12	37
Completely Applied	3	5	4	12
Total	27	10	16	**53**

Out of a total of 27 questions in the Securing Involvement of Third-Party Service Provider subcategory, there are three questions with the response "In Planning," 21 questions with the response "In Implementation," and three questions with the response "Completely Implemented" in Table 6. The score that the company received in this subcategory is 2.00. Additionally, of the ten questions in the Cloud Service Security (Cloud Service) subcategory, 1 question has an answer of "In Planning," 4 questions have an answer of "Under Implementation," and five questions have an answer of "Completely Implemented." The score that the company received in this subcategory is 2.40. The Personal Data Protection subcategory has 16 questions, with 12 having "Under Application" and four having "Completely Implemented" as the response. The score that the company received in this subcategory is 2.25.

G. Achievement Percentage

Table 7 Percentage of Achievement in 5 Areas

Score	Area I	Area II	Area III	Area IV	Area V
Score	124	66	156	159	118
Max Score	126	72	159	168	120
Percentage	**98,4 %**	**91,7 %**	**98,1 1%**	**94,6%**	**98,4 %**

In the evaluation of the five areas shown in Table 7, it can be seen that PT XYZ's achievement of the maximum achievement score in each area has reached <90%.

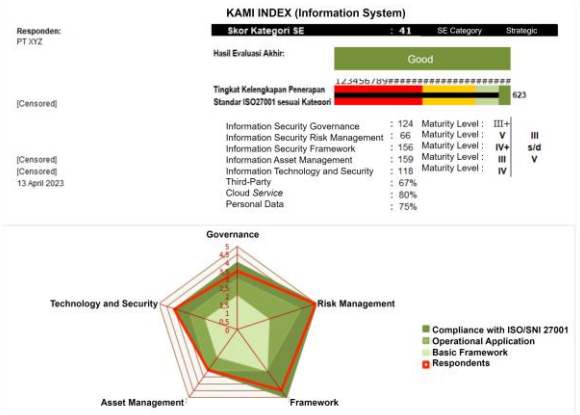

Figure 5 PT XYZ Dashboard Evaluation

The dashboard shown in Figure 5 indicates that the Electronic System at the company falls under the Strategic category, indicating that Electronic System at the company plays a significant role in assisting the ongoing work process. Additionally, the company earned a 623 overall rating. With this score, the company is now in the positive zone. It is evident from the evaluation's findings that the company complied fully with the completeness requirements for maintaining ISO 27001:2013 certification.

H. Recommendation

Recommendations for improvement in maximizing the maturity level of Information Security management at the company in accordance with ISO 27001 version 2013:

Table 8 Recommendations Based on the ISO 27001:2013

No	Current State	Recommendation	ISO 27001:2013 Controls
Information Security Governance			
1.	Not yet defined in detail and complete requirements or security needs and solutions to existing problems.	The company completes documents with requirements or security needs and resolution of problems with responsible parties.	*Clause* 5.2 *Policy* *Clause* 6.1 *Actions to address risks and opportunities.* *Clause* 7 *Support* A.5.1.1 *Policies for information security* A.18.1.1 *Identification of applicable legislation and contractual requirements*
Information Security Risk Management			
1.	Still in the implementation stage to identify threats and weaknesses related to information assets.	The company completes documents that identify threats and weaknesses related to information assets.	*Clause* 6.1.2 *Information security risk evaluation* A.8.2 *Information classification*
2.	Still in the implementation stage to identify the impact of losses related to the loss or disruption of the main asset function.	The company completes a document that defines the impact of losses related to the loss or disruption of the main asset function.	*Clause* 6.1.2 *Information security risk evaluation* A.8.1.3 *Acceptable use of assets*
3.	Still in the implementation stage to carry out a structured Information Security risk analysis or study.	Companies are used to implementing structured Information Security risk analysis or studies.	*Clause* 6.1.2 *Information security risk evaluation* A.18.2.1 *Independent review of information security*
4.	Incomplete documents of risk mitigation and overcoming steps, which are arranged based on priority levels and completion targets and those in charge.	The company completes a document of risk mitigation and overcoming steps, according to priorities, completion targets, and person in charge.	*Clause* 6.1.3 *Information security risk evaluation* A.6.1.1 *Information security roles and responsibilities* A.8.3 *Media handling* A.16.1 *Management of information security incidents and improvements*
Information Security Framework			
1.	Still in implementation to run a long-term planning program to improve Information Security.	The company sets a schedule and realizes long-term planning to improve Information Security.	*Clause* 4.4 *Information security management system* *Clause* 6.1.2 *Information security risk evaluation* *Clause* 6.2 *Information security objectives and planning to achieve them* *Clause* 9.1 *Monitoring, measurement, analysis, and evaluation* *Clause* 10 *Improvement*
Information Asset Management			
1.	Still in the stage of making a list of data or information that needs to be backed up.	The company completes a list of data or information that needs to be backed up.	A.12.3.1 *Information backup*
2.	Still in the stage of making a list of records of Information Security implementation.	The company completes a list of records of Information Security implementation.	*Clause* 7.5.3 *Control of documented information* A.12.1 *Operational procedures and responsibilities*
3.	Still in the planning stage of making procedures for using information processing devices and securing access to third parties.	The company makes procedures for the use of information processing devices for third parties and ensures access security for third parties.	*Clause* 4.3 *Understanding the needs and expectations of interested parties.* *Clause* 7.3 *Awareness* A.9 *Access control*

No	Current State	Recommendation	ISO 27001:2013 Controls
			A.13.2.4 *Confidentiality or nondisclosure agreements*
Information Technology and Security			
1.	Still in implementation to ensure all systems and applications support and implement automatic password changes.	The company ensures that its systems and applications can support the application and change of passwords automatically.	A.9.4.3 *Password management system*

Table 8 recommends improvement for the five KAMI Index components based on the evaluation's findings. The recommendations are made based on ISO 27001 version 2013 standard. Additionally, this recommendation is given to the company with the expectation that the company will implement the recommendation to maximize the Information Security Management System.

V. CONCLUSION

The following are conclusions from research at PT XYZ that evaluated information security using the KAMI Index:

A. According to Evaluation Category I: Electronic Systems at PT XYZ, the company scored 41, placing it in the Strategic category.

