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IJNMT (International Journal of New Media Technology) is a scholarly open access, peer-reviewed, and interdisciplinary journal focusing on theories, methods and implementations of new media technology. Topics include, but not limited to digital technology for creative industry, infrastructure technology, computing communication and networking, signal and image processing, intelligent system, control and embedded system, mobile and web based system, and robotics. IJNMT is published regularly twice a year (June and December) by Faculty of Engineering and Informatics, Universitas Multimedia Nusantara in cooperation with UMN Press.

Call for Papers

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FOREWORD

Greetings!

IJNMT (International Journal of New Media Technology) is a scholarly open access, peer-reviewed, and interdisciplinary journal focusing on theories, methods and implementations of new media technology. Topics include, but not limited to digital technology for creative industry, infrastructure technology, computing communication and networking, signal and image processing, intelligent system, control and embedded system, mobile and web based system, and robotics. IJNMT is published regularly twice a year (June and December) by Faculty of Engineering and Informatics, Universitas Multimedia Nusantara in cooperation with UMN Press.

In this December 2023 edition, IJNMT enters the 2st Edition of Volume 10. In this edition there are seven scientific papers from researchers, academics and practitioners in the fields covered by IJNMT. Some of the topics raised in this journal are: Development of Learning Media in Fluids in Higher Education Based on Android, Development of Web-Based Leave Management System for Telkom Delivery Department Crowdsource Employees in PT Sigma Cipta Caraka, Examining the Impact of Platform Usage on Online Purchasing in E-commerce, Voice Control Turn-Based Role Playing Game Development Using Unity Speech Recognition, Implementation of Decision Support System Method to Evaluate Posyandu Program in Tangerang Selatan, Implementation Analytical Hierarchy Process Algorithm for Design and Development Website Hero Mage Recommendation for Mobile Legends, Implementation of AHP Algorithm for Design and Development Halal Food Recommendation System at Cirebon Regional.

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 ultimaijnmt@umn.ac.id and the web page of our Journal here.

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

December 2023,

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

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Development of Learning Media in Fluids in Higher Education Based on Android

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***Abstract*— Mobile learning is an alternative to developing learning media. The presence of mobile learning is intended as a complement to learning and practicum so that it can provide opportunities for students to learn material and practices that are not mastered anywhere and anytime. The purpose of this community service activity is to optimize the function of technology as a practicum learning medium on android-based fluid material at Pakuan University Laboratory, Bogor. The implementation of this activity is in three stages, namely the planning, implementation and evaluation stages. The planning stage is to create an Android-based learning media system using Frame by Frame, Low-poly modeling and Shader Graph techniques. The implementation stage is system testing, namely the validation test and system compatibility test. The validation test consists of: theory testing, simulated sample questions and quizzes whose results are in accordance with the theory, while in the compatibility test, the system runs well with a minimum HP RAM of 4GB and OS 6.0 (Marshmallow). The last stage is the evaluation stage, namely giving the feasibility test to experts at 90.95%, lecturers 96.13%, a comparison between online and offline testing systems 81.86%, and a comparison of written test post testing and post application test results in an average student get an increase of 20.66%.**

Keywords*— *Learning media; Multimedia Development Life Cycle; Fluids; Low-poly modeling; Shader graph

I. INTRODUCTION

Technological developments have had a major impact in various fields, especially in education [1]. The development of computers in terms of hardware and software has improved the learning process in terms of learning methods. The classical learning method is still based on the lecture system, in which the teacher explains the materials and students listen passively and the teacher-student relationship must occur face-to-face [2]. The face-to-face learning system has several obstacles when students cannot go to learning places such as classes or laboratories and rely heavily on the ability of the teacher to explain the material [3]. In practicum learning, students are faced with mastering the material, using tools and calculating data. The limitations of practicum tools and mastery of practicum materials by practicum instructors cause students' understanding to be reduced [4].

To overcome problems with face-to-face learning systems, especially practicum learning, the development of computer science has made many breakthroughs in the form of learning media. According to the National Education Association (NEA), learning media are forms of communication, both printed and audiovisual, and their equipment [5]. The media should be manipulated, can be seen, heard, and read. Learning media can be understood as anything that can convey or convey messages from the source in a planned manner, thus forming a useful learning environment where recipients can carry out the learning process efficiently and effectively [6]. Learning media can overcome several problems in face-to-face learning, including the condition of the spread of the corona virus, which requires students not to be able to go to the laboratory, limited practicum facilities and infrastructure so that practicum activities are not optimal, or limited students' understanding of practicum material that is classified as difficult, such as Physics and Chemistry [7].

For physics subjects, learning media have been designed and implemented at the Physics Laboratory of Pakuan University, as a form of technology application and learning effectiveness. Multimedia learning systems are designed using Low-poly and Shader Graph modeling. The high-poly 3D model will be a reference for reconstructing the high-poly 3D

model into a low-poly 3D model [8]. The advantage of using low poly is that it speeds up the process of creating 3D objects because it doesn't require excessive detail. Meanwhile, Shader Graph is a shader creation technique developed by Unity to visually create shaders using a node-based editor without the need to carry out the process of writing code which can later be applied to certain materials [9]. Making learning media using high-poly 3D models and Shader Graph is a breakthrough to provide students with a perfect understanding of Physics practicum learning in Fluid material, which connects it to practicum objects in 3D form

Testing of the multimedia system for fluid practicum materials using the Likert Scale has been carried out on students, experts, and lecturers, at the Physics Laboratory, Pakuan University. The Likert scale is a scale that can be used to measure attitudes, opinions, and perceptions of a person or group of people about an educational symptom or phenomenon [10, 11]. The feasibility test using a Likert Scale shows the feasibility of the system above 90% according to lecturers and media experts, and above 80% according to students.

II. METHOD

In the learning media design process, realistic 3D models are used keep an eye on performance optimization on device users, for 3D models used in lowpoly style coming from unity asset store, sketchfab and some of the assets created through unity. Several components in the system are also made, such as: back-sound, logo, icon and font Application development is based on the design stage. Making the application is based on storyboards and flowcharts. All objects or materials are created and combined into one complete application. In building this system is used several software such as Unity, Audacity and Inkscape. The stages of making learning media use low poly 3D as shown in Figure 1, namely:

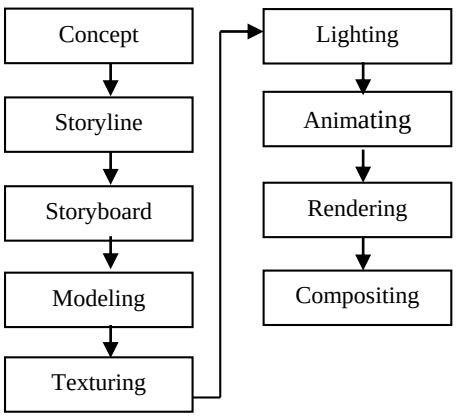


Fig. 1. Cart of design method

- Storyline is making grooves in the fluid chapter with animation
- Storyboard is the main guide of the animation production process in the form of panels that contain images of characters and their supporting environment
- Modeling is the process of digitizing the storyboard that was made later followed by making objects in 3D form
- Texturing is the process of giving color to the object that has been done previous modeling
- Lighting is the process of giving color to objects that have been modeled before
- Animating the process of making animation on characters, camera movements, and others
- Rendering is the process of calculating the 3D model and proceeding with the arrangement of camera angles
- Compositing is the process of combining image elements into one whole part, color correction, adding text and photos that are combined in the video

In using the Likert scale, there are two forms of questions, namely positive questions to measure positive scales, and negative questions to measure negative scales. Positive questions are scored 5, 4, 3, 2, and 1; while negative questions are given a score of 1, 2, 3, 4, and 5. Forms of Likert scale answers include: strongly agree, agree, undecided, disagree, and disagree. In addition, the answers to each instrument item using the Likert Scale can also have a graduation from very positive to very negative, which can be in the form of words including: Very Important (SP), Important (P), Undecided (R), Not Important (TP), Not Very Important (STP). The total score of each individual is the sum of the scores of each item from that individual. Responses were analyzed to find out which items had a very significant difference between high scores and low scores on the total scale.

$$T_S = T_R \times P_N \quad (1)$$

T_S is total score, T_R is total number of respondents who voted, and P_N is choice of numbers from Likert scores. The score interpretation criteria is based on the interval determined based on the lowest distance interval of 0%

$$I_S = 100 / N_L \quad (2)$$

N_L is total Score (Likert). Respondents interpretation of the feasibility of the system is the result of the value generated using the formula from Index %.

$$\%I = \frac{T_S}{Y} \times 100 \quad (3)$$

$\%I = \frac{T_S}{Y} \times 100$ is the highest Likert score multiplied by the number of respondents. The interpretation criterion of $\%I$ is based on the interval determined through I_S, for example if N_L is worth 20, then the score interpretation criterion is based on the following interval:

TABLE I. SCORE INTERPRETATION CRITERIA

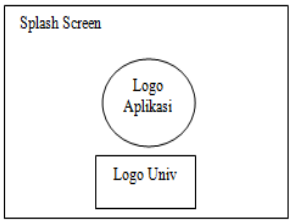
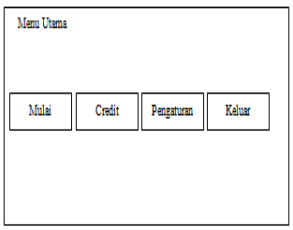
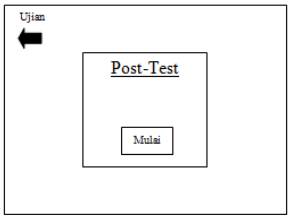
No	Interval	Criteria
1	$0\% < \%I < 20\%$	Strongly disagree / very bad / very poor.
2	$20\% \leq \%I < 40\%$	Disagree / Not good
3	$40\% \leq \%I < 60\%$	Fair / Neutral
4	$60\% \leq \%I < 80\%$	Agree/Good/like
5	$80\% \leq \%I < 100\%$	Totally agree/very good/like very much

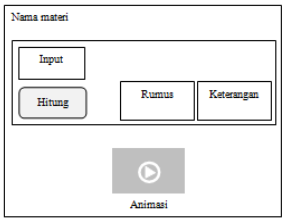
III. RESULT AND DISCUSSION

The results of the application development are the implementation of the interface design based on the story board, which can be seen in Table I. The interface design consists of opening pages, material pages, exam pages, and simulation pages

The Learning Media Application has the goal of developing fluid learning media for basic physics in Android-based universities. The learning media runs on an Android operating system device with a minimum version of 4.4 (KitKat), where in this application, after the user has done the post-test in writing, the user can access material about fluids starting from basic theory, interactive simulation and there are practice questions and post-test applications. When accessing each material, the user needs to enter the amount in the available input column so that the simulation can run. Then there is also a post-test where, after the user understands and tries all the simulations, he will be faced with practice questions to measure the learning outcome

TABLE II. USER-INTERFACE DESIGN

No	Design	Description
1		The opening page is used as a user intermediary on the main menu of the application. On the opening page there is the application logo and the unity logo.
2		On the main menu, there are 4 sub-menus, namely start, credit, settings and exit. The start menu functions to select simulation equipment, the credit menu functions to display asset use licenses, the settings menu to adjust music and sound effects, and the exit menu to end the application.
3		The exam page will provide several questions to test the ability to knowledge of fluid materials, and the user is given time to complete all questions.

4		The Simulation page displays a 3-dimensional. Users can access theory so they can understand the basic concepts of the material as well as help when having difficulties running the simulation. To carry out the simulation, the user needs to enter a magnitude value then press the calculate button to play the animation and display the result value, as well as to test the user's brief understanding of mastering the material provided by practice questions.

A. Validation Test

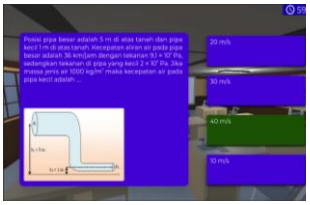
The system consists of theory, calculation simulation, and practice questions (quiz). In the theory section, the system covers the basic theory of fluid statics and dynamics. All theories in the system have been validated against the theories found in physics textbooks. Display in table 2 no.1 is one of the theories of static fluids, namely hydrostatic pressure, which is in accordance with an essay in Physics textbooks [11]. For simulation calculations, the user can fill in the input variables for each formulation in fluid. The output will appear according to the formulation accompanied by 3-dimensional animation to prove the theory. Displayed in table II no.2, is an example of calculating hydrostatic pressure, with the input variable being the height or distance from the water surface (h). The output pressure will adjust to the formula in theory, namely:

$$P = \rho g h \quad (4)$$

With P is hydrostatic pressure in Pa , ρ is density of water in kg/m^3, g is earth's gravitational acceleration in m/s^2, and h is the height or distance from the water surface in m. On the system (table 2), for $h = 5m$ the system outputs according to manual calculations, which produces an output value of hydrostatic pressure of $P = 49000$. In the simulation questions, the questions are in the form of multiple choices and the user can choose one answer with the correct answer indicator being a green button. One example in the display in table 2 no.3 is regarding Bernoulli's law with the correct answer and according to manual calculations. For theory, examples of questions and other quizzes, include static and dynamic fluid chapters, namely: Pascal's law. Archimedes' law, surface tension, viscosity, continuity principle, and Bernoulli's law. All calculations in the sample questions and quizzes are in International Standard units (SI). The addition of theory, sample questions, and quizzes can be done through source code in the systems, because the learning system is dynamic.

TABLE III. DESIGN SUB OF THE USER-INTERFACE

No	Interface	Validation Test
1		One of the theories in static fluid, which explains hydrostatic pressure, regarding the theory and formulation in hydrostatic theory .
2		$P = \rho g h$ $P = (1000)(9.8)(5)$ $P = 49000$

3		On the questions contained in the system, $P_1 = 9.1 \times 10^5 Pa, v_1 = 36km / jam$ $P_2 = 2 \times 10^5 Pa, h_2 = 1m$ Answer in the system $40m / s$

B. Compability Test

Compatibility testing is a trial conducted to determine application compatibility with several Android devices with different hardware and software specifications. The test results can be seen in table III. Applications can run at least the specifications of the Smartphone using Android 6.0 (Marshmallow), Resolution 1080x1920 pixels, ratio 16:9, CPU Deca core 2.1 GHz.

TABLE IV. COMPABILITY TEST

No	Interface	Compability Test
1	Chipset Qualcomm MSM8916 Snapdragon 410, CPU Quad-core 1.2 GHz Cortex-A53, GPU Adreno 306, Internal 8GB, RAM 1GB, OS Android 4.4.4 (KitKat), Resolution 720x1280 pixels, ratio 16:9	The Welcome Page does not appear. Water shaders like Liquid Wooble and Cartoon Water don't show up 
2	Chipset Mediatek MT6797 Helio X20, CPU Deca-core 2.1 GHz, GPU Mali-T880 MP4, Internal 64 GB, RAM 3 GB, OS Android 6.0 (Marshmallow), Resolution 1080x1920 pixels, ratio 16:9	The application runs smoothly 
3	Chipset Qualcomm MSM8998 Snapdragon 835, CPU Octa-core (4x2.45 GHz Kryo& 4x1.9 GHz Kryo), GPU Adreno 540, Internal 64 GB, RAM 4 GB, OS Android 8.0 (Oreo), Resolution 1080 x 1920 pixels, ratio 16:9	The application runs smoothly. The colors in the water shader seem more vivid 

C. Feasibility Test

The feasibility test using a questionnaire is aimed at determining the quality or feasibility of fluid learning media applications. This test is carried out by one media expert, one materials expert or physics lecturer, as well as 30 students divided into 2 materials sessions, namely offline and online, based on the background of their respective areas of expertise. The feasibility test consists of two parts, namely the alpha test and beta test. Alpha test is a test

performed by the user in the development environment. Alpha testing takes place on the developer site by an internal team, before release to external customers. So that later when users use the application they are not disappointed because of defects or application failures. Included in the alpha test is the results test from media experts and the results test from the Physics lecturer. Beta testing is a test where the developer gives access to users to use it and also many of the developers do not provide general access to users. Beta testing is also carried out so that users who use it can provide information about damage or errors that occur in the application made by the developer, as well as reports regarding errors or damage will be received for approximately until the completion of beta testing. That way the problems that occur in the application will be fixed. Included in the beta test is the test of results from students. The following are the results of the feasibility trials listed in table III, table IV, table V and table VII.

Based on the table IV, it can be concluded that media experts respond by answering each aspect on average 88.69%, namely the design feasibility aspect with 11 questions. The score is 92.73% including the very feasible category, linguistic aspects 3 questions with a score of 80% including the appropriate category, learning aspects 3 questions with a score of 93.33 %, is included in the very feasible category, and, for the feasibility results of the application including all aspects, it can be seen that the result is 90.59% which concludes that this application is very feasible to use. The questionnaire table for media experts can be seen in Appendix A.

Based on the table V, it can be concluded that respondents from lecturers for each aspect answered with an average score of 97.04%. In namely, the learning design aspect with 15 questions, the score was 93.33%, including the very feasible category, the design feasibility aspect, 7 questions with a score of 100%, the very feasible category, the learning aspect of 9 questions with a score of 97.78%, is included in the very feasible category, and, for, the results of the, feasibility of the application including all aspects it can be seen that the result is 96.13% which concludes that this application is very feasible to use. The questionnaire table for lecture can be seen in Appendix B.

The results of the application feasibility score were obtained with a score of 81.86% with a total of 30 student respondents who were divided into 2 forms of test, namely offline and online (table VI). And each test gets a score, namely an offline test with a score of 77.73% including the eligible category, an online test with a score of 85.98% including a very feasible category, and because of the feasibility results of the application including all tests, it can be seen that the result is 81.86%, which concludes that this application is feasible to use. The questionnaire table for post test and application pos test experts can be seen in Appendix C

The table VII below shows that the average student obtains an offline written post-test result of 75.63%, an offline application post-test result is 86.25%, the average score for the difference between the offline written post-test and the offline application post-test is 10.63%, the increase in the offline application test is 14.05% , while for the online written post-test students obtained an average of 65.71%, the results of the online application post-test were 84.29%, the average difference between the online written post-test and the online application post-test was 18.57%, the increase in the online application test was 28.26 % and it can be concluded that the average student gets a pretty good increase with a 20.66% increase as in the table VIII.