B. The evaluation of PT XYZ's efficiency in the five KAMI Index categories (Governance, Risk Management, Framework, Asset Management, and Technology) reveals that the company has a Good category maturity level, scoring 623 out of 645. According to the results of the evaluation done using the KAMI Index in the area of information security governance, this area receives a maturity level III+, the area of information security risk management, maturity level V, the area of information security management framework, maturity level IV+, the area of information asset management, maturity level III, and the area of technology and information security, maturity level IV.

Results from the previous evaluations led to recommendations for improvement for each KAMI Index aspect. This will enable PT XYZ to implement suggestions to maximize information security at the company.

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Web-based Decision Support System for Characters Selection in Game Genshin Impact with SAW Method

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***Abstract*— Genshin Impact is a game that has lots of amazing playable and time-limited characters. Many F2P players are in a dilemma most of the time, and can't choose the characters they should draw. This research's aim is to design and develop a web-based decision support system capable of ranking the best characters based on five combat roles to help F2P fans or player to select the best character, using the SAW (Simple Additive Weighting) method. SAW is capable of choosing the desired criteria (DPS, Heal, Shield, Buff, and Elemental) and each of their weight. The purpose of the recommendation is for Genshin Impact fans to be able to make a decision on who they should pull-based. The Result of this research is that the Characters will be ranked on each of their combat roles criteria using website as a form of implementation. The highest ranked for criteria DPS is Eula, Heal is Hu Tao, Shield is Iito, Buff is Eula, and Elemental is Eula. The prototype website used for this research has been validated by being tested using User Acceptance Tests by some players of Genshin Impact**.

***Index Terms*- Decision Support System; Prototype methods; Simple Additive Weighting; Web-Based Information System.**

I. INTRODUCTION

Genshin Impact is a newly developed game that was launched by Mihoyo, a Video Games company from Shanghai, China. Genshin Impact is a multiplatform video game that attracts players with excellent character designs, engaging storytelling, and the depth of the world of Teyvat, the world inside Genshin Impact. Since its release in September 2020, Genshin Impact's fans have continued to grow, as according to website Sensor Tower in its article titled "Genshin Impact Generates $2 Billion on Mobile in First Year" [1] and followed with its article titled "Genshin Impact Generates $3.7 Billion on Mobile in First Two Years" [2]. As the story progresses, the characters have also increased, bringing the total of up to 46 characters in version 2.4 and are still increasing [3]. Their combat roles can be categorized into DPS (characters meant to deal damage), and Support (characters that can upgrade, shield, heal, or create elemental advantages.

Image 1. Genshin Impact Limited-Time Character Banner

Image 1 above is the screenshot from inside the game of Genshin Impact, it is the screenshot of one of limited-time character banner that is showing at that moment, and the above is Tartaglia or can be known as Childe. In the game, there are two ways to get characters, one if Genshin Impact give the character for free (which is incredibly rare) or two, by player to "pull" the character from that banner. It can be seen from the image above, that there are buttons in the rightdown corner button "Wish x1" and "Wish x10",

when player "Wish", there are chances player might get that character, and "Pull" is another term that fans used to call the action of "Wish" or clicking that button. Because this banner is using a gacha system, there are chances that player might not get Tartaglia, and he is one the character that can only be get or "Wish" or "Pull" from limited-time banner only. The term "comes home" means that players managed to get Tartaglia as their teams member, or their "Wish" is successful.

But to be able to pull in a banner, player must use what is called "Intertwined Fates" it is a pink ball that can be seen in the top-right corner or at the Wish buttons. Then to get that pink ball players need to buy it using currency called "Primogems", that can be seen in the top-right corner beside the pink ball (in the image 1 there are 1290 Primogems). Primogems or free Primogems is given only on special occasions and quite rare, except if players want to buy it with real money. Therefore making it almost impossible for Free-to-Play or little spender players to pull every banner and get all of the characters (up until version 2.4 there are 46 characters), unless they are very lucky. Nevertheless, a F2P or little spender player sometimes can cross the line. For example case from website msn.com titled "18-Year-Old Daughter's 6-Week Genshin Impact Gacha Spree Hands Dad a $20,000 Credit Card Bill" [4].

All of Genshin Impact's characters have their own unique ability and special talents. But for this project, none of them will be included, and instead will be limited to only using attributes or stats from character's trials as data for calculating the rankings, and will be using one player who has been playing since the game was released to determine the criteria and weight.

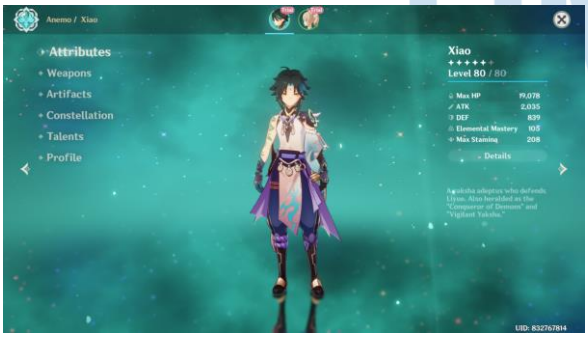

Image 2. Genshin Impact Character Trial

Image 2 above is the screenshot of Xiao's attributes as Character Trials, and a more detailed attributes can be seen by clicking button "Details". Players can use the stats from Character Trials as references when building their characters, and from this screenshots of every Character Trials that have appear up until version 2.4 is what will be used as the data in this project.

This project is aimed especially at Free-to-Play or Little Spender players, showing five rankings of characters, from five combat roles namely DPS, Heal, Shield, Buff, and Elemental, and their own calculation. Based on the previous research [5][6][7][8][9] for calculating criteria and weights, web-based is the best way that can be used as an implementation.

Simple Additive Weight (SAW). Therefore is a method that requires decision-makers to determine a set of criteria for a set of alternatives, and weight to measure the criteria's priority for ranking the alternative [10]. Whereas to build a character, the player must choose or prioritize on the stats that best suit the character's role by applying the right Artifacts and Weapons onto the said character. Therefore, for this project, SAW method is best suited as it can weight each chosen criteria and prioritize the most suited stats on each role.

The purpose of this research is to help provide some insight for F2P players with limited Primogems to choose which characters should the players choose, by ranking the characters using the data from in-game Characters Trial as a base, and showing the ranked recommendations through a platform that is web-based.

II. Theoretical Basis

A. *Decision Support System*

A decision support system is a system that assists users in making decisions, using programs to help solve certain problems, through making choices that are as accurate as possible according to the method chosen so that it becomes a solution to solving the problem [11]. These computerized programs capable of calculating which decision to be made according to the weight or criteria or alternative that is chosen, and that calculation then is implemented inside either into a program or system, or website [6].