D. EffectivenessTest

This test was conducted on 30 computer science students in the form of post-test questions. Giving a post-test is to find out how effective the application is to support student learning, the results of the post-test can be seen in Table IX. The questions consist of a written post-test and an application post-test, where there is a positive difference in value, which means there is an increase.The average results of the post-test items showed an increase of 20.66%

TABLE V. FEASIBILITY TEST BY EXPERT

No	Aspect	Statement proof	Value result	Total maximum value	Feasibility
1	Feasibility aspects of design	1,2,3,4,5,6,7,8,9,10,11	51	55	92.73
2	Linguistic aspect	12,13,14	12	15	80
3	Learning aspects	15,16,17	14	15	93.33
		Number of results	77	85	90.95
		Overage amount	25.67	28.33	88.69

TABLE VI. FEASIBILITY TEST BY LECTURE

No	Aspect	Statement proof	Value result	Total maximum value	Feasibility
1	Feasibility aspects of design	16,17,18,19,20,21,22	35	35	100
2	Learning design aspects	1,2,3,4,5,6,7,8,9,10,11,12,13,14	70	75	93.33
3	Learning aspects	23,24,25,26,27,28,29,30,31	44	45	97.78
		Number of results	149	155	96.13
		Average amount	49.67	51.67	97.04

TABLE VII. FEASIBILITY TEST BY ONLINE AND OFFLINE

No	Test form	Statement proof	Value result	Total maximum value	Feasibility
1	Offline	1,2,3,4,5,6,7,8,9,10,11,12,13, 14,15	955	1280	77.73
2	Online	1,2,3,4,5,6,7,8,9,10,11,12,13, 14,15	963	1120	85.98
		Average amount	979	1200	81.86

TABLE VIII. FEASIBILITY TEST BY WRITTEN POS TEST AND APPLICATION POS TEST

No	Test form	Writen post tes	Application pos test	Score difference	Enhancement
1	Offline	75.63	86.25	10.63	14.05
2	Online	65.71	84.29	18.57	28.26
	Average amoun	70.67	85.27	14.60	20.66

TABLE IX. EFFECTIVENESS TEST

No	Name	NPM	Writing post test	Application post-test	Score difference	Enhancement (%)
1	Gugun Adiguna	065117010	90	80	10	11.11
2	Erlan Rifandi	065117012	70	80	10	14.29
3	Ditra Albar	065117017	70	90	20	28.57
4	Riski Suganda	065117018	80	90	10	12.50
5	Hendrik Sidarta	065117031	70	90	20	28.57
6	Galih Rakasiwi	065117035	80	90	10	12.50
7	Gozali	065117041	60	90	30	50.00
8	Ramdam Hidayat	065117042	80	90	10	12.50
9	Mohammad Ervin	065117043	80	90	10	12.50
10	Reusmana Sujani	065117046	80	90	10	12.50
11	Yudhi Pratama	065117047	80	90	10	12.50
12	Rico Saputra	065117048	70	80	10	14.29
13	Muzia Vandri	065117110	70	80	10	14.29
14	Abdu Muhammad	065117127	80	70	10	12.50
15	Wirawan	065117144	70	80	10	14.29
16	Ricky Wahyudi	065117150	80	100	20	25.00
17	Vicky Herdyan	065117005	70	80	10	14.29
18	Aji Saputro	065117013	70	90	20	28.57
19	Muhammad Latif	065117014	70	80	10	14.29
20	Agung Dwi	065117023	50	70	20	25.00
21	Wahyu Irawan	065117028	70	80	10	14.29
22	Fransiscus Xaverius	065117032	70	100	30	42.86
23	Raka Fachrurahman	065117033	50	70	20	40.00
24	Gustana Nurul	065117036	50	80	30	60.00
25	Ananda Dwi Laras	065117037	60	80	20	33.33
26	Anggiat Mora	065117038	70	100	30	42.86
27	Purnama	065117049	90	100	10	11.11
28	Rizqi Nur Aditya	065117051	70	80	10	14.29
29	Muhamad Recka	065117058	70	80	10	14.29
30	Atix Medixa	065117095	60	90	30	50.00
	AVERAGE		70.67	85.27	14.60	20.66

IV. CONCLUSION

After t Based on the results of the research that has been done, it can be concluded that the use of Learning Media applications can make it easier for students to understand material and basic fluid physics practicum with interactive 3D simulation models as well as theoretical explanations and exercises regarding the material being discussed. The application can be used on low-end Android devices with a minimum operating system of KitKat 4.4, 8 Gb of internal memory and 1 GB of RAM. This is evidenced by the results of compatibility trials on 3 different devices. There are deficiencies in the first device, including several shader effects that don't appear , the opening page that does not appear temporarily for the 3rd color shader device seems more vivid than the previous 2 devices. Application development applies two techniques, namely Low-Poly Modeling and Shader Graph.

The application of the Low-Poly Modeling technique is used to support universal device compatibility and minimize force closes while the application of the Shader Graph technique is used to give a realistic effect to the simulation even though the 3D model only uses a Low-Poly model. To test the feasibility of the application through a questionnaire to respondents, satisfactory results were obtained. For media experts, they responded with a value of 90.59 which was included in the very feasible category. For lecturers, they responded with a value of 96.13 which was included in the very feasible category, and students responded with a value of 81.86 which was included in the feasible category while testing the written post-test and application post-test resulted in a significant increase of 20.66% increase, given material in the form of interactive simulations and theory which was divided into 2 sessions, namely offline and online.

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Development of Web-Based Leave Management System for Telkom Delivery Department Crowdsource Employees in PT Sigma Cipta Caraka

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***Abstract*— Technology is one of the solutions that can bring automation to a process, with technology all processes can be more time efficient. This is necessary for some processes that were previously done manually. One of them is in Telkom Delivery's division at PT Sigma Cipta Caraka, a company that has some crowdsource employees, who have the right to take leave every year. The current system can still be used because it still sends leave application messages using e-mail, this also indicates that it is not integrated properly. The purpose of designing this leave application information system is to provide a solution to the problem of managing employee leave so that it can run more efficiently. The methods used in the data collection process to obtain user requirements are observation, interviews, and literature study. To support the development of this information system, the author uses several technologies, namely the Laravel framework and MySQL database using certain software development lifecycle (SDLC). This research results in a leave management web application for crowdsource employees in PT Sigma Cipta Caraka. The web application is bringing efficiency in leave requests and processing.**

Keywords*— Terms—*leave management, attendance, leave monitoring system

I. INTRODUCTION

Telkomsigma (PT Sigma Cipta Caraka) is a subsidiary of PT Telkom Indonesia (Persero) Tbk. Telkomsigma needs a qualified employee management system, because of the many employees in the company. The number of employees in Telkomsigma reached 1.756 employees, as registered in 2018. Telkom Delivery is a unit within Telkomsigma, and most of the employees are registered as Crowdsource which is also recorded as permanent employees.

Amongst systems that are critical for employee management, there is one system that is known as the leave application system. For crowdsource employees, the leave application system is still done manually, namely by sending an email to each Team Leader and Project Manager, then the application will be validated and written in an online spreadsheet. The current system has drawbacks, for example, the lack of integration between leave application platforms, so it takes a lot of time to validate and send it back to each employee and tends to be a lot of miscommunications. Based on this situation, a solution is created through research to improve the system.

The methodology used to build the system is the agile development model that applied Scrum as the system development framework. Several sprints need to be done to fulfill the requirements of the system, which are scheduled in a sprint backlog.

This research was conducted with the purpose of optimizing the existing leave application process in Telkomsigma by building a website-based leave application system, to provide benefits and convenience for crowdsource employees to apply for leave and access leave information online and to

provide an integrated system. The following is the scope of this research:

- The research was conducted on employees of the Telkom Delivery unit PT Sigma Cipta Caraka.
- The system is limited to the process of leave application and providing information on employees' leave.
- The system is a web-based application.

Current technological development nowadays is a challenge for organizations to utilize business interventions as well as HR professionals in the future to help achieve the expected levels [3].

The process of leave application will be very effective and efficient if it is computerized. The intention of effectiveness is in terms of time, where if the process is computerized, employees can carry out the leave request process from anywhere and anytime, which makes the process more effective. Then efficient means, that not really a lot of energy is wasted when the process of leave application has proceeded in a computerized where employees can apply from an electronic device, and more, it can reduce the usage of paper due to the application system [6].

This research presents the development of a leave management system for employees which functions as a more accurate and efficient system.

II. METHOD

In developing a Leave Management System, the methodology used to manage the processes is System Development Life Cycle (SDLC), which can be seen in Fig. 1. This methodology is a software system development concept with steps to identify each work process which is divided into certain phases which are carried out in stages starting from planning, analysis, design, to implementation [9].

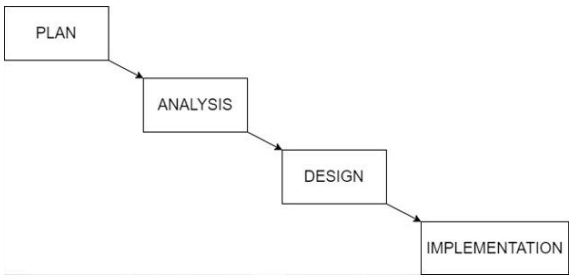

Fig. 1. System development life cycle.

The development model used is Agile, as can be seen in Fig. 2. This model is known to be adaptive to changes that may occur during the development process and can support the development of application systems quickly and effectively [9].

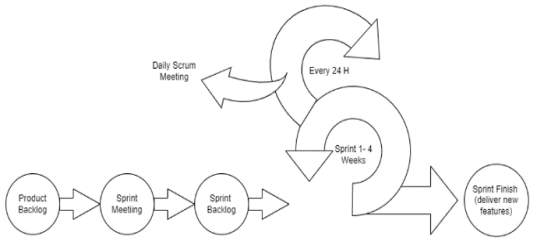

Fig. 2. Agile methodology.

In implementing Agile, the Scrum technique is applied as a system development framework. The Scrum flow is known to be quite complicated, when the sprint starts, you are not allowed to add new requirements. If there is a new requirement it will be placed in the backlog of the upcoming sprint.

Before starting the sprint, an estimation of the user stories development is conducted using poker planning in determining story points, the author uses the Fibonacci sequence. This is done to be able to estimate the effort and processing time on product backlog items [14]. And, when the sprint starts, a burndown chart is needed to see the progress of each sprint that has been running [15].

During the sprint, you must hold a meeting with the team to report what was done yesterday, what will be done today, and what problems occurred. This is done every day to be able to find out the progress that has been made by each team member. When the sprint period is over, the team will release the features/systems that have been made to the user [9].

Based on the description above, the framework for designing a web-based leave management system for crowdsource employees at PT Sigma Cipta Caraka is described as follows (Fig. 3):

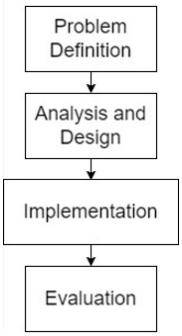

Fig. 3. Leave management system development framework.

In the first step, a problem definition is conducted by gathering data on the existing system and its usage. From data gathering activities, users' pain points are

collected and then concluded with a summary of the problem statement.

After the problem is clearly defined, then before starting the analysis and design stage, a planning activity is conducted. At this planning event, it is proposed to describe a business system in the form of system planning as the first step that needs to be taken to begin the development of an information system. Referring to the running system problems that are still manual, the following is a proposed solution plan:

1. Application and approval process of leave can be done in real-time in one leave application.
2. Managers and leaders can view information and monitor the list of employees on leave through the application.
3. Managers and leaders will get notification of employee leave information via Telegram.

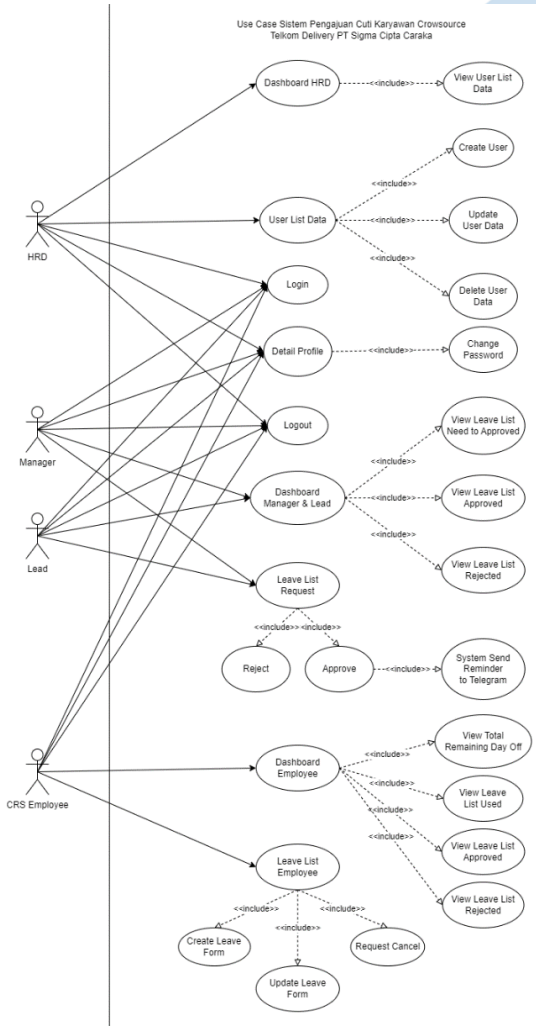

Fig. 4. Leave management use case diagram at PT Sigma Cipta Caraka.

The second step is analysis and design to analyze the root cause of the problems. After the root causes are found, a solution option could be picked to solve all those root causes all at once. Then the next step is to move to the detail of the solution design.

In Fig. 4, a systematic analysis of the Leave Management system using the Use Case Diagram is presented, where there are four actors who have different roles. The first actor is HRD which has the role of registering all employees into the system, this role should be done because of system needs. Then, the second actor is the Manager who has the role to approve or reject leave requests from crowdsource employees. And for the leader, the role is the same as Manager but has another role to assign "delegate to" for crowdsource employees that requested leave. And for the last one is crowdsourcing employees that have the main role to request leave from the Manager and the Leader.

In the third step, the solution implementation is done with the design that is already finalized. Conduct some necessary testing on it, then deliver the solution to the users.

After done with the user acceptance testing and the users have approved the result, the solution can then be promoted into the production environment and used in daily operations. After some period of agreed time of monitoring, a performance evaluation is conducted to review the usage of the new system.

III. Result and Discussion

A. Design

The following is the design of the Web-based Leave Management System at PT Sigma Cipta Caraka:

1) Dashboard Page

There are 3 kinds of dashboard pages, depending on the user that logged in:

a. Dashboard page for employees.

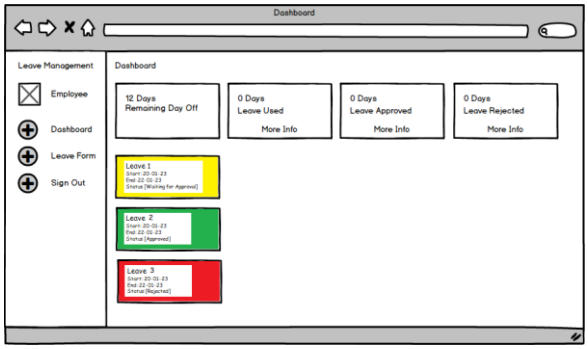

Fig. 5. Dashboard page for employees.

This dashboard in Fig. 5, gives employees information about remaining leaves, used leaves, and approved or rejected leaves. The dashboard also shows the leaves request status, so the employees can track the progress of their leave approval process.

b. Dashboard page for manager and leader.

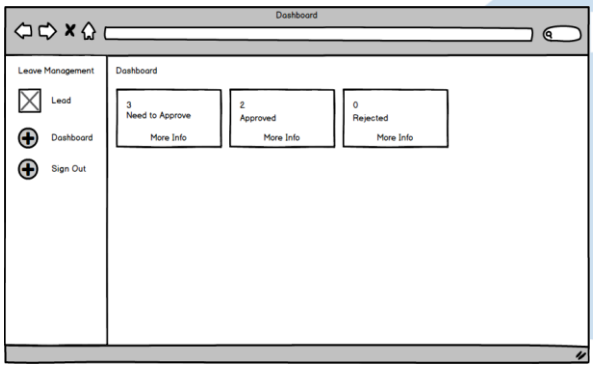

Fig. 6. Dashboard page for manager and leader.

This dashboard in Fig. 6, shows the number of leaves that becomes a responsibility for a manager or leader to approve or reject. The user can click on the "more info" link in each of the boxes to see the details of the list.

c. Dashboard page for HR manager.

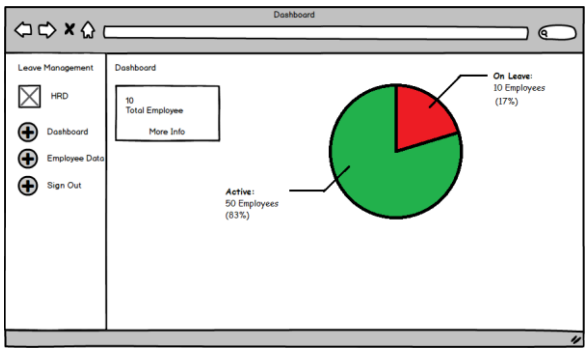

Fig. 7. Dashboard page for HR manager.

This dashboard in Fig. 7, is for the HR manager, it shows how many employees take their leave in total. It also has a pie chart displaying the composition of a group of employees that take their leave and another group that is still actively working.

2) Profile Page

This page in Fig. 8, displays various user information, including name, NIK, position, phone number, telegram username, and email address.

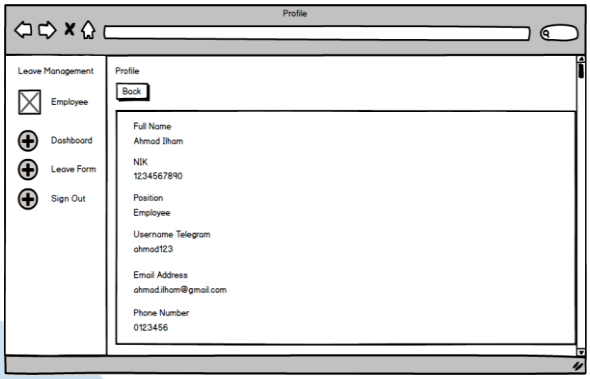

Fig. 8. Profile page.

3) Change the Password Page

On this page in Fig. 9, users can change their password to be used for logging in to the Leave Management System.

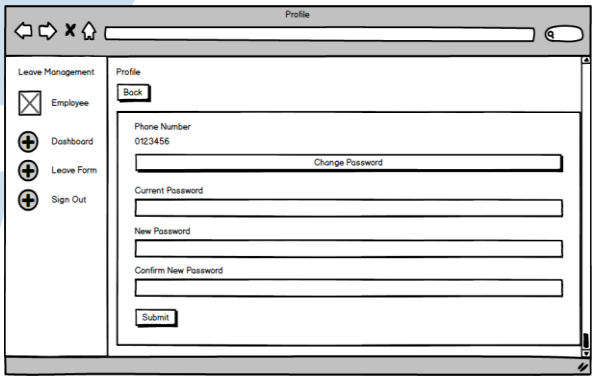

Fig. 9. Change password page.

4) Insert User's Data Page

This page in Fig. 10, is restricted to only HRD, which can be used for inserting new employee data.

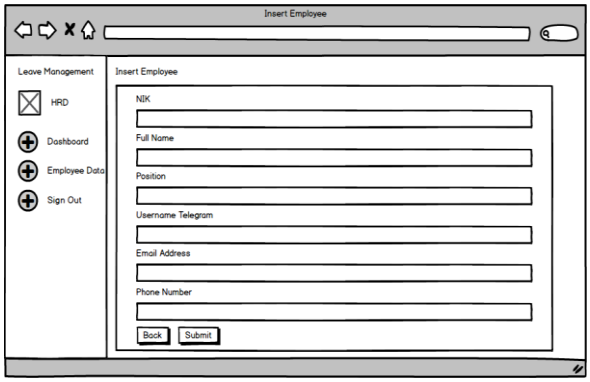

Fig. 10. Insert users' data page.

5) View Users Data Page

This page in Fig. 11, can only be accessed by HRD, which can be used for viewing and managing all the user's data, such as editing, resetting password, and deleting data.

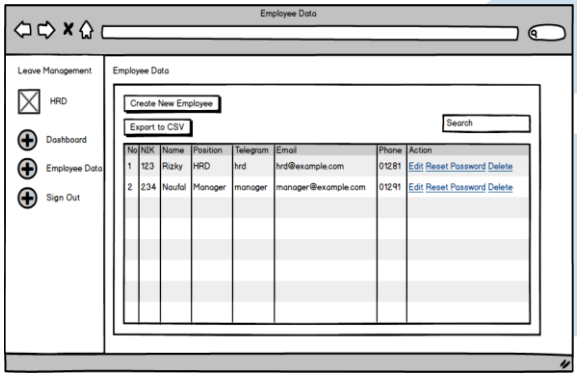

Fig. 11. View users' data page.

6) Edit the User's Data Page

This page in Fig. 12, displays User's data that can be edited by only HRD, such as name, NIK, position, email address, telegram username, and phone number.

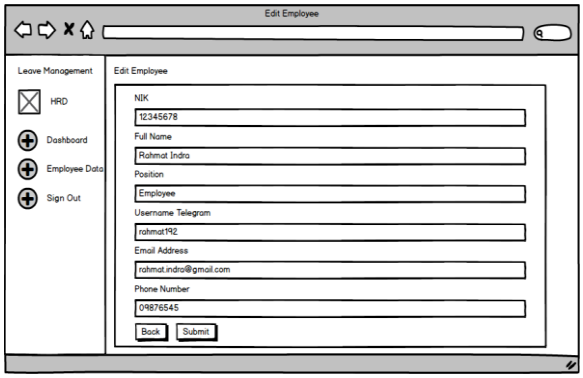

Fig. 12. Edit users' data page.

7) Create a Leave Request Page

This page in Fig. 13, displays the fields that employees should fill in to apply for leave requests, including start date, end date, leave duration, and leave reason.

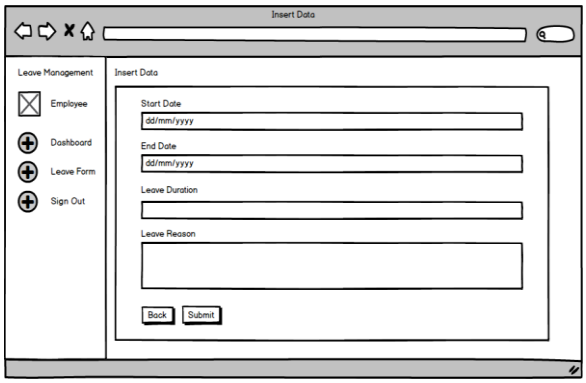

Fig. 13. Create a leave request page.

8) View Data Leave Request by Employee Page

This page in Fig. 14, can be used to view employees' submitted leave requests, which can only be accessed by employees.

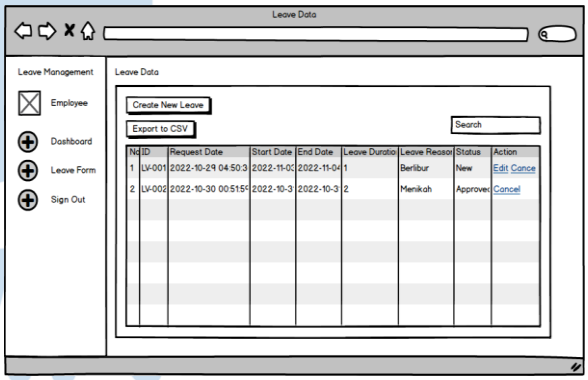

Fig. 14. View data leave request by employee page.

9) View Data Leave Request by Manager and Leader Page

This page, in Fig. 15, contains information about leave requests that need to be approved/rejected by the Manager and Leader.

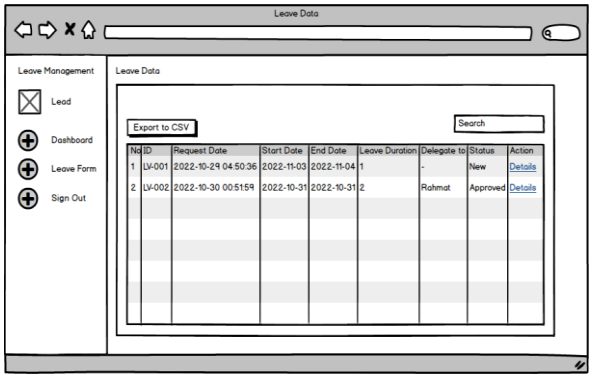

Fig. 15. View data leave request by manager and leader page.

10) Leave Confirmation by Manager and Leader Page

Managers and Leaders can use this page in Fig. 16, to confirm leave requests submitted by Employees.

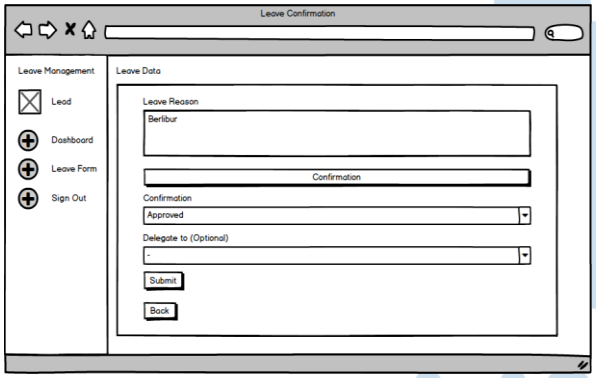

Fig. 16. Leave confirmation by manager and leader page.

11) Edit Leave Request Data by Employee Page

This page in Fig. 17, contains information on leave request data that can be edited by the employee, in which the status still hasn't been accepted by the Leader/Manager.

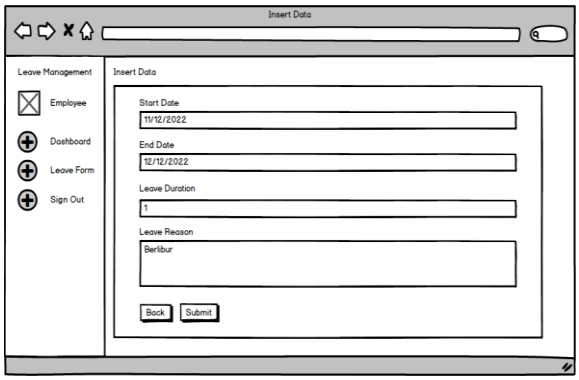

Fig. 17. Edit leave request data by employee page.

B. Implementation

After the development of the Leave Management system for crowdsource employees at PT Sigma Cipta Caraka, these are the highlight result from the Testing phase with the users (user acceptance test) (Table 1-6):

TABLE 1. Crowdsource employee dashboard page test result.

No	Scenario	Expected Result	Actual Result	Status
1.	View the total number of remaining days off employees	Displays the total number of remaining days off CRS Employee	Managed to see the total number of remaining days off CRS Employee	PASSED
2.	View the total amount of leave that has been used on "Leave Used"	Displays the total number of vacations that have been used	Successfully see the total amount of leave that has been used on "Leave Used"	PASSED
3.	Click "More Info" on Leave Used	Displays the leave list requests that have been used	Managed to see the list of request lists that have been used	PASSED
4.	View the total number of approved leaves	Displays the total number of approved leaves	Managed to see the total amount of leave that has been approved by the manager or leader	PASSED
5.	Click "More Info" on Leave Approved	Displays the approved leave request list	Managed to see the leave request list that has been approved by the manager or leader	PASSED
6.	View the total number of disapproved leaves	Displays the total number of disapproved leaves	Managed to see the total number of leaves that neither the manager nor the leader approved	PASSED
7.	Click "More Info" on Leave Rejected	Displays a leave request list that is not approved	Managed to see a leave request list that neither the manager nor the	PASSED

			leader approved	

TABLE 2. List of leave requests page test result.

No	Scenario	Expected Result	Actual Result	Status
1.	Click "Leave Form" on the menu bar	Displays a leave list request	Displays the leave list request data by clicking "Leave Form"	PASSED
2.	Type request leave data in the search field	Displays request leave data that has been entered in the search field	Successfully displays the request leave data that has been entered in the search field	PASSED
3.	Klik "Edit" pada kolom *Action*	Click "Edit" in the Action column	Successfully displays the edit data request leave page after clicking "Edit"	PASSED
4.	Enter the data you want to change then click "Submit"	Displays a success message changing data	Successfully changed the leave request data	PASSED
5.	Click "Cancel" in the Action column	Displays the Cancel Request Leave confirmation popup	Successfully cancel request leave	PASSED
6.	Click "Export to CSV" on the user data list page	User data will be downloaded in .csv file format	Successfully download user data	PASSED

TABLE 3. Create leave request page test result.

No	Scenario	Expected Result	Actual Result	Status
1.	Click "Create New Leave" on the leave list request page	Displays a page for leave list data	Successfully displays the page for leave list data	PASSED
2.	Enter valid data on the page for leave list data	The new data leave list was added successfully	Successfully added a new data leave list by clicking the "Submit" button	PASSED
3.	Enter invalid data on the page to leave the data list	New leave list data failed to be added	Failed to add new data leave list with error message "Invalid data"	PASSED
4.	Enter empty data in the End Date field	New leave list data failed to be added	Failed to add new data leave list with the error message "Phone Number is required"	PASSED
5.	Click "Back" on the add data leave list page	Return to the leave list data page	Successfully return to the leave list data page using the “Back” button	PASSED

TABLE 4. Dashboard manager & leader page test result.

No	Scenario	Expected Result	Actual Result	Status
1.	View the total number of leave that needs to be approved in "Need to Approve"	Displays the total number of leave needed to be approved	Managed to see the total number of leaves needing to be approved on "Need to Approve"	PASSED
3.	Click "More Info" on Need to Approve	Displays a leave list of requests that need to be approved	Managed to see a list of request lists that need to be approved	PASSED
4.	View the total number of leave approved by the manager in "Approved"	Displays the total number of leave approved by the manager	Managed to see the total amount of leave that has been approved by the manager	PASSED

5.	Click "More Info" on Approved	Displays a leave request list that has been approved by the manager	Managed to see the leave request list that has been approved by the manager	PASSED
6.	View the total number of leaves that were not approved by the manager	Displays the total number of leaves that were not approved by the manager	Managed to see the total number of leaves that were not approved by the manager	PASSED
7.	Click "More Info" on Rejected	Displays a leave request list that is not approved by the manager	Managed to see a leave request list that was not approved by the manager	PASSED

TABLE 5. Leave confirmation by manager page test result.

No	Scenario	Expected Result	Actual Result	Status
1.	Click "Confirmation" on the details page	Displays the confirmation leave page	Successfully displays the confirmation leave page	PASSED
2.	Select "Approved" on the confirmation page	*Request leave approved*	Successfully approved the leave request after clicking "Submit"	PASSED
3.	Select "Rejected" on the confirmation page	*Request leave is not approved*	Successfully disapproved of the leave request after clicking "Submit"	PASSED
4.	Enter the name of the replacement employee in the "Delegate to" field	Add the overriding employee delegate	Successfully added employee delegation that replaced leave after clicking “Submit”	PASSED
5.	Click "Back" on the add data leave list page	Return to the leave list data page	Successfully return to the list data leave list page using the “Back” button	PASSED

TABLE 6. Leave confirmation by leader page test result.

No	Scenario	Expected Result	Actual Result	Status
1.	Click "Confirmation" on the details page	Displays the confirmation leave page	Successfully displays the confirmation leave page	PASSED
2.	Select "Approved" on the confirmation page	*Request leave approved*	Successfully approved the leave request after clicking "Submit"	PASSED
3.	Select "Rejected" on the confirmation page	*Request leave is not approved*	Successfully disapproved of the leave request after clicking "Submit"	PASSED
4.	Enter the name of the replacement employee in the "Delegate to" field	Add the overriding employee delegate	Successfully added employee delegation that replaced leave after clicking “Submit”	PASSED
5.	Click "Back" on the add data leave list page	Return to the leave list data page	Successfully return to the list data leave list page using the “Back” button	PASSED

The user team involved in the user acceptance test process consists of 5 staff level members, 2 supervisors, and 1 HR staff.

The UI of the web application itself is listed below (Fig. 18-30).

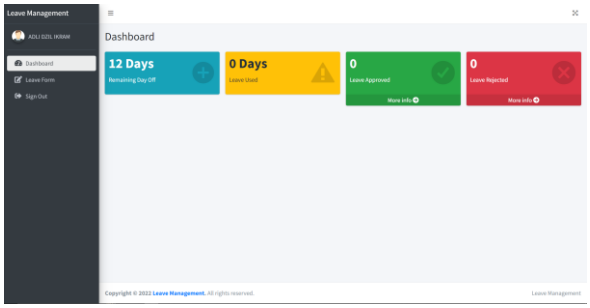

Fig. 18. Employee dashboard.

Fig. 19. Lead and manager dashboard.

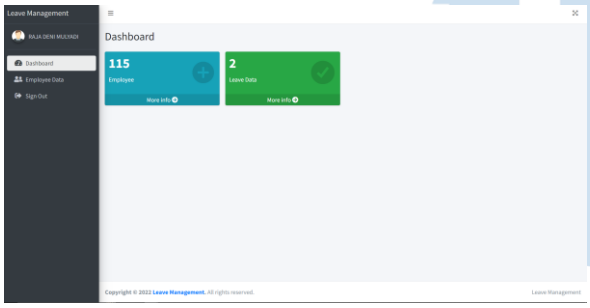

Fig. 20. HR Dashboard.

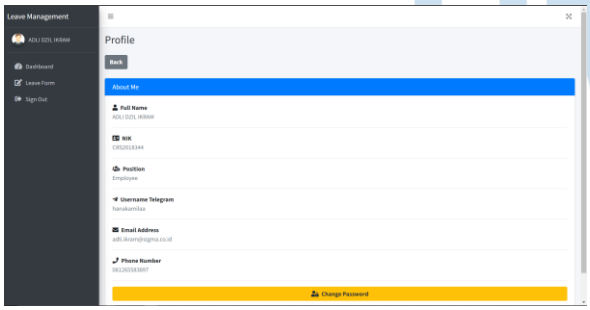

Fig. 21. Employee profile page.

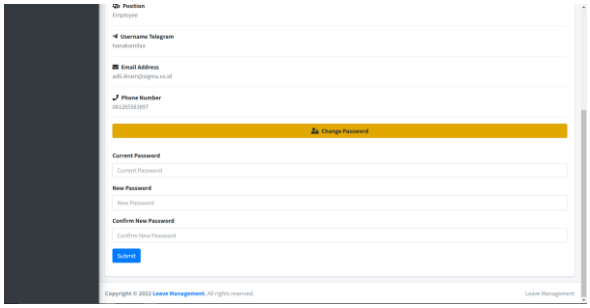

Fig. 22. Change password page.

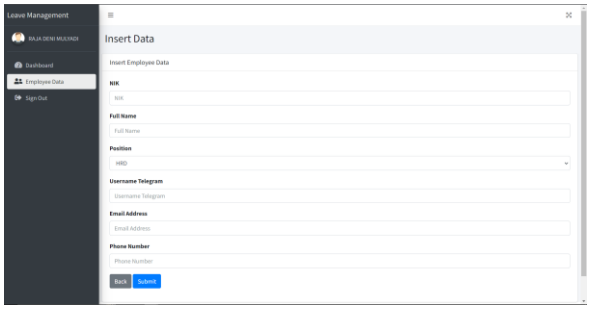

Fig. 23. Insert employee data page.

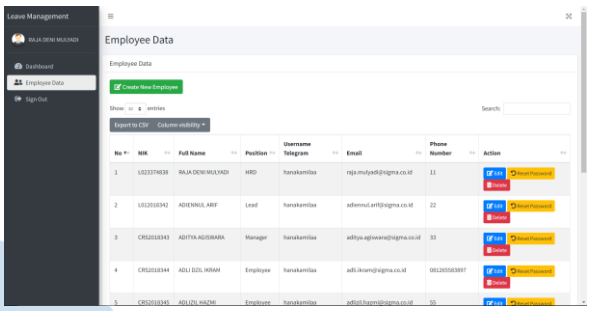

Fig. 24. View employee list page.

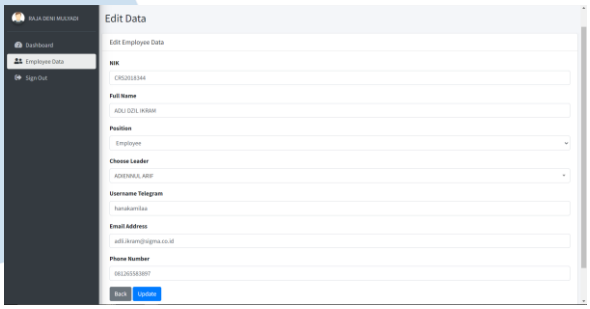

Fig. 25. Edit user data page.

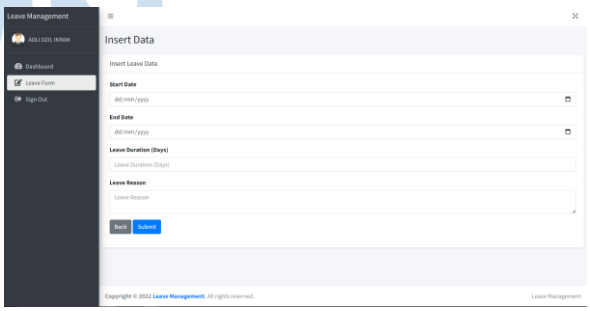

Fig. 26. Employee leave request form page.

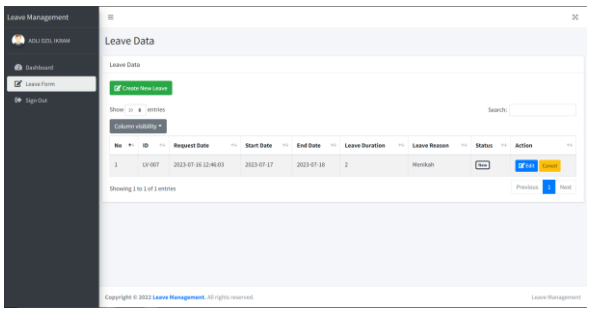

Fig. 27. Employee view leave list page.

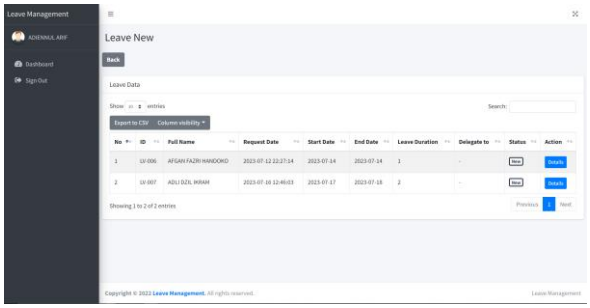

Fig. 28. Manager view leave list page.

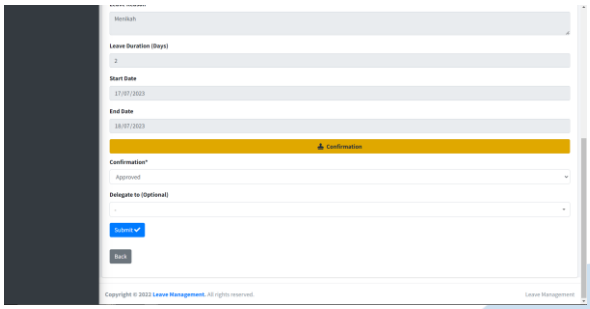

Fig. 29. Managers leave' confirmation page.