B. *Simple Additive Weighting*

Simple Additive Weighting (SAW) is a decision support system method that can calculate what choices to make based on the criteria and weight of the preferred choice to get the most accurate alternative or solution [12]. In general, these are the steps of SAW method:

1. Determine Criteria and Weight
2. Assess Benefit & Cost
3. Create Decision Matrix
4. Normalization

$$r_{ij} = \frac{x_{ij}}{\max x_{ij}} \qquad r_{ij} = \frac{\min x_{ij}}{x_{ij}} \qquad (1)$$

Max for benefit and min for cost. This formula is to obtain normalized matrix R.

5. Ranking

$$V_i = \sum_{j=1}^{n} w_j r_{ij} \qquad (2)$$

V_i is the end result and $w_j r_{ij}$ means w for weight multiple by normalized criteria weight from the previous equation and the total is V_i.

C. Prototype

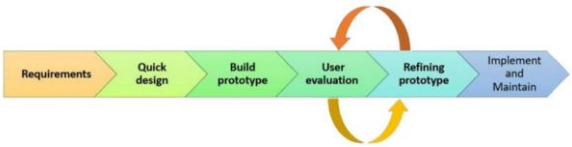

Fig. 1. Prototype Model [13]

Figure 1 above is the prototype method model, protype is a framework with a development process that involves its users. This method consists of six steps, namely requirements, rapid design, prototyping, user evaluation, prototype refinement, implementation, and maintenance [13].

D. Previous Studies

Similar research has been done before, and became the reference for this project. Some of them are titled "The Implementation of Simple Additive Weighting (SAW) Method in Decision Support System for the Best School Selection in Jambi" [5]. This study used the SAW method as the best school decision-making method in Jambi Province. Other research uses the same method in determining employee bonuses at PT Mayatama Solusindo, and implements this method on a website [6]. The SAW method has also been used as a decision support system in determining the nutritional status of toddlers [7]. Research [8] also uses the SAW method for gaming mobile selection. Meanwhile, research [9] used a different decision support system method, namely TOPSIS, but it was also successfully applied to a website design.

III. METHOD

A. Data Collection Technique

This project acquired data are by observation, literature study, and interview. Observation was done by gathering data from inside the game Genshin Impact. Literature study is using other journals as references for the flow of SAW, and the formula. Lastly, Interview is used to determine a criteria and weight from Genshin Impact fans, to get feedback, and testing the website.

B. System Development

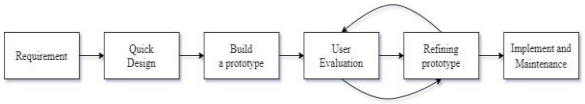

Fig. 2. Flowchart of Prototype

Figure 2 above is the flowchart for prototype methodology that will be used in this project and for developing the system [13]:

1. Requirement

   The first step is to collect information about the decision support system requirements, namely knowing the user requirements so that they can be applied in designing and developing prototypes. This stage was carried out through interviews with old Genshin Impact players, to find out and determine the weight criteria.

2. Quick Design

   The next step is to make the overall website design quickly according to the needs given. The goal is for users to have an idea of what the system will be like, and if there are some changes in the design then revisions can be made quickly.

3. Build a prototype

   This third step is to develop the first prototype, i.e. a mockup that will show the user how the system will look like, and will be built based on the requirements and a quick design.

4. User Evaluation

   In this step, the user can evaluate how the website works, by evaluating the prototype. Several enthusiasts or users are selected and asked about the performance of the system, and if revisions are needed then the prototype needs to be perfected.

5. Refining prototype

   If the prototype is rejected or requested for revision, the website will be refined according to user evaluation, then repeat step 4 until the revision is approved. If there are no changes, then this step can be skipped, or it can be used to make minor adjustments to the website.

6. Implement and Maintain

   The aim of this project is to assist fans in choosing which character they should draw, hence to allow easy access for them this system will be implemented web based.

IV. Result and Discussion

A. *Reqirement*

In building this recommendation system, the calculation was done using SAW Method. The steps are as follow:

1. Determining and choosing the necessary criteria and assess each criteria with its weight.

TABLE I. RATE FOR DPS

Rate	Weight (%)
Really Important	0.3
Important	0.25
Neutral	0.2
Less Important	0.15
Not as Much	0.1

TABLE II. RATE FOR SUPPORT

Rate	Weight (%)
Really Important	0.5
Important	0.3
Less Important	0.2

Table I Rate for DPS and table II Rate for Support are arranged by discussing it with player Arisa. Overall there are a total of ten criteria, which are HP, ATK, DEF, Elemental Mastery, CRIT Rate, CRIT DMG, Healing Bonus, Energy Recharge, Elemental Type, and Elemental DMG Bonus. Then all ten of them will be placed on five combat roles (DPS, Heal Support, Shield Support, Buff Support, and Elemental Support). Rating from table I and table II, each have their own combat role and they won't have any connection with the other combat role. It means that table I will only be used to calculate the ranking for DPS. Table II will be used to calculate the ranking for Support (Heal, Shield, Buff, and Elemental) only.

2. Making a decision matrix with character as (A_i), criteria as (C_i), and (w) for weight.

TABLE III. CRITERIA & WEIGHT FOR DPS

DPS			
Criteria	***Type***	***Weight (%)***	***Rate***
ATK	Benefit	0.2	3
CRIT Rate	Benefit	0.25	4
CRIT DMG	Benefit	0.3	5
Elemental DMG Bonus	Benefit	0.15	2
Elemental Mastery	Benefit	0.1	1
Total		1	

TABLE IV. CRITERIA & WEIGHT FOR HEAL

Heal Support			
Criteria	***Type***	***Weight (%)***	***Rate***
Healing Bonus	Benefit	0.5	3
HP	Benefit	0.3	2
ATK	Benefit	0.2	1
Total		1	

TABLE V. CRITERIA & WEIGHT FOR SHIELD

Shield Support			
Criteria	***Type***	***Weight (%)***	***Rate***
DEF	Benefit	0.5	3
HP	Benefit	0.3	2
Energy Recharge	Benefit	0.2	1
Total		1	

TABLE VI. CRITERIA & WEIGHT FOR BUFF

Buff Support			
Criteria	***Type***	***Weight (%)***	***Rate***
Elemental DMG Bonus	Benefit	0.3	2
Elemental Mastery	Benefit	0.5	3
ATK	Benefit	0.2	1
Total		1	

TABLE VII. CRITERIA & WEIGHT FOR ELEMENTAL

Elemental Support			
Criteria	***Type***	***Weight (%)***	***Rate***
Elemental Mastery	Benefit	0.5	3
Energy Recharge	Benefit	0.2	1
Elemental DMG Bonus	Benefit	0.3	2
Total		1	

Table III is for DPS, table IV is for Heal Support, table V is for Shield Support, table VI is for Buff Support, and table VII is for Elemental Support. Each combat role's criteria's weight won't allow even Admin to change it, and has been set for the total to be exactly 1. Above criteria and weight are chosen by considering what kind of attribute are player Arisa will prioritize when building a certain combat role characters.

TABLE VIII. DECISION MATRIX SCENARIO

Weight	0.2	0.25	0.3	0.15	0.1
Alternative	C_1	C_2	C_3	C_4	C_5
	ATK	*CRIT Rate*	*CRIT DMG*	*Elemental DMG Bonus*	*Elemental Mastery*
	Benefit				
Childe (A1)	1712	56.2	154.1	83.2	105
Xiao (A2)	2035	60.5	154.1	61.6	105
Hu Tao (A3)	1389	57.1	181.1	61.6	105
Eula (A4)	1712	57.1	181.1	114.8	105
Arataki Iito (A5)	1197	71.5	172.4	58.6	105

Table VIII above is table scenario for decision matrix for combat role DPS. The alternative for this decision support system will be the characters, and are the representative for criteria ATK, CRIT Rate, CRIT DMG, Elemental DMG Bonus, and Elemental Mastery. Table is filled using data attributes from the in-game character trial attributes, because the higher the number of each attributes the better, therefore the criteria type is benefit, and will be normalize using max formula.

3. Normalize the decision matrix based on the type of attributes (max for benefit and min for cost) to get normalized matrix R using formula 1.

Criteria ATK (C_1):

$$r_{11} = \frac{1712}{\max\{1712;2035;1389;1712;1197\}} = \frac{1712}{2035} = 0.84$$

$$r_{21} = \frac{2035}{\max\{1712;2035;1389;1712;1197\}} = \frac{2035}{2035} = 1.00$$

$$r_{31} = \frac{1389}{\max\{1712;2035;1389;1712;1197\}} = \frac{1389}{2035} = 0.68$$

$$r_{41} = \frac{1712}{\max\{1712;2035;1389;1712;1197\}} = \frac{1712}{2035} = 0.84$$

$$r_{51} = \frac{1197}{\max\{1712;2035;1389;1712;1197\}} = \frac{1197}{2035} = 0.59$$

Criteria CRIT Rate (C_2):

$$r_{12} = \frac{56.2}{\max\{56.2;\ 60.5;\ 57.1;\ 57.1;\ 71.5\}} = \frac{56.2}{71.5} = 0.79$$

$$r_{22} = \frac{60.5}{\max\{56.2;\ 60.5;\ 57.1;\ 57.1;\ 71.5\}} = \frac{60.5}{71.5} = 0.85$$

$$r_{32} = \frac{57.1}{\max\{56.2;\ 60.5;\ 57.1;\ 57.1;\ 71.5\}} = \frac{57.1}{71.5} = 0.80$$

$$r_{42} = \frac{57.1}{\max\{56.2;\ 60.5;\ 57.1;\ 57.1;\ 71.5\}} = \frac{57.1}{71.5} = 0.80$$

$$r_{52} = \frac{71.5}{\max\{56.2;\ 60.5;\ 57.1;\ 57.1;\ 71.5\}} = \frac{71.5}{71.5} = 1.00$$

Criteria CRIT DMG (C_3):

$$r_{13} = \frac{154.1}{\max\{154.1;154.1;181.1;181.1;172.4\}} = \frac{154.1}{181.1} = 0.85$$

$$r_{23} = \frac{154.1}{\max\{154.1;154.1;181.1;181.1;172.4\}} = \frac{154.1}{181.1} = 0.85$$

$$r_{33} = \frac{181.1}{\max\{154.1;154.1;181.1;181.1;172.4\}} = \frac{181.1}{181.1} = 1.00$$

$$r_{43} = \frac{181.1}{\max\{154.1;154.1;181.1;181.1;172.4\}} = \frac{181.1}{181.1} = 1.00$$

$$r_{53} = \frac{172.4}{\max\{154.1;154.1;181.1;181.1;172.4\}} = \frac{172.4}{181.1} = 0.95$$

Criteria Elemental DMG Bonus (C_4):

$$r_{14} = \frac{83.2}{\max\{83.2;\ 61.6;\ 61.6;\ 114.8;\ 58.6\}} = \frac{83.2}{114.8} = 0.72$$

$$r_{24} = \frac{61.6}{\max\{83.2;\ 61.6;\ 61.6;\ 114.8;\ 58.6\}} = \frac{61.6}{114.8} = 0.54$$

$$r_{34} = \frac{61.6}{\max\{83.2;\ 61.6;\ 61.6;\ 114.8;\ 58.6\}} = \frac{61.6}{114.8} = 0.54$$

$$r_{44} = \frac{114.8}{\max\{83.2;\ 61.6;\ 61.6;\ 114.8;\ 58.6\}} = \frac{114.8}{114.8} = 1.00$$

$$r_{54} = \frac{58.6}{\max\{83.2;\ 61.6;\ 61.6;\ 114.8;\ 58.6\}} = \frac{58.6}{114.8} = 0.51$$

Criteria Elemental Mastery (C_5):

$$r_{15} = \frac{105}{\max\{105;105;105;105;105\}} = \frac{105}{105} = 1.00$$

$$r_{25} = \frac{105}{\max\{105;105;105;105;105\}} = \frac{105}{105} = 1.00$$

$$r_{35} = \frac{105}{\max\{105;105;105;105;105\}} = \frac{105}{105} = 1.00$$

$$r_{45} = \frac{105}{\max\{105;105;105;105;105\}} = \frac{105}{105} = 1.00$$

$$r_{55} = \frac{105}{\max\{105;105;105;105;105\}} = \frac{105}{105} = 1.00$$

4. The final result will be obtained by multiplying the respective weight with each criteria normalized matrix and summing the result of each alternative to get the best alternative to rank them.