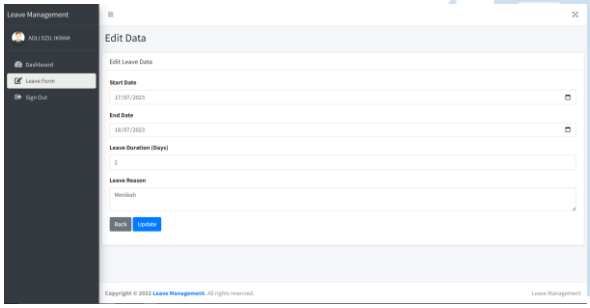

Fig. 30. Employees edit leaves data page

IV. CONCLUSION

A. *Conclusion*

Based on the statements in the sections above, the authors can draw the following conclusions:

- Development of a leave management information system for Telkom Delivery' crowdsource employee at PT Sigma Cipta Caraka was successfully carried out. The system includes a real-time leave application and approval function so that the leave application process can be done more efficiently based on the testing result summary in the implementation section, compared to the current system which is still done manually.
- As for this leave management information system, Leads and Managers can view the list of information about employees' leave and will receive leave notifications of employee leave via Telegram, which can assist in the monitoring of employee leave.
- With the support of data storage using MySQL database, all data related to Telkom Delivery crowdsource employee leave can be stored structurally in the database space.

B. *Suggestion*

The authors try to propose some suggestions that can be used in the development of further research, as follows:

- This research still has the potential for further development by exploring aspects of employee division scope, so that can include another Telkom Delivery crowdsource employee.
- Further research has the possibility to be upgraded in the website design aspect that adapts to the characteristic theme of Telkomsigma.
- This research can be developed in the form of adding other different leave types including maternity leave and annual.

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Examining the Impact of Platform Usage on Online Purchasing in E-commerce

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***Abstract*— The surge in online consumer activity, driven by a diverse user base, has propelled e-commerce platforms like Tokopedia, Shopee, TikTok Shop, and others to the forefront. This study investigates the relationship between e-commerce platform usage and consumer preferences. The data was collected through online questionnaires randomly distributed via social media using online forms (Google Forms). Before analysis, a questionnaire validation test was conducted to ensure the validity of respondents' answers to the survey questions. The findings reveal significant factors influencing user preferences in the realm of online purchasing. This research sheds light on the dynamic interplay between e-commerce platforms and consumer choices, providing valuable insights for businesses and marketers. Based on the findings of this research, it can be concluded that e-commerce platform usage does influence online buying interest. The study explored various aspects of purchasing products through popular e-commerce platforms such as Tokopedia, Shopee, Lazada, and others. However, it is noteworthy that no significant or positive relationship was found between the product variable and the purchase intention variable on Tokopedia. These insights contribute to a deeper understanding of consumer behavior in the context of e-commerce, allowing businesses and marketers to make informed decisions when catering to their target audience**

***Keywords*— e-commerce; Interest; Platform Preferences**

I. INTRODUCTION

Background

Technological advancements have greatly impacted the field of business, particularly with the emergence of e-commerce and online shops. This rapid technological development has led to a shift in business operations towards online platforms. In Indonesia, the growth of e-commerce has been remarkable, providing people with the convenience of shopping anytime and from anywhere. As e-commerce continues to expand, many individuals have started selling their products through various platforms, including social media channels like Instagram and TikTok, to reach a wider customer base [1].

This research could be considered urgent because E-commerce Industry Growing Rapidly: The ongoing surge in online consumer activity and the continuous growth of the e-commerce industry makes it essential to understand consumer preferences and behavior. Timely research can provide valuable insights to businesses looking to adapt their strategies to meet the evolving needs of online shoppers. Increasing Competition among E-commerce Platforms: With multiple e-commerce platforms vying for consumers' attention, understanding the factors that influence user preferences becomes crucial for these platforms to stay competitive and retain their user base. Shifting Consumer Trends: Consumer preferences and behaviors in the online shopping landscape can change rapidly. Research conducted promptly can help capture current trends and behaviors, allowing businesses to respond effectively to market dynamics. [2]

The pandemic triggered an unprecedented surge in online sales. With restricted visits to physical stores and financial constraints, consumers turned to online shopping, leading to a remarkable growth in online purchases. [3]. Consumers had already been conscientious shoppers even before the pandemic [4]. As a result, certain shopping categories, like experiences, were gradually deprioritized on their lists. The advent of COVID-19 further expedited this shift in consumer behavior. [5].

The COVID-19 pandemic has affected the lifestyles and motivations of many people, such that their purchasing behaviors also changed. The present study seeks to assess these changes. In achieving this goal, the study determined the impact of the pandemic on e-commerce across industries to identify the priorities of online consumers. It also identified the most important factors influencing online consumers' shopping behavior based on a multi-stage survey as the

pandemic spread [6] According to the correlation analysis, researchers have identified significant relationships between the studied factors and the complex indicator of online consumer behavior activation. Furthermore, they investigated how these relationships changed in response to the pandemic. [7]

There are multiple ways for buyers to make online purchases, one of which is through online retailers such as Tokopedia, Shopee, Lazada, and others. The millennial generation, in particular, is drawn to the engaging features offered by e-commerce applications, such as gamification, live shopping, free shipping, cashback vouchers, and more. Additionally, there are various promotions, product protection insurance, and seller credibility measures in place. This statement is derived from a study of previous research, aiming to explore the impact of e-commerce usage on online purchasing preferences and to pinpoint crucial factors that buyers should consider when choosing an e-commerce platform.

This research aims to investigate the impact of using an e-commerce platform on consumers' preferences and interests and to identify the factors influencing their decision-making process when purchasing an e-commerce platform that there has been an increase in ordering products via e-commerce during the Covid-19 pandemic and this research is intended to see after the pandemic is over whether the demand for ordering products via e-commerce is still increasing or not

Drawing upon the research background, the problem statement is defined as follows:

1. What is the extent of the influence of e-commerce platform usage on consumer preferences?
2. What factors play a significant role in influencing consumers' decisions to purchase products through e-commerce platforms?

The development of the questionnaire was guided by the background information and the formulated research problem. The data was collected through online questionnaires randomly distributed via social media using Google Forms. Before analysis, a questionnaire validation test was conducted to ensure the validity of respondents' answers to the survey questions

In this research, the independent t-test will be employed as a parametric test to assess differences between men and women. The data will be collected from multiple sources. Additionally, a two-way or two-tailed hypothesis test will be utilized, allowing for the evaluation of a hypothesis that has not been confirmed by previous research. The preliminary hypothesis, which is based on equations and inequalities, provides support for our research direction.

The questionnaire data were analyzed using the RStudio application for conducting statistical hypothesis testing and correlation analysis between variables.

II. METHOD

Based on the provided introduction and problem formulation, the following hypotheses can be proposed:

A. Major Hypothesis

H0: There is no significant effect of using e-commerce platforms on preferences for online purchase intentions after the pandemic is over

Ha: There is a significant effect of using the e-commerce platform on preferences for online purchase intentions after the pandemic is over

B. Minor Hypothesis :

B1.A correlation between price and interest preference variables

H0: There is no correlation between the price and interest preference variables.

Ha: There is a correlation between the price and interest preference variables

B2. A correlation between service and interest preference variables

H0: There is no correlation between the service and interest preference variables.

Ha: There is a correlation between the service and interest preference variables.

B3.A correlation between feature and interest preference variables

H0 = There is no correlation between the feature and interest preference variables.

Ha = There is a correlation between the feature and interest preference variables.

E-commerce, as defined by [8], refers to the digital exchange of goods, services, or information between two companies. It encompasses various activities such as buying and selling products, promoting them, facilitating transactions, and making payments through digital means

C.Preference & Interest

According to [9], states that preferences are tastes about an object. Usually, preferences are determined through various things, hobbies, social conditions, the economy, and the environment.

The concept of interest, as articulated by [10], encompasses a multifaceted spectrum of human engagement with an object. It is characterized by a

dynamic interplay of desire, preference, and willingness. In the realm of [10]'s research, interest is not a monolithic notion but rather a nuanced and evolving phenomenon that reflects the intricate ways in which individuals interact with and respond to a given object. This definition prompts a deeper exploration into the various dimensions of interest, inviting an examination of the psychological, emotional, and cognitive aspects that contribute to this complex and often subjective phenomenon. Understanding interest in such a comprehensive manner lays the groundwork for a more nuanced analysis and interpretation of human behavior and choices in diverse contexts

To reach a broader audience, the e-commerce platform employs a comprehensive marketing and promotion strategy that encompasses various aspects such as products, prices, advertisements, and promotions. A key element of this strategy involves conducting a detailed analysis of consumer behavior. The platform focuses on creating a matrix of consumer shopping psychology to effectively attract more consumers during their marketing and promotional efforts [11].

D. *Previous Studies*

D1. 1st Research

In a research titled " The Influence of Digital Marketing and Product Choices in Consumer Purchase Decision Interest on the Tokopedia Marketplace," published in 2022, [12]. highlighted that the business sector, including marketplaces, has shifted online due to technological advancements. Online marketplaces provide a vast array of options for both sellers and products, empowering customers to make their own decisions. As a marketing strategy for marketplaces, businesses strive to leverage the simplicity and convenience offered by online platforms, facilitating seamless trade and business transactions for both consumers and producers.

In this research, a non-experimental method was employed to collect data through questionnaires from Tokopedia marketplace users residing in Bandung. Due to the unknown population size, a sample of 100 individuals was selected. The research employed a correlational technique to investigate the relationship between the independent variables, specifically digital marketing and product preference, and the dependent variable, which is customer buying interest at the Tokopedia online store. Several analysis techniques were employed, including the Multicollinearity Test Technique, Heteroscedasticity Test, and Multiple Linear Regression Test, to assess consumer buying interest. The research focused on dimensions represented by variables, namely digital marketing, product selection, and consumer buying interest at the Tokopedia online store. The sub-dimensions comprised search engine optimization, social media/blog posting, search/social ads, personalization/content, emails/newsletters, videos/ motion graphics, product categories, and customer interest. Based on the findings of this research, a positive and significant relationship between the digital marketing variable and the purchase intention variable in the Tokopedia marketplace can be concluded. However, no significant or positive relationship was found between the product variable and the purchase intention variable on Tokopedia. The research suggests that companies and buyers can benefit from addressing digital marketing aspects before making a purchase. However, it is important to note that several other factors such as promotional campaigns, price lists, ease of payment, and product quality were not considered in this research. These factors may also play a crucial role in influencing purchase intentions and should be further explored in future research.

D.2 2nd Research

According to the research titled "Peran Ulasan Produk dan Foto Produk Yang Ditampilkan Penjual pada Marketplace Shopee Terhadap Minat Beli Pria dan Wanita" [13], it is evident that sellers are increasingly transitioning to conducting their businesses online through e-commerce platforms accessible via smartphones. This shift can be attributed to the continuous technological growth of the internet. E-commerce offers a simpler and more efficient way for vendors to showcase their products and connect with customers on a global scale. Businesses that embrace e-commerce find it considerably easier to sell their goods compared to those that do not utilize e-commerce platforms.

In this research, the research approach employed is associative quantitative research, utilizing a specific population or sample as the research tool. The sample is typically collected through random sampling methods to test the established hypotheses. The researchers utilized a variety of analytical methods, including multiple linear regression analysis, descriptive statistics, partial t-tests, validity tests, reliability tests, normality tests, heteroscedasticity tests, and multicollinearity tests. These analytical methods provide valuable insights and allow for a comprehensive examination of the research data.

The parameters or indicators in this research are based on the buying interest of both men and women. Buying interest refers to the process of consumer desires when considering purchasing a product or service, involving multiple factors that influence consumer decision-making. The research highlights that two factors, namely product reviews and product images presented by sellers, significantly impact customer interest in sellers. By examining customer data, product preferences, and consumer interests, this

research aims to further investigate the dimensions related to these factors.

Based on the results of testing the first hypothesis, it can be concluded that product reviews have a significant impact on consumer purchasing interest in the Shopee marketplace. The research found that more positive and comprehensive product reviews positively influence consumer interest in making a purchase.

Similarly, based on the results of testing the second hypothesis, it can be inferred that product photos displayed by sellers have a significant effect on consumer buying interest in the Shopee marketplace. The research revealed that better product photos presented by sellers lead to increased consumer interest in the products.

These findings emphasize the significance of product reviews and product photos in influencing consumer behavior and the decision-making process in the Shopee marketplace. Sellers must prioritize providing high-quality product reviews and visually appealing product images. These elements play a vital role in enhancing consumer interest, driving sales, and ultimately influencing purchasing decisions. By investing in compelling product reviews and visually appealing images, sellers can effectively engage and attract potential buyers, leading to increased sales and business success.

III. RESULT AND DISCUSSION

A. *Data Set Quantitative Research*

Quantitative research methods were utilized in this study. As stated by [14], quantitative research is a structured approach that involves the analysis of numerical data using statistical techniques. In this research, the focus was on examining the impact of independent variables, such as pricing (free shipping, vouchers), convenience of use (delivery, application services, payments), and features (live shopping, games, free shipping), on the dependent variable, which is the desire to make online purchases through e-commerce platforms. Through the utilization of quantitative research methods, the study aimed to quantify the relationships and effects of these variables, thereby gaining a more profound comprehension of consumer behavior within the realm of e-commerce.

B. *Sample Population*

The sample for this research consists of individuals within the community surrounding the researcher's environment. A total of 128 respondents completed the online questionnaires. After conducting a validity test, 105 respondents' answers were considered valid. The validity test was related to questions about respondents' usage of one or several online marketplaces and their interest in online shopping. Respondents who answered 'never' or indicated no interest in online shopping were excluded from the valid questionnaire set. Specifically, the research focuses on individuals who regularly use or have used e-commerce applications and are at least 18 years old. These criteria were established to ensure that the research focuses on individuals with relevant experience and knowledge in using e-commerce platforms. By targeting this specific group, the research aims to gather insights and data that are representative of the population segment most relevant to the research objectives

C. *Data Collection Techniques*

In this research, data collection was conducted using a Google form questionnaire to gather information on how online shopping preferences have evolved due to the utilization of e-commerce platforms. The questionnaires were distributed to the community residing in and around the research locations. The aim was to collect data on attitudes and behaviors related to the use of e-commerce for online purchases.

To ensure the reliability of the research findings, various tests were conducted, including normality tests, correlation tests, hypothesis tests, and other assessments. These tests were performed to evaluate the quality of the measurement instruments and to analyze the results obtained from the questionnaires filled out by the respondents. By conducting rigorous analyses and tests, the research aims to draw meaningful and accurate conclusions based on the collected data.

D. *Residual Analysis Test*

D1.Normality Test using Shapiro-Wilk Test

In this research, the normality test, specifically the Shapiro-Wilk test, was employed to assess the distribution of residuals for each variable. The significance level, represented as the p-value, was used to determine whether the data adhered to a normal distribution. A p-value greater than 0.05 suggested that the data were normally distributed, whereas a p-value less than or equal to 0.05 indicated non-normal distribution. By conducting the Shapiro-Wilk test, the study aimed to evaluate the normality of the data, an essential assumption for many statistical analyses.

The hypothesis for the normality test can be stated as follows:

H0: The data follows a normal distribution.

Ha: The data does not follow a normal distribution

Table 1 - Price Variable

W Value	P-Value	Criteria	Explanation
0.95919	0.2452	> 0.05	Accept H0

Table 2 - Service Variable

W Value	P-Value	Criteria	Explanation
0.86431	0.0007147	> 0.05	Reject H0

Table 3 - Feature Variable

W Value	P-Value	Criteria	Explanation
0.94053	0.07037	> 0.05	Accept H0

Table 4 - Interest Preference Variable

W Value	P-Value	Criteria	Explanation
0.91461	0.01303	> 0.05	Accept H0

Based on the results of the Shapiro-Wilk test, the price variable in this research has a p-value of 0.2452, suggesting that it follows a normal distribution. However, the service variable has a p-value of 0.0007147, indicating that it is not normally distributed. Similarly, the feature variable has a p-value of 0.07, indicating normal distribution, while the interest preference variable has a p-value of 0.01303, also suggesting normal distribution.

Since the significance level value is set at 0.05, variables with p-values greater than 0.05 (price, feature, and interest preference) are considered normally distributed. However, the service variable, with a p-value less than the significance level, does not meet the assumption of normal distribution.

D2. Autocorrelation test using Durbin-Watson Test

The Durbin-Watson (DW) test is a statistical tool used to examine the presence of autocorrelation in the residuals of a regression model. It is essential for determining the suitability of a linear regression model for the data. The DW test generates a test statistic value that ranges from 0 to 4. A value of 2 is considered the benchmark for the absence of significant autocorrelation. A value close to 0 indicates positive autocorrelation, whereas a value close to 4 suggests negative autocorrelation [15]

In this research, the model regression between the interest preference factor and the independent variables, namely price, service, and characteristics, was tested using the DW test. The aim was to evaluate whether autocorrelation exists in the residuals of the regression model. By examining the DW test statistic, researchers can determine the presence and nature of autocorrelation, which helps in assessing the validity of the regression model and drawing meaningful conclusions from the analysis.

The hypothesis for the autocorrelation test can be stated as follows:

H0: There is no autocorrelation in the residual model.

Ha: Autocorrelation occurs in the residual model.

Table 5 - Interest Preference vs Price Variables

DW Value	P-Value	Criteria	Explanation
2.4615	0.9134	> 0.05	Accept H0

Table 6 - Interest Preference vs Service Variables

DW Value	P-Value	Criteria	Explanation
2.3428	0.8465	> 0.05	Accept H0

Table 7 - Interest Preference vs Feature Variables

DW Value	P-Value	Criteria	Explanation
2.5259	0.9433	> 0.05	Accept H0

Based on the results of the interest preference regression model with price, the Durbin-Watson test statistic value is 2.4615 and the corresponding p-value is 0.9134. Since the p-value (0.9134) is greater than the significance level value of 0.05, we fail to reject the null hypothesis. Therefore, based on this analysis, it can be concluded that there is no evidence of positive autocorrelation in the residuals of the regression model.

For the interest preference regression model with services, the Durbin-Watson test statistic value is 2.3428 and the corresponding p-value is 0.8465. Since the p-value (0.8465) is greater than the significance level value of 0.05, we fail to reject the null hypothesis. Therefore, based on this analysis, it can be concluded that there is no evidence of positive autocorrelation in the residuals of the regression model.

Similarly, for the interest preference regression model with features, the Durbin-Watson test statistic value is 2.5259 and the corresponding p-value is 0.9433. Since the p-value (0.9433) is greater than the significance level value of 0.05, we fail to reject the null hypothesis. Therefore, based on this analysis, it can be concluded that there is no evidence of positive autocorrelation in the residuals of the regression model.

D3. Heteroscedasticity test using Breusch-Pagan Test

The Breusch-Pagan test is utilized to examine heteroscedasticity in the residual regression model. It assesses whether there is a significant relationship between the squared residuals and the independent

variables in the model. The p-value obtained from the Breusch-Pagan test is then compared to the significance level (usually 0.05) to determine whether there is evidence of heteroscedasticity.

If the p-value obtained from the Breusch-Pagan test is less than 0.05, there is evidence of heteroscedasticity, and the null hypothesis is rejected. Conversely, if the p-value is greater than 0.05, there is no significant evidence of heteroscedasticity, and the null hypothesis is accepted, indicating that the residuals exhibit homoscedasticity.

Given by the following hypothesis:

H0 = no heteroscedasticity occurs in the residual model, which is homoscedasticity.

Ha = Heteroscedasticity occurs in the residual model, which is not homoscedasticity.