$$R = \begin{pmatrix} 0.84 & 0.79 & 0.85 & 0.72 & 1.00 \\ 1.00 & 0.85 & 0.85 & 0.54 & 1.00 \\ 0.68 & 0.80 & 1.00 & 0.54 & 1.00 \\ 0.84 & 0.80 & 1.00 & 1.00 & 1.00 \\ 0.59 & 1.00 & 0.95 & 0.51 & 1.00 \end{pmatrix}$$

Using formula 2, the next step is to multiply each value with their respective weight, for ATK, CRIT Rate, CRIT DMG, Elemental DMG Bonus, and Elemental Mastery in order w = [0.2; 0.25; 0.3; 0.15; 0.1]. After that, all the result will be added with each other, below:

V_1 = (0.2 x 0.84) + (0.25 x 0.79) + (0.3 x 0.85) + (0.15 x 0.72) + (0.1 x 1.00)
= 0.82874315580488

V_2 = (0.2 x 1.00) + (0.25 x 0.85) + (0.3 x 0.85) + (0.15 x 0.54) + (0.1 x 1.00)
= 0.84729959606864

V_3 = (0.2 x 0.68) + (0.25 x 0.80) + (0.3 x 1.00) + (0.15 x 0.54) + (0.1 x 1.00)
= 0.81664921103946

V_4 = (0.2 x 0.84) + (0.25 x 0.80) + (0.3 x 1.00) + (0.15 x 1.00) + (0.1 x 1.00)
= 0.91790587790588

V_5 = (0.2 x 0.59) + (0.25 x 1.00) + (0.3 x 0.95) + (0.15 x 0.51) + (0.1 x 1.00)
= 0.82979729478006

From above ranking calculation, it can be concluded that alternative V_4 (Eula) has the highest value of 0.91790587790588, which mean Eula is rank 1 and the most suited for combat role DPS, followed by alternative V_2 (Xiao), V_5 (Arataki Iito), V_1 (Childe), and V_3 (Hu Tao).

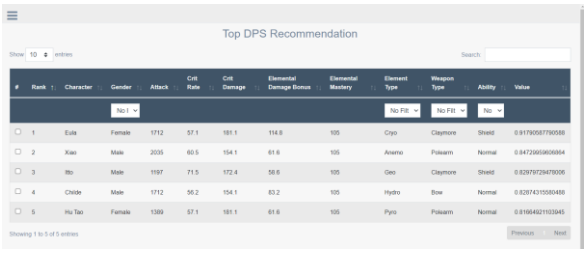

Fig. 3. Ranking DPS in Website

Figure 3 above is the screenshot from the web-based decision support system this project made. To prevent any difference from the scenario, at the image, there are only five characters that was inputted into the system.

TABLE IX. COMPARISON RANKING

Rank	Characters	Ranking's Value	
		Manual/Scenario	System
1.	Eula	0.91790587790588	0.91790587790588
2.	Xiao	0.84729959606864	0.84729959606864
3.	Iito	0.82979729478006	0.82979729478006
4.	Childe	0.82874315580488	0.82874315580488
5.	Hu Tao	0.81664921103946	0.81664921103945

Table IX above is the table comparison of the five rank's value, and as can be the ranking is the same Eula with 0.91790587790588, followed by Xiao, Iito, Childe, and Hu Tao.

B. Quick Design

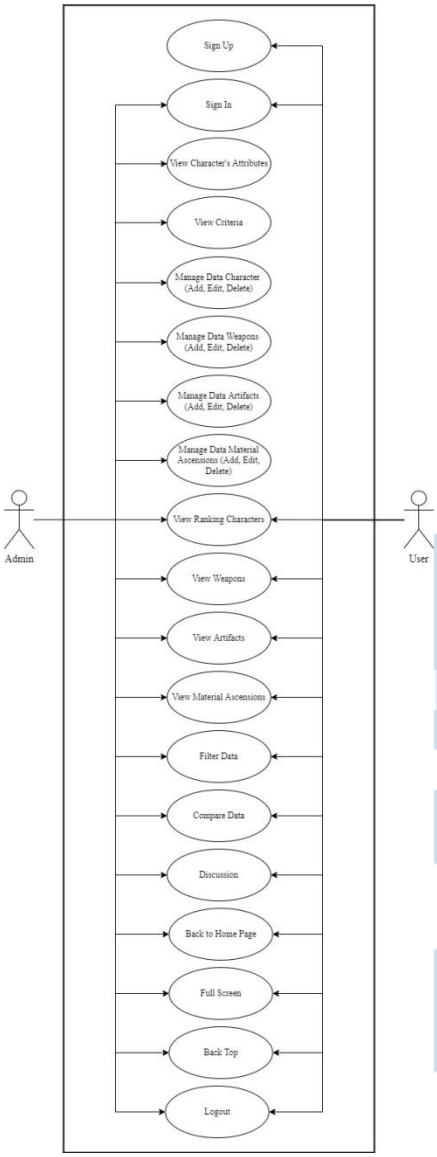

Image 3. Use Case Diagram

Image 3 is the use case diagram showing some features or interactions that are happening in the system involving users. Those are;

1. Sign up and Login If user doesn't have any account yet, they can create a new account by registering their username, email, and password. If user already had account, they can input the detail such as their username and password and Login into the website.
2. View Character's Attribute User can view attributes of characters based on in-game character's trial.
3. View Criteria View Criteria is residing inside Data Admin tab, it consists of criteria DPS, criteria Heal, criteria Shield, criteria Buff, and criteria Elemental Mastery. This page is restricted only for Admin.
4. Manage Data Character Admin can add new character along with their attributes, make some changes, and delete the existing character.
5. Manage Data Weapons Admin can add, edit, and delete data weapons into and from the Data Weapons page.
6. Manage Data Artifacts Admin can add new data Artifacts, edit, and delete the existing data Artifacts from the page.
7. Manage Data Material Ascensions Admin can add, edit, and delete data Material Ascensions.
8. View Ranking Characters Admin and user can view the ranking of characters based on their combat role, those are Ranking DPS, Ranking Heal, Ranking Shield, Ranking Buff, and Ranking Elemental Mastery.
9. View Weapons, Artifacts, and Material Ascensions Admin and user can view information regarding Weapons, Artifacts, and Material Ascensions from tab Data Information.
10. Filter Data Both admin and user can filter data from table Character's Attributes, Ranking Characters, Weapons, Artifacts, and Material Ascensions.
11. Compare Data Admin and user can choose at least two items, and click button compare. Then user can see only the data from those chosen items.
12. Discussion Admin and user can view, add new discussion, reply to another discussion, and like discussion or reply,
13. Back to Home Page Admin and user can back to Home Page by clicking button at the bottom-left with home icon and click "The World of Teyvat" at top-left.
14. Full Screen Admin and user can full screen the website by clicking the second icon after home icon at bottom-left.
15. Back Top Admin and user can back to the top of their page by clicking the up-arrow icon at bottom-left
16. Logout Admin and user can logout from the website and returning back to the login page.

C. Build a Prototype

While developing both the website and SAW algorithm, the prototype of that version was shown and discus with player Arisa and Golddy to gain feedbacks

on how the user experience of that current prototype was.

1. Ranking Character's Tables only Showing Name, Gender, and SAW Value.
2. Filter Positioned in the Bottom of Table.
3. There is no Function for "Full Screen" or "Back Top".
4. Can only Compares at least and at most 2 Items.
5. Can only Compare Ranking Characters.
6. Character's Attributes can only be view by admin
7. Website is Open without Sign up/Login.
8. Website is Completely Restricted for Member only

D. User Evaluation

1. Users that participate on giving feedback is mainly player Golddy, and player Arisa also giving some comments about the website. Table X below is the feedback from users for every time user view and try the website.

TABLE X. USER EVALUATION

No	Function/Interface	Feedbacks
1	Ranking Character's Tables only Showing Name, Gender, and SAW Value.	Users prefer to be able to see the necessary attributes for that combat role
2	Filter Positioned in the Bottom of Table	Users feel that the position of filter at the bottom makes it harder to see, and tends to move a lot
3	There is no Function for "Full Screen" nor "Back Top"	Users got ideas to add "Full Screen" and "Back Top" button
4	Can only Compare at least and at most 2 Items	Users prefer to be able to compare more than 2 characters
5	Can only Compare Ranking Characters	Users think it would be better if compare function is applied on other tables as well
6	Character's Attributes can only be view by admin	Character's Attributes should be able to be view by user as well
7	Website is Open without Sign up/Sign in	Users said that if there is discussion section, then user should need to Sign up/Sign in
8	To enter website, user needs to Sign up/Sign in	User thinks that the website should be able to be enter freely, and Sign in only for discussion section

2. The second round of testing will be done by three players Genshin Impact that has been playing for quite some times, they are Arisa (Rank 58) who have been playing since September 2020, Golddy (Rank 56) have been playing since Mei 2021, and Nick_Vero (Rank 56) have been playing since Mei 2021. They will be testing if all of the functions in the website is working as without any issue.

TABLE XI. USER ACCEPTANCE TEST (UAT)

Date	Tester	Success	Fail
20/05/2022	Nick_V (Rank 57)	43	0
20/05/2022	Golddy (Rank 56)	43	0
21/05/2022	Arisa (Rank 58)	43	0

Table XI above is the summary for the UAT that have been done. The results of this testing will be recorded using User Acceptance Test (UAT) that can be seen in detail via Appendix. For the UAT, there are a total 15 process for user, and a total of 28 for admin.

E. Refining Prototype

While developing both the website and SAW algorithm, the prototype of that version was shown and discus with player Arisa and Golddy to gain feedbacks on how the user experience of that current prototype was.

1. Ranking Character's Tables are now Showing their Respective Criteria Column
2. Filter Positioned now in the Top of Table, as Header under Title.
3. There is now Function for "Full Screen" and "Back Top".
4. Now can compare more than 2 characters.
5. Now Can Compare at Ranking Characters, Weapons, Artifacts, and Material Ascensions.
6. Now user can view Character's Attributes page.
7. Website is now can only be enter or view through Sign up or Sign in.
8. User now only required to Sign up or Sign in when entering Discussion Section.

F. Implementation and Maintenance

The design of website for this project has two sides, one is for user and the other is admin. But this journal will only show the admin side, with the difference between user is only that admin is capable of managing data such as add, edit, and delete.

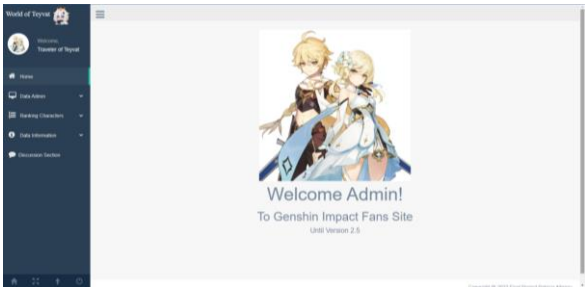

Fig. 4. Home Page

Figure 4 above is the Home Page layout for admin of Genshin Impact Fans Site that admin, will definitely lands in when he or she login into the website. There are navigation bar or menu on the left side, serves as buttons to go to another page. From the top is the word "World of Teyvat" and Home for returning into the Home Page, menu Data Admin, Ranking Characters, Data Information, and Discussion Section. The four little icons at the bottoms serves as a button, from the left Home, Full Screen, Back Top, and Logout.

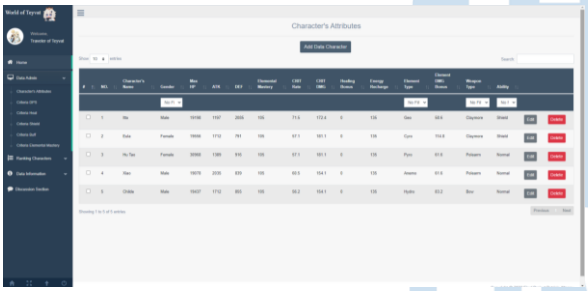

Fig. 5. Character's Attributes Page

Figure 5 above is the interface for Character's Attributes Page for admin, and is residing inside Data Admin tab. Character's Attributes Page's purpose is so that admin can view the current list of data character, to add a new character for ranking it, to edit, and delete if necessary. Admin can filter the data inside the table, select show entries, and search for keywords that exist inside the data table.