Table 8. - Interest Preference vs Price Variables

BP Value	df	P-Value	Criteria	Explanation
0.099468	1	0.7525	> 0.05	Accept H0

Table 9 - Interest Preference vs Service Variables

BP Value	df	P-Value	Criteria	Explanation
1.3374	1	0.2475	> 0.05	Accept H0

Table 10 - Interest Preference vs Feature Variables

BP Value	df	P-Value	Criteria	Explanation
3.5215	1	0.06058	> 0.05	Accept H0

The results of the interest preference regression model with prices are obtained with BP values of 0.099468, df = 1, and p-value of 0.7525. Because the p-value is higher than the significant level value of 0.05, the regression model can be said to accept the null hypothesis which is homoscedasticity rather than heteroscedasticity.

The results of the interest preference regression model with services indicate a Breusch-Pagan test statistic (BP) of 1.3374, with degrees of freedom (df) equal to 1, and a corresponding p-value of 0.2475. Given that the p-value is higher than the significance level of 0.05, it suggests homoscedasticity rather than heteroscedasticity. As a result, it can be assumed that the regression model accepts the null hypothesis.

The results of the interest preference regression model with features show a Breusch-Pagan test statistic (BP) of 3.5215, with degrees of freedom (df) equal to 1, and a corresponding p-value of 0.06058. Since the p-value is less than the significance level of 0.05, which suggests homoscedasticity rather than heteroscedasticity, it can be concluded that this regression model accepts the null hypothesis

E. Strong Intercorrelation Test Between Variables using Multicollinearity Test

In this research, the multicollinearity test was performed to investigate the presence of multicollinearity among the independent variables in the regression model. Specifically, the Variance Inflation Factor (VIF) approach was utilized to assess the extent to which multicollinearity influenced the regression coefficients by quantifying the amount of variance inflation.

A high VIF score suggests the presence of significant multicollinearity, indicating that the independent variables are highly correlated with each other. This can pose challenges in interpreting the individual effects of the independent variables on the dependent variable. By performing the multicollinearity test and calculating the VIF scores for the independent variables, the research aimed to identify and address potential issues related to multicollinearity, ensuring the reliability and accuracy of the regression model's results.

It is possible to identify the Variance Inflation Factor (VIF) value to determine whether multicollinearity and/or a relationship between the independent variables exist. These values have the meaning as follows:

- A VIF value < 1 indicates that there is no multicollinearity, making the variables independent of one another.
- A VIF value of 1 means that there is no or very little multicollinearity, this indicates with no significant correlation occurs in the independent variable.
- A VIF value between 1 and 5 indicates that independent variables have a poor relationship with one another and that there is considerable slight multicollinearity.
- Significant multicollinearity is indicated by a VIF value above 5 or 10; this indicates that the independent variables are strongly correlated with one another.

Table 11 - Multicollinearity

Price Variable	Service Variable	Feature Variable
1.358873	1.101824	1.279636

Based on the VIF scores obtained for the independent variables in this research, namely the price variable (1.358873), the service variable (1.101824), and the feature variable (1.279636), Based on the results, it can be concluded that there is no significant correlation or multicollinearity among these variables. These VIF scores indicate that there is very little or almost no multicollinearity present.

When VIF scores are close to 1, it suggests that there is little correlation between the independent variables. In this case, the VIF scores for all three variables are below 5, which is a commonly used threshold for identifying significant multicollinearity. Therefore, it can be concluded that there is no significant multicollinearity among these variables. Therefore, it can be inferred that the independent variables (price, service, and feature) in this research are not highly correlated with each other, and multicollinearity is not a significant concern.

T Value	df	P-Value	Confidence Interval	Coefficient Correlation	Criteria	Explanation
1.4172	31	0.1664	-0.1055818 - 0.5439165	0.2466682	> 0.05	Accept H0

A. Regression Equation

The estimated coefficient for the price variable (price$avrg) in the regression model is 0.37585, and the associated level of significance is 0.03510.

Preferensi$avrg = 0.96758 + 0.37585 * harga$avrg + 0.07249 * layanan$avrg + 0.38941 * fitur$avrg (1)

This indicates that, when all other variables are held constant, a one-unit increase in the price variable leads to an average increase of 0.37585 units in the dependent variable (preferences$avrg).

The level of significance (0.03510) being less than the conventional threshold of 0.05 suggests that the coefficient is statistically significant. In conclusion, the evidence strongly supports the claim that the price variable has a meaningful and non-zero impact on the dependent variable. This suggests that changes in the price variable are associated with significant and systematic changes in the dependent variable, rather than being due to random chance.

The estimated coefficient for the service variable (service$avrg) is 0.07249, with a significance level of 0.54639. A high P value suggests that there are insufficient results to conclude that the service variable in this model significantly affects the dependent variable.

The estimated coefficient for the feature variable (features$avrg) is 0.38941, with a significance level of 0.00111 (**). This shows that, if the other variables are maintained constant, a one-unit change in the feature variable is correlated with an increase of roughly 0.38941 units in the dependent variable.

A combination of the price, service, and feature variables in this model may be accountable for around 53.67% of the variability in the dependent variable, given the Multiple R-squared value is 0.5367.

The F-statistic has a value of 11.2 with a p-value of 4.732e-05. This suggests that overall, the regression model is statistically significant in explaining variation in the dependent variable.

B. Pearson Correlation Test

A test used to measure the relationship between these two variables is the correlation test. The Pearson correlation test was used in this research to determine whether there is a relationship between the price and service variable, service and feature variable, feature and interest preference variable, and the interest preference and price variable.

The hypothesis for the correlation test can be stated as follows:

H0 = There is no correlation between the two variables.

Ha = Correlation occurs between the two variables.

Table 12 - Interest Preference vs Service Variables

T Value	df	P-Value	Confidence Interval	Coefficient Correlation	Criteria	Explanation
-0.28923	31	0.7743	-0.3882705 - 0.2967169	-0.0518765	> 0.05	Accept H0

Table 13 - Feature vs Service Variables

T Value	df	P-Value	Confidence Interval	Coefficient Correlation	Criteria	Explanation
4.8379	31	3.416e-05	0.4034338 - 0.8155629	0.6558991	> 0.05	Accept H0

Table 14 - Interest Preference vs Feature Variables

T Value	df	P-Value	Confidence Interval	Coefficient Correlation	Criteria	Explanation
0.75553	31	0.4556	-0.2189514 - 0.4566917	0.134465	> 0.05	Accept H0

Table 15 - Interest Preference vs Service Variables

T Value	df	P-Value	Confidence Interval	Coefficient Correlation	Criteria	Explanation

Table 16 - Price vs Interest Preference Variables

3.8838	31	0.000504	0.2847277 - 0.7651397	0.5721129	> 0.05	Reject H0

The evidence suggests that there is not enough support to establish a significant correlation between the price variable with service. This is indicated by the p-value of 0.1664 and the correlation coefficient of 0.2466682 at a significance level of 0.05, with a confidence interval ranging from -0.1055818 to 0.5439165. Therefore, based on this analysis, there is no strong evidence to conclude a significant correlation between the price variable and service.

Based on the results, there is not enough evidence to support a significant correlation between the service variable and features. The analysis yielded a p-value of 0.7743 and a correlation coefficient of -0.0518765 at a significance level of 0.05, with a confidence interval ranging from -0.3882705 to 0.2967169. Therefore, based on this information, there is no strong evidence to conclude a significant correlation between the service variable and features.

Sufficient evidence is supported by the f**eature variable with interest preferences** p-value of 3.416e-05 and correlation coefficient of 0.6558991 at a significant correlation of 0.05 with a confidence interval between 0.4034338 and 0.8155629.

With a p-value of 0.000504 and a correlation coefficient of 0.5721129 for the interest preference variable with price at a significance level of 0.05, and a confidence interval ranging from 0.2847277 to 0.7651397, there is sufficient evidence to support a correlation between the interest preference variable and price. The p-value indicates that the correlation is unlikely to be due to chance, and the correlation coefficient of 0.5721129 suggests a moderately strong positive relationship between the two variables. Therefore, based on this analysis, it can be concluded that there is a significant correlation between the interest preference variable and price.

There is sufficient evidence to support a correlation in the **interest preference variable with service**, with a p-value of 0.4556 and a correlation coefficient of 0.134465 at a significant level of 0.05 with a confidence range between -0.2189514 and 0.4566917.

With a significance level of 0.05 and looking at the direction of the correlation coefficient, it can be stated that the variables of interest vs. price preferences and interest vs. features preferences are positively correlated. There is no correlation between interest preferences with services, prices with services, or features with services.

IV. CONCLUSION

Based on the research findings, it can be concluded that the utilization of e-commerce platforms significantly influences online buying interest after the pandemic is over. The study thoroughly examined different aspects of purchasing products through well-known e-commerce platforms, including Tokopedia, Shopee, and Lazada, among others

The results of hypothesis testing indicate that there is insufficient evidence to support all the claims of significance in the correlation test. However, it's important to note that the regression model, which incorporates multiple tests involving variables such as price, service, features, and external factors, provides valuable insights. Despite the lack of significant correlations individually, the combination of these variables in the regression model allows for a more comprehensive understanding of their joint impact on the dependent variable. The regression analysis can reveal complex relationships and uncover hidden patterns that might not be evident in individual correlation tests. Thus, the regression model remains valuable for drawing meaningful conclusions and gaining insights into the overall relationships among the variables.

The preference regression model reveals linear relationships that align with the assumptions of interest and price preferences. Additionally, the linear assumptions of the interest and service preference regression model are satisfied. However, it is worth noting that the linear assumptions made by the model regarding interest preferences and feature regression are not met.

These conclusions shed light on the complex dynamics between e-commerce platforms and online buying interest. Further research is recommended to gather more comprehensive data and explore additional factors that may influence these relationships

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Voice Control Turn-Based Role Playing Game Development Using Unity Speech Recognition

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Abstract*— This research endeavors to create and develop a turn-based role-playing video game utilizing speech recognition as an innovative means to introduce a novel experience in video games. The game is designed and implemented using the Unity game engine. The game prototype produced in this study is intended to provide a unique experience when playing games, namely using voice recognition to try to beat opponents. The researcher adopts the Extreme Programming methodology, compassing four stages: Planning, Design, Develop and Testing/Release. The culmination of this research is a turn-based role-playing game featuring speech recognition controls intended for Windows computers equipped with a microphone. The game offers players fresh and innovative gameplay by incorporating speech recognition. Based on the closed beta trial on three respondents, the result was that there was an influence from the playing room. Two words are difficult for the game to detect: "molten spear" with an average detection rate of 40% and "chakra magic" with an average detection rate of 33%.

***Keywords*— turn-based, role-playing video game speech recognition, extreme programming**

I. INTRODUCTION

Games usually require the user to engage in new and exciting systems, to manipulate the form and content displayed on the screen in accurate or real-time. In this way, the player's relationship with the media shifts from a more passive recipient of information to a more active involvement [1]. They all involve the player interacting with the on-screen action via multiple device inputs, which change depending on the platform the game is being played. Most computer games use a mouse and keyboard, and other games use a joystick/gamepad, but other controllers also exist. A joystick or gamepad is designed primarily for games on a game console, a device to play games other than computers [2].

Game development itself is defined as a medium of fictitious activity, unpredictable and not productive with rules, with time and space limits, and without obligations [3]. These elements are: players, goals, procedures or methods, rules, resources, conflicts, boundaries, then results [4].

Game genres are specific game categories that are related to similar game characteristics. Genre is usually not defined by the setting, story, or media of the game but by how players interact with the game. An example of an RPG game can be interpreted as a Role Playing Game, and players must control a character in a fictional theme. The character's purpose usually depends on the narrative or theme of the game. In RPGs, players usually have a strategic gameplay method by providing resources such as levels, types of magic, weapon types, and other mechanics. Conflicts in regular RPGs are in the form of computer-controlled enemies and even other players if the game is online. Conflict resolution and an understanding of the limits or boundaries of the game will result in the player's goals or goals, which can be in the form of victory or the end of the story if the game has narrative elements [5][6].

Game development itself cannot be separated from development in the world of computing, especially in the world of computer software development. One example is the use of artificial intelligence or artificial intelligence. Artificial intelligence in most modern games fulfills three basic needs: the ability to move the character, decide where to move, and think tactically or strategically [7].

The horror game Phasmopobhia uses the same AI properties, only now it uses speech recognition, a form of machine learning. Ghosts in this game can respond based on the words spoken by the player through the microphone, making players more careful with what they say [8]. The history of speech recognition implementation in games was done by shouting orders to their squad mates, who followed the player's orders [9].

Most games still use vital combinations on the joystick and keyboard/mouse to communicate with and control our characters on the screen. Things like this can provide the potential for a new way of playing the game; due to the previous statement that most games still use button-shaped controls, the following games that will be developed can provide a new exploration of usage: game controller or controller [10].

History of the implementation of voice recognition or speech recognition in games has played barking orders to their squad mates, and they follow the player's orders. Almost all games still use a combination of buttons on the joystick and keyboard/mouse to communicate with and control our characters on the screen. Things like this can provide the potential for new ways of playing games, due to the previous statement, that most games still use button controls, the game that will be developed below can provide a new exploration in the use of game controllers.

Based on the background described, this research's main problem is building a turn-based RPG game with Desktop-based speech recognition elements.

II. METHODOLOGY

A. State of The Art

Several previous studies are relevant and have become a reference for this research. Research by Ahmad et al. [11]. This research developed an educational game for learning English pronunciation based on speech recognition. This research underlies how speech recognition can be a control medium in games. Further research by Mustaquim [12], this paper aims to find a standard way of using voice commands in games that uses a speech recognition system in the back end, and that can be universally applied for designing inclusive games.

Research by Aguirre-Peralt et al. [13] stated that persons with disabilities have limitations in accessing certain types of hardware. Therefore speech recognition can be a medium that can help them use the software. Further research by Jung et al. [14], the development of voice user interface (VUI), which has become popular recently, presents new possibilities for human-computer interaction, especially in game development.

Based on these four studies, these research produces a game that uses voice recognition media as the primary control medium. The game genres from these research vary; therefore, the authors designed a desktop-based turn-based role-playing game in this study. The game prototype produced in this study is intended to provide a unique experience when playing games, namely using voice recognition to try to beat opponents. The development of this game uses the extreme programming framework.

B. Turn-based Game

In a turn-based game, players only run the action on the turn or turn away. Action can generally be restricted; for example, a player can only do two any action in turn. A turn-based strategy allows players to think without a limited time. An essential aspect of Turn Based Strategy Games is the presence of opponents or enemies. Enemies are also considered by players in making strategic decisions, and players who play this game will always show that they are smarter than their opponents [15].

C. Role-playing Game

In a role-playing game, the player can control a character according to his role in a fictional world. The role in question is the functionality of the character, such as a wizard, sniper, knight, or healer. RPG genre games usually have elements of action, adventure, or strategy [16].

Role-playing games allow the player to immerse themselves in the character's situation. Role Playing Games (RPG) continue their rich history in storytelling by embracing innovative ways to vary and report stories. Characters tend to be rich, the gameplay is extended, and character management is technical in RPGs [17].

D. Speech Recognition

Speech recognition, also known as Automatic Speech recognition (ASR), is a technology applied to software to receive input in spoken words. This technology allows a device to recognize and understand spoken words by digitizing the words and matching the digital signal with a particular pattern stored in a device [18] [19] [20].

E. Windows Speech Recognition

Microsoft has developed the Speech API since 1993. The Microsoft team has released the Speech API (SAPI) 5.3 with Windows Vista, which was very powerful and valuable. This allows developers to easily speech-enable Windows Forms applications and apps based on the Windows Presentation Framework [21].

F. Extreme Programming

Extreme Programming, commonly called XP, is a rapid software development approach. The XP method focuses on object-oriented development; this method has four frameworks for software development activities: the Planning Phase, the Design Phase, the Develop Phase, and finally, the Testing Phase before returning to the Planning Phase to start the next sprint [22]. The XP process is shown in Fig. 1.

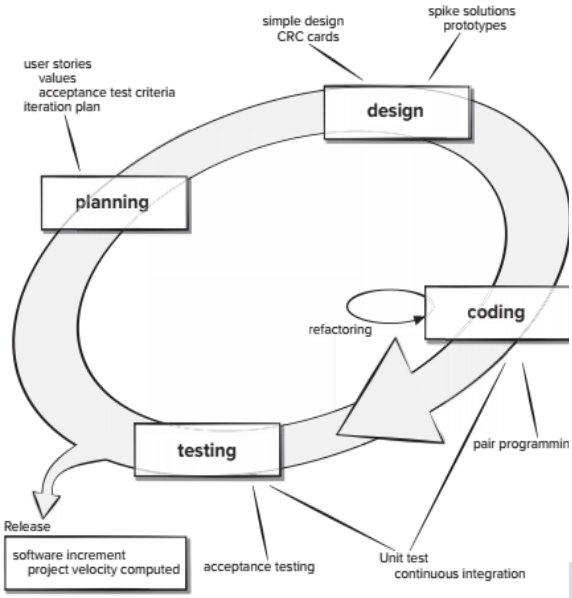

Fig. 1. The extreme programming process [22]

The Extreme Programming processes are as follows [22]:

- Planning: The planning activity (the planning game) begins with a requirements activity called listening. Listening leads to creating a set of "stories" that describe the required output, features, and functionality for software to be built.
- Design. XP recommends immediately creating an operational prototype of that portion of the design.
- Coding. After user stories are developed and preliminary design work is done, the team does not move to code but instead develops a series of unit tests that will exercise each story to be included in the current release (software increment).
- Testing. XP acceptance tests, also called customer tests, are specified by the customer and focus on overall system features and functionality that are visible and reviewable by the customer. They are derived from user stories implemented as part of a software release.

III. Result and Discussion

A. Planning Phase

This stage generates game formal elements as well as dramatic elements. The game's formal elements are shown in Table I.

TABLE I. Game Formal Element

Element	Description
Players	Single Player vs. Game, players defeat enemies controlled by artificial intelligence, taking turns. Players will use a microphone and speech to act.
Objectives	Players try to defeat the enemy with all their might, a skill that can be cast until the enemy's health runs out; all at once, try not to make the player's health run out.
Procedures	The game is seen from a two-dimensional side view or side scroller. The player can see himself and the enemy. At the time of the player's turn, the player can say the word through the microphone or see what skills the player has before saying it. Players can also see players' and enemies' health and mana bars.
Flow	If the player wins, the player will move on to the next level, with more difficult enemies.
Resources	Players have a health bar. Players have a list of skills that can be chanted to perform actions.
Boundaries	Players are limited by a system of taking turns or turn-based with the enemy after acting.
Outcome	Players will find the game's final level to fight the last enemy; if the player manages to defeat him, the player will win. If the player loses against the enemy, the player will repeat the match (restart) without returning to the initial level (unless the player exits the game application).

In addition to formal elements, this game also has dramatic elements. Dramatic elements are elements that can show the emotions of players when playing a game. The game's dramatic elements are shown in Table II.

TABLE II. Game Dramatic Element

Element	Description
Challenge	In the game, the player has to defeat artificial intelligence-controlled enemies. Players are given several skills that must be spoken through the player's microphone to fight or defend against enemy attacks. Players will take turns with the enemy acting. If successful, the player will advance to the next level and fight more difficult enemies; players will also get new skills every time they level up.
Theme	Turn-based role-playing game
Premise	Defeat enemies using the power of sound.
Character	a. The protagonist is a wizard with his spell book. b. Antagonists are monsters of various forms.

B. Design Phase

This stage describes several game design elements, including determining the words players will speak when engaging in turn-based combat. This stage will cover the game architecture plan or design pattern, the use of game assets, and the technology used. The important thing in the controller of this game is the

pronunciation of keywords of some skills because it is an essential tool in developing this game. The following is a list of the skills in this game, and their keywords are shown in Table III.

TABLE III. GAME KEYWORDS FOR SPEECH CONTROL

Keyword	Type	Description
Explosion	Damage	*Summons an explosive fire*
Black hole	Damage	*Summons an unknown force of power*
Molten spear	Damage	*Summons a molten spear from hell*
Splash	Damage	*Spawn a geyser of water*
Spike	Damage	*Summon earth spikes*
Tornado	Damage	*Summons a wind tornado*
Bless	*Charge/Heal*	*Heals player for 500*
Hand of God	*Charge/Heal*	*Heals player for 1000*
Chakra Magic	*Charge/Mana*	*Restore mana for 300*
Power up	*Buff/Attack*	*Increase Attack by 150 for five turns*
Protect me	*Buff/Defense*	*Increase Defense by 20 for five turns*
I am motivated	*Buff/Critical Chance*	*Increase Crit Chance by 25% for three turns.*
I need more power	*Buff/Critical Damage*	*Increase Critical damage by 100% for three turns.*
Curse you	*Debuff/Attack*	*Decrease Attack by 100 for three turns*
corruption	*Debuff/Defense*	*Decrease Defense by 15 for three turns*

Table III displays the keywords used as game controls. This keyword was tested on three users to find out whether the system read this keyword correctly or not.

At this stage, the design of game wireframes is also carried out. Wireframe is the basic appearance of a software-based interface or user interface. The game itself is an artwork with interactive computer software, and the wireframe on the game project must be designed to understand how the game looks and to make an impression and message, reinforcing the elements and premise of the game that will be played. The wireframes are shown in Fig. 2 to Fig. 7.

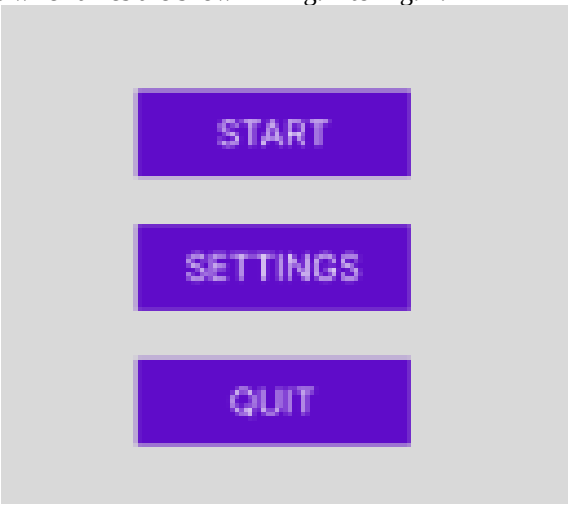

Fig. 2. The game main menu

Fig. 2 displays the start menu display of the game starting. The interaction between the player and the game is given buttons to navigate the display. Fig. 3. displays the settings menu. This menu is used so players can adjust the game's appearance, starting from the resolution size, full screen, and others. Players can also test the microphone before playing on this menu.

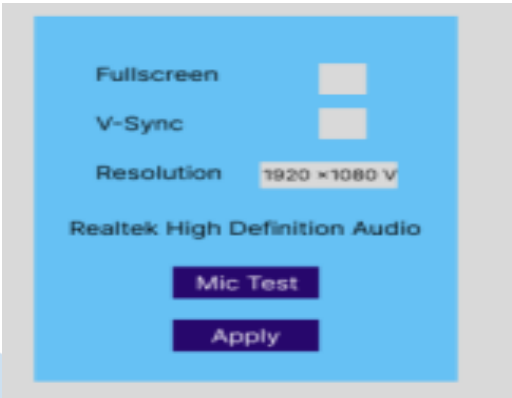

Fig. 3. The game setting menu

Fig. 4 shows the battle scene. This figure shows the main game; the player positioned on the left will face the enemy on the right. Complete display with menus - other menus that are useful for the course of the game. This display is also complete with subtitles to help players learn several things, for example, the words the player says.

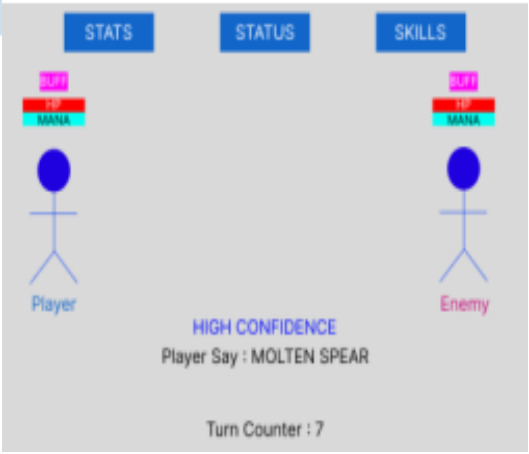

Fig. 4. The battle scene

Fig. 5. The status effect menu

Fig. 5 shows the menu status and the status effects. This view focuses on providing additional information on the game, such as stats or statistics from players and enemies, for example: comparing the amount of strength of players and enemies and seeing what adverse effects are on both characters. Fig. 6 shows the skills list. This display shows the player's skills and all the information.

Fig. 6. The skills list menu

Fig. 7. The result scene

Fig. 7 shows the result scene. This display will appear if the player wins or loses. If the player wins, the player is given the option to continue to the next level. If the player loses, the choice is replaced by repeating the game.

C. Coding Phase

This stage produces the game development process, which already includes implementing the results from the two previous stages that must be programmed into the game. The result of the coding phase is shown in Fig. 8 to Fig. 12.

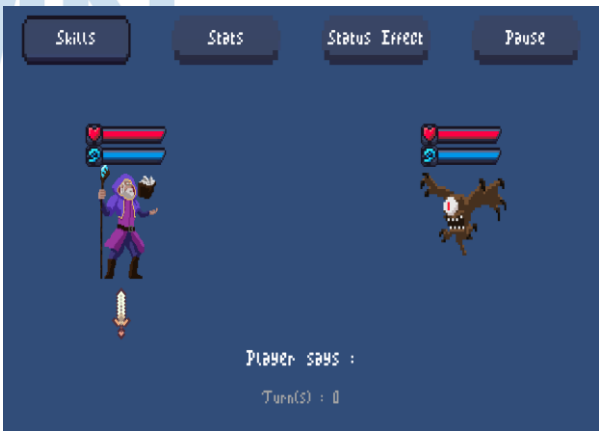

Fig. 8. The game start battle

Fig. 8 shows the game start battle. The player's character is on the left while the enemy is on the right side. Fig. 9 features players attacking using "Tornado" keyword. A high-confidence statement indicates that voice input is heard very well.

Fig. 9. The in-game battle (1)

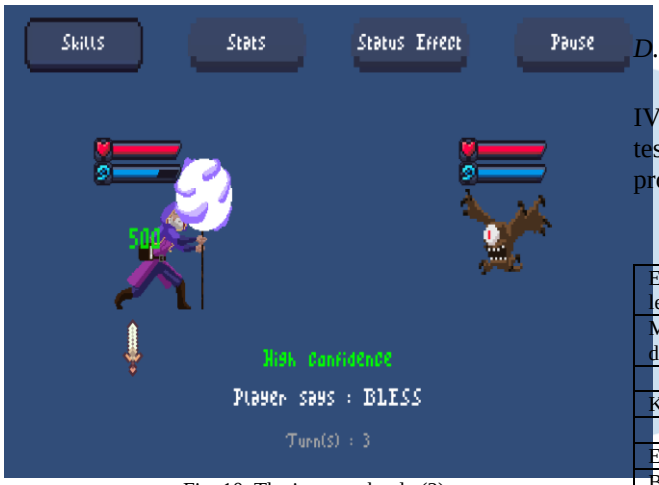

Fig. 10. The in-game battle (2)

Fig. 10 features player buff self using "Bless" keyword. A high-confidence statement indicates that voice input is heard very well. Fig. 11 features player buff self using "Power Up" keyword. A medium-confidence statement indicates that voice input is heard quite well.

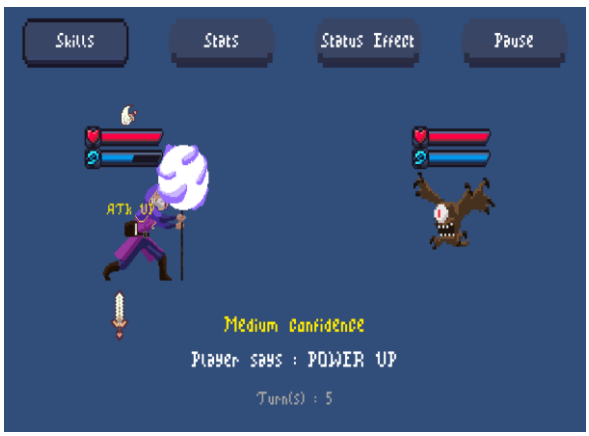

Fig. 11. The in-game battle (3)

Fig. 12 shows the winning result. When the enemy's health bar is empty, the player wins.

Fig. 12. The in-game battle (4)

D. Testing Phase

At this stage, a closed beta test will be tried. Tables IV, V, and VI are examples of the results of closed beta testing by three testers, aiming to try the keyword pronunciation performance of the game specifically.

TABLE IV. FIRST TESTER RESULT

English level	Frequent speaker						
Microphone device	Steelseries Actris 5 (tested in a quiet public room)						
Keyword	Trial #					Result	Complexity
	1	2	3	4	5		
Explosion	v	v	x	x	x	40%	Easy
Black hole	v	x	v	x	x	40%	Easy
Molten spear	x	x	x	x	x	0%	Hard
Splash	x	x	x	x	x	0%	Hard
Spike	v	v	v	v	v	100%	Easy
Tornado	v	v	v	v	v	100%	Easy
Bless	v	v	v	v	v	100%	Easy
Hand of God	v	x	v	v	x	60%	Easy
Chakra Magic	x	v	x	x	v	40%	Hard
Power up	v	v	v	v	x	80%	Easy
Protect me	v	v	x	x	v	60%	Easy
I am motivated	v	v	v	v	x	80%	Easy
I need more power	v	v	v	x	x	60%	Easy
Curse you	v	x	v	x	x	40%	Neutral
Corruption	v	v	v	v	v	100%	Easy

TABLE V. SECOND TESTER RESULT

English level	Frequent speaker						
Microphone device	Rexus Fonix F26M (tested in a private room)						
Keyword	Trial #					Result	Complexity
	1	2	3	4	5		
Explosion	v	v	v	v	x	80%	Easy
Black hole	v	v	v	v	v	100%	Easy

Molten spear	x	v	v	v	v	80%	Easy
Splash	v	v	v	v	v	100%	Easy
Spike	v	v	v	v	v	100%	Easy
Tornado	v	x	x	v	x	40%	Hard
Bless	v	v	v	v	v	100%	Easy
Hand of God	v	x	x	x	v	40%	Hard
Chakra Magic	v	v	x	x	x	40%	Hard
Power up	v	v	v	v	x	80%	Easy
Protect me	v	v	v	v	v	100%	Easy
I am motivated	v	v	x	v	x	60%	Neutral
I need more power	v	v	v	v	v	100%	Easy
Curse you	v	v	v	v	v	100%	Easy
Corruption	v	v	v	v	v	100%	Easy

TABLE VI. THIRD TESTER RESULT

English level	Native speaker						
Microphone device	Steelseries Actris 5 (tested in a crowded private room)						
Keyword	Trial #					Result	Complexity
	1	2	3	4	5		
Explosion	x	x	v	x	x	20%	Hard
Black hole	v	v	v	v	x	80%	Easy
Molten spear	x	v	x	x	v	40%	Hard
Splash	v	v	v	v	v	100%	Easy
Spike	v	v	v	v	v	100%	Easy
Tornado	v	v	v	v	v	100%	Easy
Bless	v	v	v	v	v	100%	Easy
Hand of God	v	v	v	v	v	100%	Easy
Chakra Magic	x	x	x	x	v	20%	Hard
Power up	v	v	v	v	v	100%	Easy
Protect me	v	v	v	v	v	100%	Easy
I am motivated	v	v	v	v	v	100%	Easy
I need more power	v	v	v	v	v	100%	Easy
Curse you	v	v	v	v	x	80%	Easy
Corruption	v	v	v	v	v	100%	Easy

IV. CONCLUSION

The development of the application prototype has been completed. From this development process, it can be concluded as follows. There is a statement regarding the quality of sound input. This is influenced by the pronunciation of the word and the quality of the microphone used. Based on closed beta testing from three respondents, it can be concluded that the keywords that are difficult to detect in this game are "molten spear" with an average detection rate of 40%, and "chakra magic" with an average detection rate of 33%.

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Implementation of Decision Support System Method to Evaluate Posyandu Program in Tangerang Selatan

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***Abstract*— The objective of the research is to develop a decision support system (DSS) of Posyandu in the South Tangerang area using the Technique for Order Preference by Similarity to Solution (TOPSIS) and Simple Multi-Attribute Rating Technique (SMART) approaches. The issue at hand is the selection of posyandu programs that are considered to have the most impact on mothers and children. The DSS system development utilizes the TOPSIS method's ranking feature to select the best alternative based on agreed-upon criteria with the local posyandu. This method will measure the distance between each alternative with a positive ideal solution and a negative ideal solution, then calculate the relative preference value, which can ultimately determine the ranking. Furthermore, the SMART method gives weights to each criterion. These weights contribute to calculating the final value for the alternatives. The system development methodology is prototyping, and the system modeling process utilizes UML diagrams. The final result of this research is a DSS system using TOPSIS and SMART methods, which helps in the decision-making process so that Posyandu can always improve the quality of services for mothers and children.**

***Keywords*— decision-making; decision support system; TOPSIS; SMART**

I. INTRODUCTION

Health is a crucial aspect of people's lives and serves as a key foundation for supporting other areas such as the economy and social environment. This statement is supported by study findings indicating that central government investment in the health sector is in the APBN and regional government expenditure, which has a substantial effect on growth in the economic and human development index [1]. To achieve this, communities need accessible healthcare services. According to the Minister of Health's press statement, both the central and regional governments are facing challenges in providing healthcare services, exacerbated by the fact that the number of primary healthcare centers (Posyandu) is insufficient to reach the wider population. Posyandu (Integrated Health Service Post) is a service unit provided by the Indonesian government. Its main objective is to deliver integrated and comprehensive healthcare services, covering various aspects such as maternal and child health, nutrition, immunization, posyandu programs, and environmental health. The primary goal of Posyandu is to improve community health, particularly for mothers and children. Through Posyandu, communities can access basic healthcare services easily, thus enhancing disease prevention efforts. Posyandu serves as a place where the community can monitor the health of mothers and children within their environment. However, Posyandu often faces challenges in managing health data and information in practice. Therefore, the management of data and health information in Posyandu can be aided using information technology, such as a Decision Support System (DSS). DSS can assist in more effective and organized management of health data and information, as well as enable more accurate decision-making for monitoring the health of mothers and children. The implementation of an information system like the DSS is expected to make Posyandu operate more effectively and efficiently in monitoring the health of mothers and children in the surrounding community, utilizing tools such as a DSS (Decision Support System) [2]. A DSS system can also be utilized by Posyandu cadres for the decision-making process to improve Posyandu's service quality. Based on data from Posyandu in the South Tangerang area, the initial problem that occurred was the need to evaluate some Posyandu programs, such as Bina Keluarga Balita (Child Family Care),

Tanaman Obat Keluarga (Family Medicinal Plants), Bina Keluarga Lansia (Elderly Family Care), Early Childhood Education (PAUD), and Bina Keluarga Remaja (Youth Family Care). One issue faced by Posyandu is the confusion among the community in selecting the appropriate programs. This research utilized two DSS methods namely Technique for Order Preference by Similarity to Solution (TOPSIS) and Simple Multi-Attribute Rating Technique (SMART). Five criteria for evaluating the programs were determined as a result of discussions with Posyandu cadres: cost, maximum program utilization, supporting capability for the Posyandu program, program availability or convenience, and cadre services.

II. METHODOLOGY

A. *Decision Support System*

The Decision Support System (DSS) is defined as a computer-based system consisting of several components. DSS is not a decision-making tool itself, but rather a system that assists in making decisions by providing us with relevant information derived from processed data, thereby facilitating accurate decision-making.

B. *Black Box Testing*

Black box testing is a software testing approach that allows for the evaluation of a system or application without knowledge of its internal implementation. It focuses on examining the input and output of the system or application being tested, disregarding its internal workings [3]. The objective of black box testing is to ensure that the system or application functions by user requirements. This testing method can encompass various techniques, including functional testing, non-functional testing, regression testing, and security testing. An advantage of utilizing black box testing is that it can be conducted by individuals without extensive technical knowledge, leading to varied testing outcomes based on the tester's level of technical expertise.

C. *SMART Method*

The SMART method is a decision-making technique used in DSS to evaluate and rank alternatives based on multiple criteria. It simplifies the decision-making process by assigning scores to each alternative and considering their relative importance, allowing for informed decision-making based on priorities [4].

D. *TOPSIS Method*

The TOPSIS approach is used in Decision Support Systems (DSS) to analyze and rank alternatives based on multiple criteria. It provides a systematic process for decision-making by considering factors such as cost, fuel efficiency, safety ratings, and style in selecting the best alternative. The TOPSIS method allows for a clear and objective evaluation of alternatives, providing valuable information for informed decision-making [5].

E. *Previous Research*

Several previous research are used as references. The first research resulted in a system that referred to developing a web-based dog adoption system. The research findings were positive. The findings of research number one serve as guidelines for applying the black box testing approach [6]. The current study relates to earlier studies that used the SMART technique to create a DSS system [7]. Furthermore, the TOPSIS approach was used in the current study by referring to two previous research that used the TOPSIS method to the DSS application that was developed [8][9].

F. *Research Methods*

The research flow is carried out in four stages adopting a prototyping approach where the output from each stage will become input for the next stage.

The first stage is an analysis of the problem and research needs. At this stage, interviews were conducted with cadres from Posyandu Sakura, Posyandu Mahoni, dan Posyandu Nusa Indah, all three of which are in the South Tangerang area. The interviews revealed several issues faced by the program, including the community's reluctance to engage in the program and the lack of efficiency in its implementation. The community members expressed uncertainty in selecting the programs due to limited information about the available options, while the cadres faced challenges in evaluating the program's outcomes without a dedicated evaluation team. These concerns highlight a lack of community awareness and government support for the existing programs. Addressing these issues is crucial for improving the effectiveness and acceptance of the program in the community.

The second stage is the stage of implementing DSS methods which are SMART and TOPSIS.

The third stage is system modeling using UML Diagram such as use case diagram, activity diagram and class diagram.

The fourth stage is system implementation and testing.

G. *Data Collection Methods*

Data collection methods were carried out using questionnaires, interviews, and observations. The distribution of questionnaires and the interview process were carried out for 7 weeks in parallel. During this time, we conducted observation activities for a duration of 3 weeks

III. RESULT AND DISCUSSION

A. Determination of Research Criteria and weight

1) Criteria

The determination of criteria and weights is done through direct offline interviews with the cadres from each Posyandu. The criteria are obtained from Posyandu cadres who suggest several commonly used criteria in Posyandu. Table 1 details the alternatives that can be selected.