Fig. 6. Criteria DPS Page

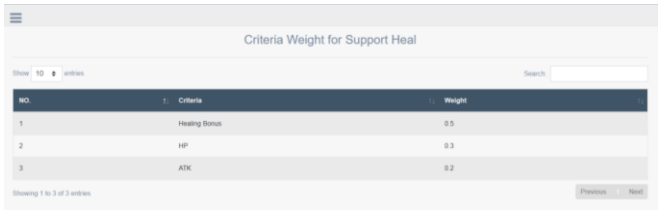

Fig. 7. Criteria Heal Page

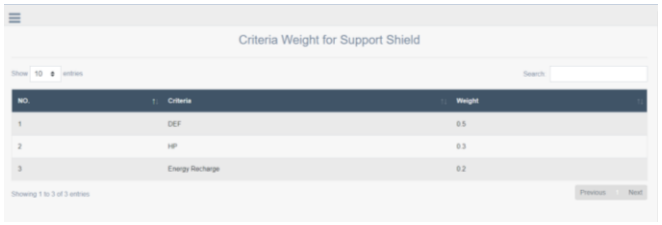

Fig. 8. Criteria Shield Page

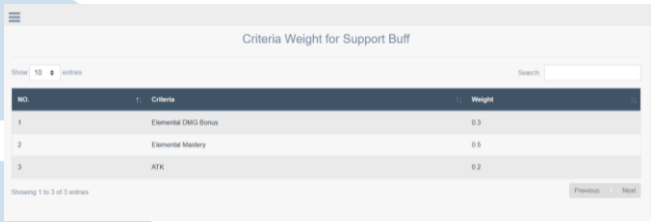

Fig. 9. Criteria Buff Page

Fig. 10. Criteria Elemental Page

Figure 6, 7, 8, 9, and 10 above are the interface for Criteria Pages for DPS, Heal, Shield, Buff, and Elemental that is all located inside Data Admin tab. This page's purpose is to show the criteria used for calculating and ranking characters based on their combat capabilities (DPS, Heal, Shield, Buff, and Elemental). Data criteria can only be view and can't be change or delete even by admin.

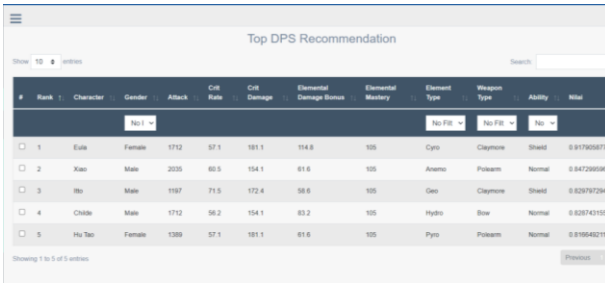

Fig. 11. Top DPS Recommendation

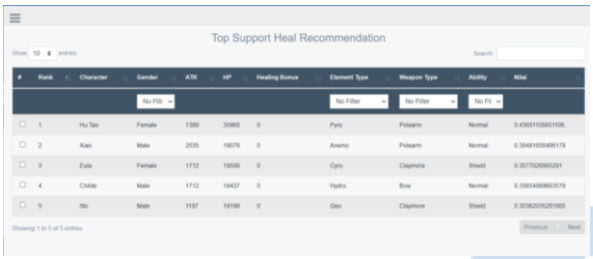

Fig. 12. Top Heal Recommendation

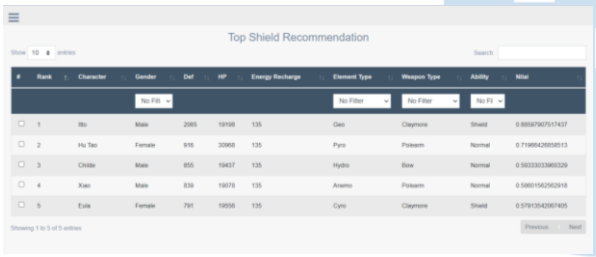

Fig. 13. Top Shield Recommendation

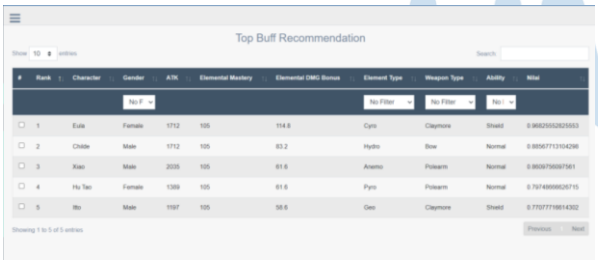

Fig. 14. Top Buff Recommendation

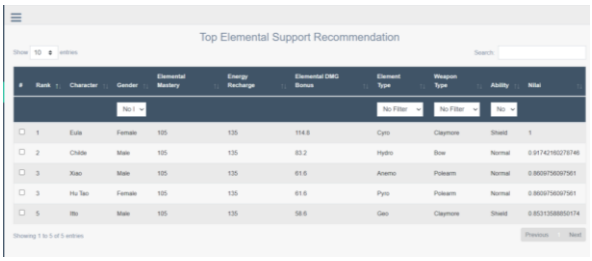

Fig. 15. Top Elemental Recommendation

Figure 11, 12, 13, 14, and 15 above is the interface for ranking characters based on their combat role (DPS, Heal, Shield, Buff, and Elemental). The rankings of these characters are based on the final result of SAW calculations of each character, sorted by descending. So these rankings of characters could hopefully serve as recommendations for user. The interface for Ranking Characters does not differ from what user seen on user's site. Admin can filter the data inside the table, select show entries, and search for keywords that exist inside the data table.