TABLE I. ALTERNATIVES

Data Code	Program Posyandu
A1	Bina Keluarga Balita (BKB)
A2	Tanaman Obat Keluarga (TOGA)
A3	Bina Keluarga Lansia (BKL)
A4	Pos Pendidikan Anak Usia Dini (PAUD)
A5	Bina Keluarga Remaja (BKR)

2) Weight

The weights for the criteria are determined from Posyandu cadres who provide estimated weights commonly used in Posyandu. Table 2 details the criteria and the weight of each criteria.

TABLE II. WEIGHT TABLE

Criteria	Value Weighting	Rating Scale	Number Scale
Price	15%	Very Bad	1
The most used program	30%	Bad	2
Support towards the program at Posyandu	20%	Enough	3
Program availability or convenience	25%	Good	4
Service from cadres	10%	Very Good	5

B. Use Case Diagram

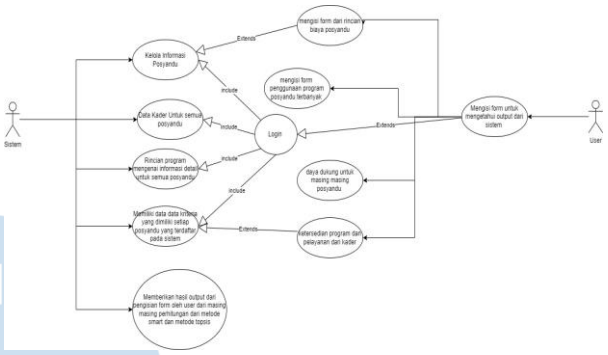

Fig. 1. Use Case Diagram of Proposed System

Use case diagram is used to describe the main functions contained in the system [10].

The use case diagram shown at figure 1 above has 1 role based on the agreed user requirements, namely the user of each posyandu, that role is the user. Starting from filling out the form to find out the output of the system. After completing the filling, proceed with filling out the form with details of posyandu costs, filling out the form for the most posyandu program users, the carrying capacity for each posyandu, and the availability of programs and services from cadres. Then you can log in by redirecting to the next page, namely the system page, which can manage posyandu information, cadre data for all posyandu, program details regarding detailed information for all posyandu, and has data - data criteria owned by each posyandu registered in the system. Finally, the system will provide output results from filling out the form by the user from each calculation from the SMART method and the TOPSIS method.

C. Activity Diagram

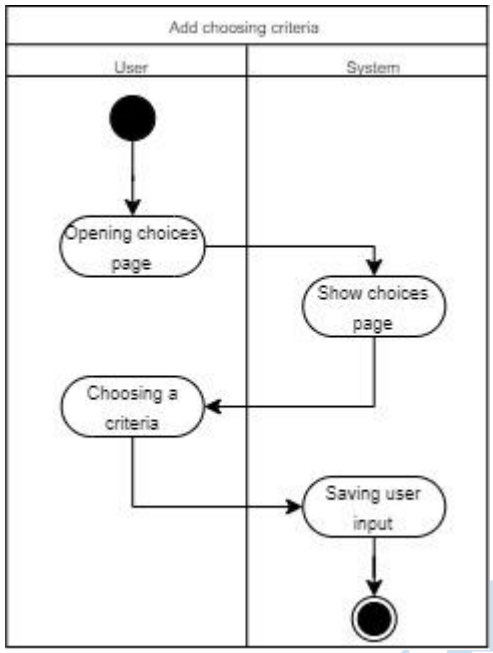

Fig. 2. Activity Diagram Add Choosing Criteria

Figure 2 shows that the cadres would go to the first page, namely selection page. The system will be displaying a criteria selection page to Cadre. After the data has been selected, it will be stored in the system database.

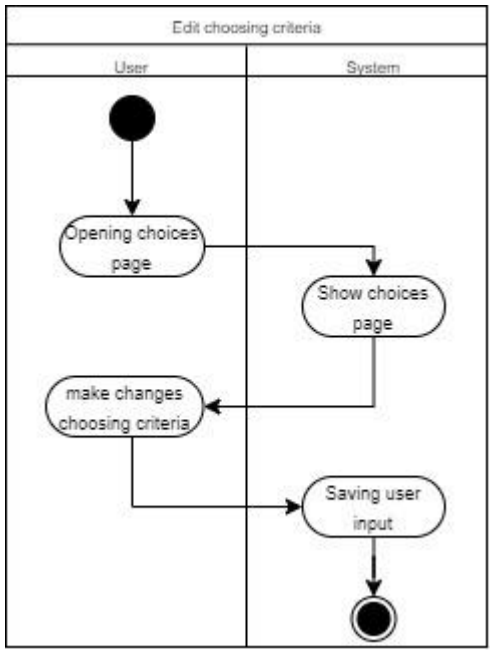

Fig. 3. Activity Diagram Edit Choosing Criteria

Figure 3 Shows the cadres will access the first page, which is the selection page. Next, the user will display the criteria modification selection page, where the user themselves will choose the criteria, they want to access on that page. Once the data is selected, the user's selection data will be stored in the system's database.

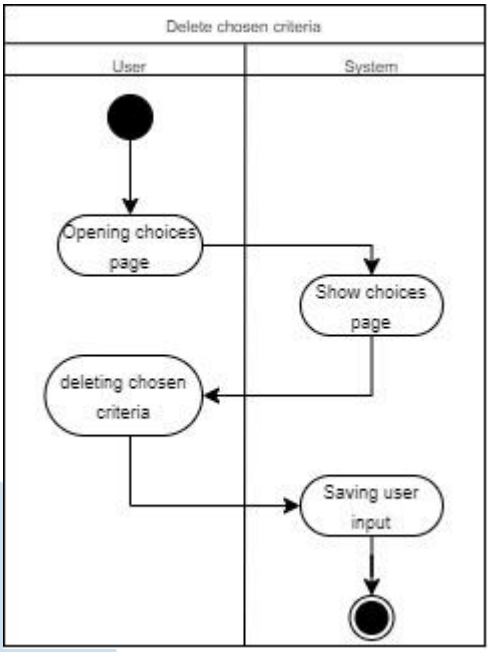

Fig. 4. Activity Diagram Delete Chosen Criteria

Figure 4 The cadre will access the first page, which is the selection page. Then, the user will display the input criteria deletion selection page, where the user themselves will choose the input criteria they want to access on that page. Once the data is selected, the user's selection data will be stored in the system's database.

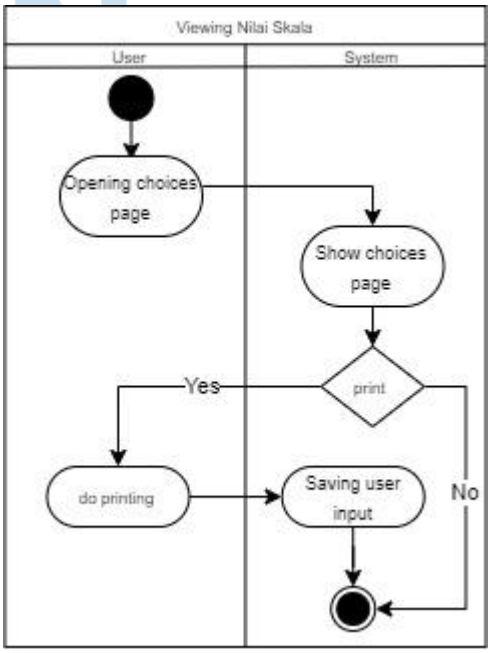

Fig. 5. Activity Diagram Viewing Nilai Skala

Figure 5 displays that the cadre will access the first page, which is the criteria selection page. Then, the user will display the criteria selection page where they can choose the criteria they want to access. The user can then select the specific page they want to print, and once the data is selected, the user's selection data will be stored in the system's database.

D. Class Diagram

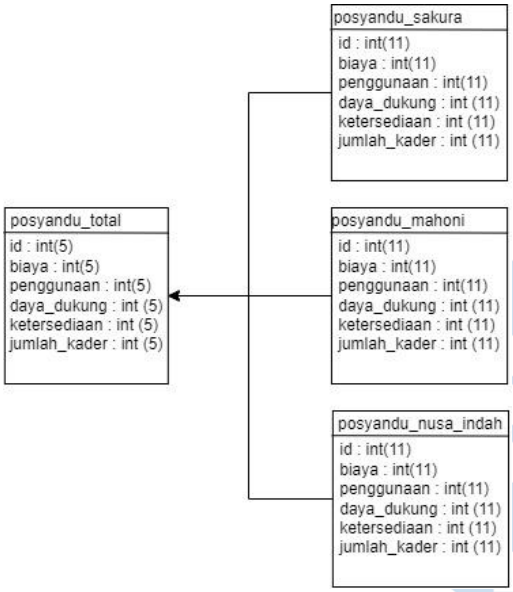

Fig. 6. Class Diagram of Proposed System

The class diagram in figure 6 shows the relationship that occurs between one class and another class. The class diagram above explains that only 1 database is used which is the result of the database, namely posyandu_total. The descriptions of several tables from several posyandu are combined into posyandu_total where the results of the calculations will end up in that table. Few databases are used because the system used is already integrated with the API.

E. User Interface

Fig. 7. Start Page

Figure 7 The Login Page serves as the entry point to the application and displays a welcoming message "Welcome to the Posyandu Recommendation with TOPSIS and SMART Method". It also features a "Mulai Sekarang" button that allows users to proceed to the next page, which is the Personal Data Input Page.

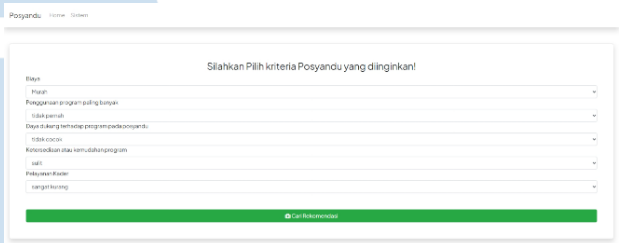

Fig. 8. Criteria Selection Page

Figure 8 is the Criteria Selection Page that allows users to choose the criteria and scales they want to use to find recommendations that align with their preferences. After selecting the desired criteria, the system calculates the recommendations based on the chosen criteria, and the results are displayed to the user.

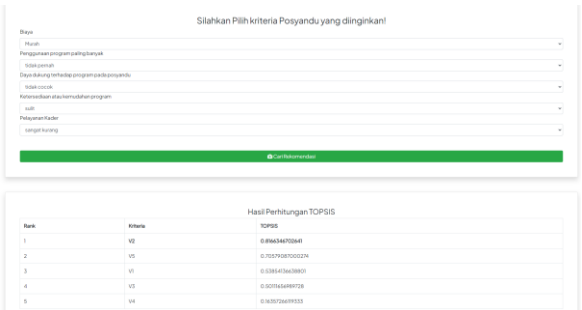

Fig. 9. Calculation Results Page TOPSIS Method

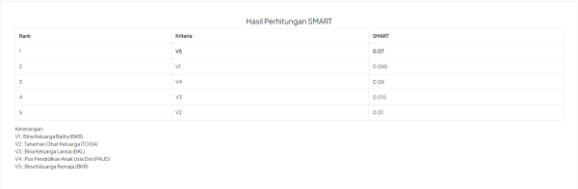

Fig. 10. Calculation Results Page SMART Method

In Figure 9 and Figure 10 are pages of calculation results according to the method that has been selected, namely the TOPSIS method and the SMART method. On this page has the ranking results of each method. It can be seen that the TOPSIS method gives better results because the results are more objective than the SMART method, which has simpler calculations.

IV. CONCLUSION

The following conclusions are based on the outcomes of the decision support system's development. The use of TOPSIS and SMART approaches in the construction of a Decision Support System (DSS) provides benefits in decision-making for enhanced service quality. TOPSIS ranks alternatives, and SMART assigns weights to DSS to help pick optimum alternatives based on criteria. The selection of health center programs is based on familiarity, and they are administered via a web platform with the publication of comparative results. TOPSIS and SMART approaches in DSS give organized information for correct judgments, improving service quality and community well-being.

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Implementation Analytical Hierarchy Process Algorithm for Design and Development Website Hero Mage Recommendation for Mobile Legends

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***Abstract*— Mobile Legends is a Multiplayer Online Battle Arena genre game that is currently hot. There are 122 heroes in Mobile Legends which are divided into 6 roles. The currently popular role is mage, where this mage role occupies 3 of the 5 most used in the MPL S11 tournament. Purchasing heroes can be done with a currency called battlepoints amounting to 32,000. The collection of battlepoints is limited to one week, and there is no refund feature for hero purchases, meaning that if the player makes the wrong hero purchase, the player has to collect the currency again to be able to buy another hero. The Mobile Legends mage hero recommendation system is a system that can provide assistance in purchasing heroes that suit user preferences. Recommendation results are provided based on input provided by the user and processed using the Analytical Hierarchy Process method. The evaluation results using the End User Computing Satisfaction method obtained a percentage of 88.64%, which indicates that the system has been well developed and can be used to provide mage hero recommendations for the Mobile Legends game.**

Keywords*— *Analytical Hierarchy Process, Game, Mobile Legends, Recommendation system

I. INTRODUCTION

Game is one of the forms of entertainment, and games are created with the purpose of entertaining the players who engage with them. Games have evolved significantly, starting from traditional games to digital games [1]. One of the popular MOBA (Multiplayer Online Battle Arena) games is Mobile Legends: Bang Bang, commonly referred to as ML, which recently concluded the M4 World Championship tournament on January 15, 2023. This tournament broke the record for the highest number of viewers, with 4,268,018 viewers, surpassing the previous ML tournament's viewership record of 2.84 million viewers. Mobile Legends is a MOBA game developed and published by Moonton. In this game, players engage in 5 vs. 5 battles against other players with the goal of destroying the enemy team's base to achieve victory, and each match typically lasts around 15-20 minutes.

Mobile Legends features a total of 122 heroes, divided into 6 roles, including Tank, Mage, Marksman, Fighter, Assassin, Identify applicable funding agency here. If none, delete this.
and Support. One of the roles with a substantial number of heroes is "mage," with 25 heroes falling into this category. Mages rely on using skills with short cooldowns to deal magic damage to enemies. Mages are often preferred due to their high damage output in the early game, the ability to control opponents' movements, and being considered easy to use. Mages are quite popular in tournaments, as evidenced by statistics from liquipedia website where in MPL Indonesia Season 11 tournament, where 3 out of the top 5 most-picked heroes were mages

II. METHODOLOGY

A. Recommendation System

In 1990, the concept of recommender systems was introduced as providing recommendations about relevant information to users by using information from user with similar taste [9]. Recommender system algorithms predict how users will react to some choices. There are four entities in a recommender system: items, users, utility matrix, and transactions [10]. The main feature in a recommender system is the ability to predict user preferences by processing user data and data from other users with similar preferences

[11]. Recommender systems are divided into 3 types, namely [12]:

1) Content Based Filtering, providing recommendations by marking existing items or products with keywords then analyzing user desires through information in the database, then suggesting items or products that match their wishes.
2) Collaborative-Based Filtering, providing recommendations to users based on the wishes of other users who have similar characteristics.
3) Hybrid Collaborative Filtering, combines content based filtering with collaborative based filtering to provide recommendations to users.

B. *Multiple Criteria Decision Making (MCDM)*

Multi-Criteria Decision Making (MCDM) is a technique for making decisions among several alternative options. The elements found in MCDM are as follows [13].

1) *Attribute* or criteria, providing characteristics for objects or alternatives.
2) Objectives, is a target to achieve a goal..
3) Goals, determining solution to a problem.

There are two categories in MCDM, namely Multiple Attribute Decision Making (MADM) and Multiple Objective Decision Making (MODM). The steps taken for decision-making in MCDM are as follows [14].

1) Determining the main goals.
2) Determining value of criteria and alternative .
3) Determining best alternative to reach main goals.

C. *Analytical Hierarchy Process (AHP)*

Analytical Hierarchy Process (AHP) is a method used for decision-making by ranking the existing decision alternatives, and then the criteria with the highest values are chosen as recommendations [15]. AHP helps break down complex problems into several components structured in a hierarchy for a systematic approach. [16]. AHP method steps are as follows. AHP method steps are as follows [17].

1) Describing the problem and the desired solution.
2) Creating a hierarchy structure that begins with the main goal.
3) Creating pairwise comparison matrices that reflect the relationships of each element to the criteria located one level above them. Pairwise comparison mattrices can be seen in Table I.

TABLE I
PAIRWISE COMPARISON MATRICES

	Criteria 1	Criteria 2	Criteria 3	Criteria n
Criteria 1	K11	K12	K13	K1n
Criteria 2	K21	K22	K23	K2n
Criteria 3	K31	K32	K33	K3n
Criteria m	Km1	Km2	Km3	Kmn

4) Defining pairwise comparisons using

$$n \times \left[\frac{n-1}{2}\right] \quad (1)$$

n is number of elements being compared. The pairwise comparison rating scale can be seen in Table II.

TABLE II
PAIRWISE COMPARISON RATING SCALE

Intensitas Importance	Description
1	Both elements are important
3	One element is slightly more important than another element
5	One element is more important than another element
7	One element is very much more important than another element
9	One element is absolutely more important than another element
2,4,6,8	Intermediate Values
Reverse	If activity A receive 1 points compared to B, Then B have inverse value compared to A

5) Calculate eigen value and the consistency level. If the value is not consistent, then data is reevaluated.
6) Repeating steps 3, 4, and 5 for all hierarchy levels.
7) Calculate eigen vector for every pairwise comparison matrices to determine every element priority. The calculation process is carried out by summing the values in each column to obtain the normalization matrix, and then summing the values in each row and dividing the result by the number of elements to obtain the average.

If A is pairwise comparison matrices, then vector weight can be calculated as follows.

$$(A)\left(\mathrm{w}^T\right) = (n)\left(\mathrm{w}^T\right) \quad (2)$$

A = Pairwise comparison matrices
w^T = vector weight n = number of criteria can be approximated by means of:

a) Normalizing every column j in A matrices

$$\Sigma_i \ \mathrm{a}\,(i,j) = 1 \quad (3)$$

a(i,j) = normalized column a matrices called A'.

b) Calculate average for every row i in A'

$$w_i = \frac{1}{n}\Sigma_i \ \mathrm{a}\,(i,j) \quad (4)$$

n = number of criteria

w = vector weight

with w_i as weight goals to i from vector weight.

8) Checking hierarchy consistency

If A is pairwise comparison matrices and w is vectro weight, then consistency value from w vector can be tested by:

a) Calculate: $(A)\,(w^T)$

$$\lambda = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{\text{i element in } (A)\,(w^T)}{\text{i element in } w^T}\right) \quad (5)$$

λ = eigen value max

n = number of criteria

b) Calculate consistency index

$$\text{CI} = \frac{\lambda - n}{n-1} \quad (6)$$

CI = consistency indeks

λ = eigen value max

n = number of criteria

c) Random index RI_n are average value of CI.

TABLE III
RANDOM INDEX (RI_n)

n	2	3	4	5	...
RI_n	0	0.5	0.90	1.12	...

d) Calculate consistency ratio

$$CR = \frac{CI}{RI_n} \quad (7)$$

CR = consistency ratio

CI = consistency index

RI_n = random index

- If CI = 0, then hierarchy is consistent.
- If CR ¡= 0.1, Then hierarchy reasonably consistent.
- IF CR ¿ 0.1, then hierarchy is not consistent.