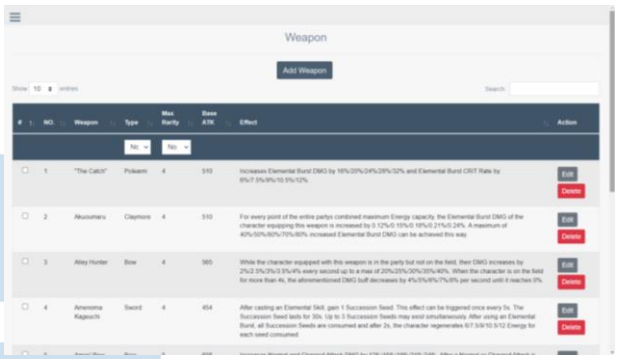

Fig. 16. Weapon Page

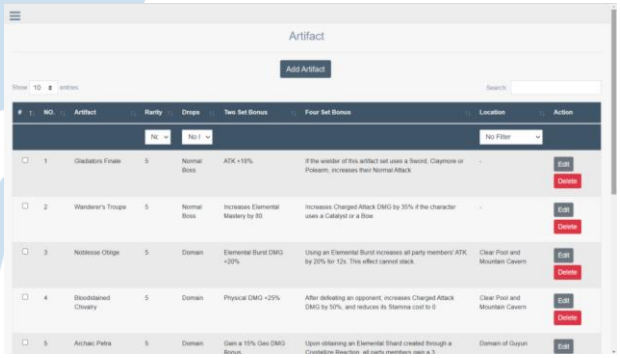

Fig. 17. Artifacts Page

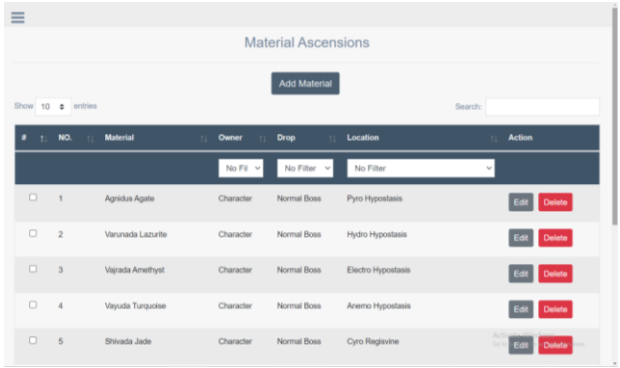

Fig. 18. Material Ascensions Page

Figure 16, 17, and 18 above are the interface for Weapon, Artifacts, and Material Ascensions Page for admin that is located inside tab menu Data Information. In this page, admin can view currently existing data, can add a new item inside the database, edit, and can also delete the existing data. Admin can filter the data inside the table, select show entries, and search for keywords that exist inside the data table.

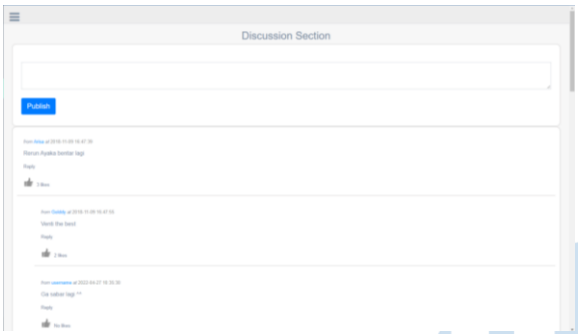

Fig. 19. Discussion Section

Figure 19 above is the interface for Discussion Section Page. This page purpose is for every user to be able to communicate, share their opinions or thought for others to see. User can write a new discussion, write a reply from an existing discussion then publish it, also to like and unlike, or reply a discussion.

V. Conclusion

A web-based decision support system to rank characters based on their combat role and a platform that provides a more straightforward view of the information of Genshin Impact Weapons, Artifacts, and Material Ascensions has been successfully created. Thus through this platform, the free-to-play user can view the Genshin Impact character's trial version that has been ranked according to the set criteria, weight, and character's attributes. This recommendation was made by looking into five different combat roles that are DPS, Heal, Shield, Buff, and Elemental.

These recommendations (ranking) along with information regarding Weapons, Artifacts, and Material Ascensions are decorated with features such as filters, search, and compare functions. Using these features and functions, the users will have easier time viewing information on characters' trial attributes and the rest of the pieces of information.

This website also has completed the User Acceptance Test (UAT) with the help of three Genshin Impact players and from Table XI the test is successful 43 Success and 0 Failure from 3 players, thus is granted with a score of 100%.

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AUTHOR GUIDELINES

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- Submitted articles could be original research articles or technical notes.
- The similarity score from plagiarism checker software such as Turnitin is 20% maximum.
- For December 2021 publication onwards, Ultima Infosys : Jurnal Ilmu Sistem Informasi will be receiving and publishing manuscripts written in English only.

2. Manuscript format

- Article been type in Microsoft Word version 2007 or later.
- Article been typed with 1 line spacing on an A4 paper size (21 cm x 29,7 cm), top-left margin are 3 cm and bottom-right margin are 2 cm, and Times New Roman's font type.
- Article should be prepared according to the following author guidelines in this template. Article contain of minimum 3500 words.
- References contain of minimum 15 references (primary references) from reputable journals/conferences

3. Organization of submitted article

The organization of the submitted article consists of Title, Abstract, Index Terms, Introduction, Method, Result and Discussion, Conclusion, Appendix (if any), Acknowledgment (if any), and References.

- Title
  The maximum words count on the title is 12 words (including the subtitle if available)
- Abstract
  Abstract consists of 150-250 words. The abstract should contain logical argumentation of the research taken, problem-solving methodology, research results, and a brief conclusion.
- Index terms
  A list in alphabetical order in between 4 to 6 words or short phrases separated by a semicolon (;), excluding words used in the title and chosen carefully to reflect the precise content of the paper.
- Introduction
  Introduction commonly contains the background, purpose of the research, problem identification, research methodology, and state of the art conducted by the authors which describe implicitly.
- Method
  Include sufficient details for the work to be repeated. Where specific equipment and materials are named, the manufacturer's details (name, city and country) should be given so that readers can trace specifications by contacting the manufacturer. Where commercially available software has been used, details of the supplier should be given in brackets or the reference given in full in the reference list.
- Results and Discussion
  State the results of experimental or modeling work, drawing attention to important details in tables and figures, and discuss them intensively by comparing and/or citing other references.
- Conclusion
  Explicitly describes the research's results been taken. Future works or suggestion could be explained after it
- Appendix and acknowledgment, if available, could be placed after Conclusion.
- All citations in the article should be written on References consecutively based on its' appearance order in the article using Mendeley (recommendation). The typing format will be in the same format as the IEEE journals and transaction format.

4. Reviewing of Manuscripts

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- **Published Conference Proceedings**
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$$\int_0^{r_2} F(r,\phi)\, dr\, d\phi = [\sigma r_2 / (2\mu_0)] \qquad (1)$$

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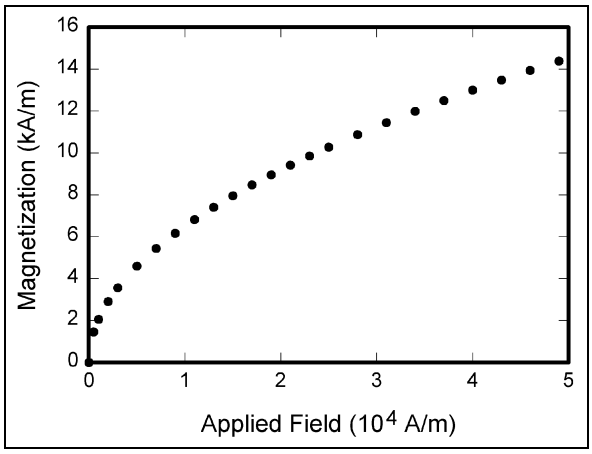

Fig. 1. Example of a figure caption

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Appendix

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[1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

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