D. . Likert Scale

The Likert scale is a scale commonly used in survey-based research. In the Likert scale, respondents specify their level of agreement on a symmetric scale ranging from ”strongly agree” to ”strongly disagree” for the given statements [18]. The Likert scale typically focuses on multiple categories on the scale, and whether the data obtained is in the form of ordinal data or data that needs to be evaluated on an interval scale [19]. The following is the formula for calculating the Likert Scale [20]:

$$\text{Score percentage} = \frac{T \times Pn}{Y} \times 100\% \quad (8)$$

T = The total number of respondents for a category.
Pn = Likert category points.
Y = Total number of respondents × likert highest score.

After obtaining the percentage score, the next step is to determine the interval for interpreting the percentage, and this can be done using the formula [20].

$$I = \frac{100\%}{\text{likert highest score (5)}} = 20 \quad (9)$$

Therefore, the interpretation of the percentage criteria is as follows.

- 0% - 20.99% = very poor
- 21% - 40.99% = poor
- 41% - 60.99% = fair
- 61% - 80.99% = good
- 81% - 100% = very good

E. End User Computing Satisfaction (EUCS)

According to Sugiyono, the suitable number of respondents in a research study ranges from 30 to 500 respondents [21]. *End User Computing Satisfaction* EUCS is a method for measuring the level of user satisfaction with an information system by comparing expectations and the reality of the system [22]. EUCS is defined as the overall evaluation of system users based on their experience with the developed system [23]. EUCS itself consists of five components [24].

1) Content
Assessing the level of user satisfaction from the aspects of the system’s functions and modules, or the content of a system that can be utilized by users and the information generated from that system.
2) Accuracy
Evaluating the level of user satisfaction from the aspect of data accuracy when the system receives input and transforms it into information.
3) Format
Assessing the level of user satisfaction from the aspect of the visual and aesthetic aspects of the system’s interface, as well as the format of reports or information generated by the system to ensure an attractive and user-friendly

interface, which can indirectly impact the system's effectiveness.

4) Ease of Use

Evaluating the level of user satisfaction from the aspect of user-friendliness, including the data input process, data processing, and the ease of finding the required information.

5) Timeliness

Assessing the level of user satisfaction regarding the availability of the developed system in providing data and information needed in a timely manner.

In the research process, there are several stages that are carried out, namely:

1) Literature Studies

In this stage, a study of reliable sources such as journals, books, academic works, essays, and others is conducted. 2) Knowledge Acquisition

In this stage, information is collected from professional players, books, computer files, and documents. This knowledge includes information about heroes and the weight values used.

3) Knowledge Representation

In this stage, approved hero weight result is displayed

TABLE IV
HERO WEIGHT

Nama	Offense Rating	Skill Stun	Skill Escape	Skill Heal
Kagura	8	3	2	0
Alice	5	1	1	1
Nana	8	2	1	0
Harith	7	0	1	0
Eudora	10	1	0	0
Gord	9	1	0	0
Cyclops	8	1	0	0
Aurora	10	3	0	0
Odette	8	1	1	0
Zhask	6	0	1	0
Pharsa	9	1	1	0
Valir	8	2	1	0
Change	9	0	0	0
Vale	10	2	0	0
Lunox	10	0	2	1
Esmeralda	4	1	1	0
Luo Yi	6	1	1	0
Yve	5	1	0	0
Valentina	9	1	1	1
Xavier	8	1	0	0
Novaria	10	0	1	0
Lylia	8	0	1	0
Vexana	9	2	0	0
Kadita	10	1	2	0
Cecilion	9	1	0	1

4) System Design

In this stage, the design for website development begins, including the creation of flowcharts, database structures, and the website's interface.

5) System Development

In this stage, the system development process is carried out according to the previously created design using PHP programming language, Code Igniter 3 framework, and MySQL as the database.

6) System Implementation

Integrating AHP Algorithm into the sistem to get recommendation based on user input.

7) Testing

In this stage, sistem testing is done by doing manual calculation and comparing it to sistem result.

8) Evaluation

The evaluation is conducted by distributing a user satisfaction questionnaire for the developed system, applying the Likert scale within the questionnaire.

HOMEPAGE FLOWCHART

In homepage, user will be displayed homepage page. There will be 4 main button which is hero recommendation button, heroes list button, feedback button, and how to use button.

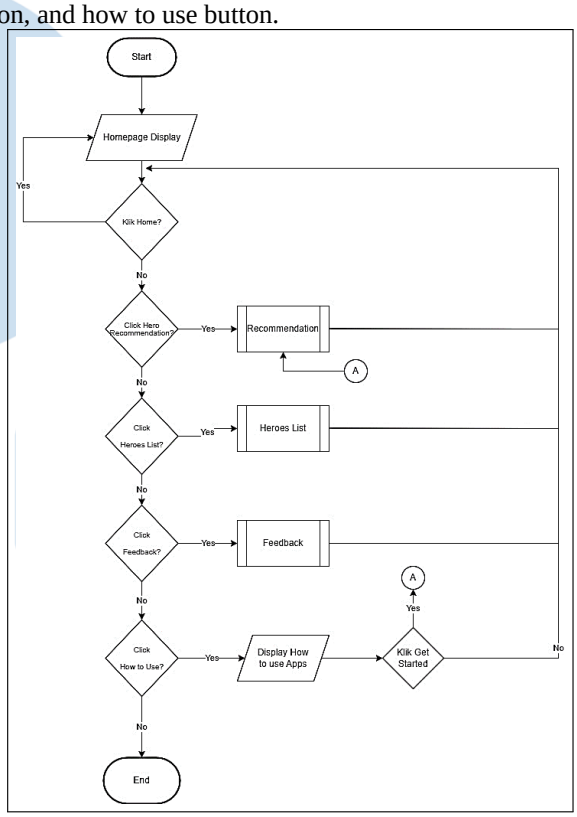

Fig. 1. Homepage flowchart

III. RESULT AND DISCUSSION

A. *Sistem Testing*

The system testing process is carried out by manually calculating the Analytical Hierarchy Process method and conducting user satisfaction tests by distributing questionnaires based on the End User

Computing Satisfaction method, and then calculating satisfaction using the Likert scale method.

B. Manual Calculation Testing

Data that will be used in manual calculation can be seen in Table V.

From the entered data, the steps taken involve creating a pairwise matrix and summing each column. The results of creating the pairwise matrix and summing each column can be seen in Table VI.

TABLE V
AHP CALCULATION DATA

Code	Description	Value
BD SS	Offense Rating to Skill Stun	4
BD SE	Offense Rating to Skill Escape	4
BD SH	Offense Rating to Skill Heal	5
SS SE	Skill Stun to Skill Escape	0.5
SS SH	Skill Stun to Skill Heal	2
SE SH	Skill Escape to Skill Heal	1

TABLE VI
PAIRWISE MATRICES

	BD	SS	SE	SH
BD	1	4	4	5
SS	0.25	1	0.5	2
SE	0.25	2	1	1
SH	0.2	0.5	1	1
Total	1.7	7.5	6.5	9

After obtaining the pairwise matrix, the next step is to normalize the matrix by dividing the values in each column by the sum of the column values. The results of the normalization calculation can be seen in Table VII.

BD / Total BD = 1/1.7 = 0.588
SS / Total BD = 0.25/1.7 = 0.147
SE / Total BD = 0.25/1.7 = 0.147
SH / Total BD = 0.2/1.7 = 0.117
the exact same calculation will be done for column 2 to 4.

TABLE VII
NORMALIZED MATRICES

	BD	SS	SE	SH
BD	0.588	0.533	0.615	0.555
SS	0.147	0.133	0.076	0.222
SE	0.147	0.266	0.153	0.111
SH	0.117	0.066	0.153	0.111

Then, the eigenvalue (w) is determined by summing the values in each row of the normalized matrix and dividing by the number of criteria used (4 criteria). The calculated values of W for each row can be seen in Table VIII.

BD = (0.588+0.533+0.615+0.555)/4 = 0.572
SS = (0.147+0.133+0.076+0.222)/4 = 0.144
SE = (0.147+0.266+0.153+0.111)/4 = 0.169
SH = (0.117+0.066+0.153+0.111)/4 = 0.111

TABLE VIII
EIGEN VECTOR (W)

Code	w value
BD	0.572
SS	0.144
SE	0.169
SH	0.111

Next is to check the consistency level of the hierarchy by means of

1) Calculate (A)(w^T) by multiplying the pairwise matrix with the eigenvalue matrix (w). The result of this multiplication can be seen in Fig 2.

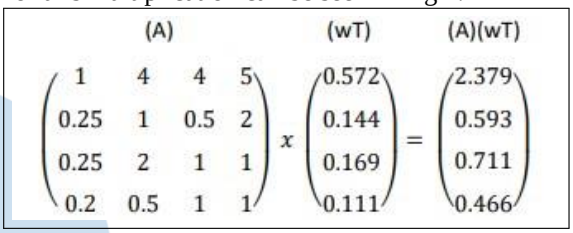

Fig. 2. (A)(wT) calculation

2) Then, calculate the value of t by dividing the result of the calculation (A)(w^T) by w, and then add the results and divide by 4.

t BD = 2.379/0.572 = 4.159
t SS = 0.593/0.144 = 4.118
t SE = 0.711/0.169 = 4.207
t SH = 0.466/0.111 = 4.198
t max = (4.159+4.118+4.207+4.198)/4 = 4.1705

3) Calculate consistency index.

CI = (4.1705 - 4) / 3 = 0.0568

4) After obtaining consistency index, calculate consistency ratio by dividing consistency index with random index value (0.9).

CR = (0.0568 / 0.9) = 0.0631

The consistency ratio value is 0.0631, which is below 0.1, so the input is valid and can be used for the next process. The next process is to multiply the value w with the weights in the system.

Kagura = (8×0.572)+(3×0.144)+(2×0.169)+(0×0.111) = 5.359
Alice = (5×0.572)+(1×0.144)+(1×0.169)+(1×0.111) = 3.292
Nana = (8×0.572)+(2×0.144)+(1×0.169)+(0×0.111) = 5.044
Harith = (7×0.572)+(0×0.144)+(1×0.169)+(0×0.111) = 4.181
Eudora = (10×0.572)+(1×0.144)+(0×0.169)+(0×0.111) = 5.876

The following is the calculation performed for each hero.

The results of the sorted calculation can be seen in Table IX. ased on the table above, the top 10 heroes with the highest final values are Kadita, Lunox,

Aurora, Vale, Novaria, Eudora, Valentina, Pharsa, Vexana, and Cecilion. The final results closely approximate the values obtained when the system performs the calculation, with the same order as shown in Figure 3.

C. User Satisfaction Test

User satisfaction testing was conducted by distributing questionnaires to application users using Google Forms. The questionnaire respondents are Mobile Legends players, and the total number of questionnaire respondents obtained was 34. The questionnaire questions are based on the dimensions following the EUCS method, which are content, accuracy, format, ease of use, and timeliness. The responses to the questionnaire statements follow the Likert Scale, starting with strongly disagree (SD), disagree (D), neutral (N), agree (A), and strongly agree (SA). The list of statements and the questionnaire results can be seen in Table 10.

TABLE IX
FINAL SCORE SORT RESULT

Name	Final Score
Kadita	6.215
Lunox	6.182
Aurora	6.165
Vale	6.021
Novaria	5.9
Eudora	5.876
Valentina	5.585
Pharsa	5.472
Vexana	5.447
Cecilion	5.415
Kagura	5.359
Gord	5.303
Change	5.158
Valir	5.044
Nana	5.044
Odette	4.899
Lylia	4.754
Cyclops	4.729
Xavier	4.729
Harith	4.181
Luo Yi	3.753
Zhask	3.608
Alice	3.292
Yve	3.01
Esmeralda	2.607

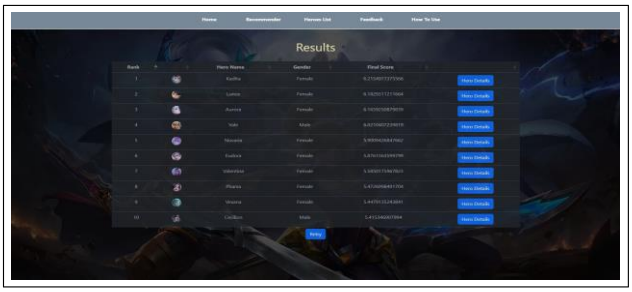

Fig. 3. Website result

TABLE X
USER SATISFACTION TEST RESULT

Dimension	Statement	SD	D	N	A	SA
Content	The hero mage recommendation system application provides information tailored to your needs.	0	1	1	14	18
Content	The hero mage recommendation system application presents information that is clear and comprehensive.	0	1	4	12	17
Accuracy	The mage hero recommendations displayed by the mage hero recommendation system application are correct and accurate.	0	0	6	10	18
Accuracy	Every link you click on in the mage hero recommendation system application displays a relevant web page.	0	0	2	9	23
Format	The design and format provided in the system make it easy for me to use the mage hero recommendation system application.	0	0	5	13	16
Format	The menu structure and options displayed in the mage hero recommendation system application are easy to understand.	0	0	2	14	18
Ease of Use	The mage hero recommendation system application is very easy to use.	0	0	5	9	20
Ease of Use	The mage hero recommendation system application is easily accessible from anywhere and at any time.	0	0	1	10	23
Timeliness	The mage hero recommendation system	0	1	8	7	18

	application saves me time in finding the desired hero.					
Timeliness	The mage hero recommendation system application displays information quickly.	0	0	5	7	22

Based on the user satisfaction test conducted, the satisfaction percentages for each EUCS variable were obtained using the Likert Scale formula. These percentages can be seen in Table XI.

TABLE XI
EUCS DIMENSION PERCENTAGE RESULT

Dimension	Percentage
Content	87.6%
Accuracy	89.6%
Format	87.9%
Ease of Use	90.8%
Timeliness	87.3%

The final user satisfaction percentage is calculated by averaging all the final percentages of each variable.

$$\text{Final Percentage} = \frac{87.6\%+89.6\%+87.9\%+90.8\%+87.3\%}{5} \quad (10)$$

$$= 88.64\%$$

Based on the user satisfaction percentage obtained in equation 10, the user satisfaction percentage is 88.64%, indicating that the developed system is already very good.

IV. CONCLUSION

Based on the conducted research, it can be summarized that:

1) The mage hero recommendation system for Mobile Legends game using the Analytical Hierarchy Process method has been successfully developed. The system can provide mage hero recommendations to users based on user preferences and hero weights confirmed by experts. System verification was performed by comparing manual calculations with the results generated by the system.
2) User satisfaction was measured by distributing questionnaires and obtaining responses from 34 respondents. Measurement using the End User Computing Satisfaction method resulted in an overall satisfaction percentage of 88.64%, concluding that the developed system has been constructed very well and can be used to provide mage hero recommendations for the Mobile Legends game.

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Implementation of AHP Algorithm for Design and Development Halal Food Recommendation System at Cirebon Regional

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***Abstract*— Cirebon is one of the cities in Indonesia that has a variety of unique culinary delights. One of the most famous Cirebonese halal culinary delights is nasi jamblang. However, the many choices of halal Cirebonese food can make tourists struggle to choose food that suits their taste and preferences. This research aims to design and build a halal Cirebonese food recommendation system using the Analytical Hierarchy Process (AHP) method. The AHP method is used to determine the weights of the factors that influence the selection of halal Cirebonese food. This recommendation system is built using PHP and JavaScript programming languages, as well as Laravel, React, and MySQL frameworks. This recommendation system has been tested by distributing questionnaires using End User Computing Satisfaction method with google form to 35 respondents The test results show that this recommendation system produces a user satisfaction value of 87.92%. This value indicates that this recommendation system has met user expectations.**

***Keywords*— Analytical Hierarchy Process, Cirebon, Halal food, Recommendation System**

I. INTRODUCTION

In the midst of diverse local cuisines spread across Indonesia, each region possesses a treasure trove in the form of recipes, spice blends, and narratives behind its culinary offerings. All of these constitute valuable assets contributing to Indonesia's cultural richness. Cirebon City, situated in Indonesia, holds a distinct charm for tourists seeking to explore. The influx of visitors to Cirebon has increased following the opening of a toll road connecting the city to other cities in Java [1]. According to data compiled by the Communication and Information Agency of Cirebon Regency, sourced from the Culture and Tourism Agency of Cirebon Regency, there were 941,435 domestic and international tourists who visited Cirebon Regency during the period of 2021-2022. Iconic foods of Cirebon, such as Empal Gentong, Sega Jamblang, Nasi Lengko, and Tahu Gejrot, contribute to the identity of the region [2].

Halal food encompasses everything that is permissible to eat according to religious requirements, and it should be of Identify applicable funding agency here. If none, delete this. good quality without compromising health [3]. Foods meeting these criteria receive certification and become symbols of high- quality halal food [4]. In addition to halal considerations, the quality of raw materials and how well the food reflects Cirebon's culture and traditions are also crucial factors. In developing a recommendation system, the primary goal is to assist users in finding relevant and interesting items from a vast array of choices. Recommendation systems significantly enhance user experience by providing precise references or suggestions aligned with user preferences. In the context of this research, it is essential to integrate various aspects to deliver recommendations that meet users' expectations.

By combining recommendation technology with a quality assessment of food based on the Analytical Hierarchy Process (AHP), users are expected to enjoy the culinary richness of Cirebon without confusion or doubts about the halal status and quality of their chosen food

II. METHODOLOGY

A. Recommendation System

A recommendation system is a type of system designed to suggest specific products or information to users based on their preferences, characteristics, or behavior. Individuals may seek opinions on books, music, or

movies from others to make decisions. This is the core idea behind the design of recommendation systems [5]. Systems that provide recommendations are crucial for enhancing user experience and assisting platforms or companies in improving user conversion, retention, and sales. Methods that can be applied to recommendation systems include Collaborative Filtering, Content-Based Filtering, and Matrix Factorization.

B. Halal Food

Halal products are products that have been declared permissible according to Islamic law. Therefore, the halal status of a product is a mandatory requirement for every consumer, especially Muslim consumers. Certification and labeling of halal products require special attention from the government, especially for food products, which are primary needs and widely consumed [6]. The criteria for halal food in Islamic perspective include:

1) It does not contain pork and anything derived from pork.
2) It originates from halal animals and is slaughtered ac- cording to Islamic law.
3) It does not contain prohibited or impure substances such as carrion, blood, materials from dirty human organs, and the like.
4) All storage, sales, processing, management, and transportation facilities for halal products must not be used for pork or other non-halal items [3].

The following is the process to obtain halal certification based on an article on the sucofindo.co.id website:

1) Submit a certificate application online at ptsp.halal.go.id.
2) BPJPH (Halal Products Assurance Agency) will check the completeness of the submitted application data. If the documents are complete, BPJPH will immediately send the documents to the Halal Inspection Institution for document verification and calculation of the halal product inspection cost.
3) Generally, the process of calculating the cost of halal product inspection takes a maximum of two working days. However, if the documents are not in order, the Halal Inspection Institution will ask you to correct the document completeness first.
4) The cost calculation for halal product inspection can be seen according to the unit cost multiplied by the established man days by BPJPH. The cost of halal product inspection does not include the cost of testing halal products through accredited laboratories and does not include accommodation and transportation costs in accordance with applicable laws.
5) Subsequently, BPJH will issue a payment invoice to the business owner.
6) Next, businesses must make the payment within a max- imum period of around 10 working days since the first invoice is provided.
7) If the business does not make the payment within the specified deadline, the application will be canceled.
8) After submitting the proof of payment, BPJPH will verify it. If it is correct, BPJPH will immediately issue a document receipt letter as the basis for assigning the Halal Inspection Institution to conduct the halal product testing.
9) The time required for the examination and testing of products is approximately 15 working days.
10) Next, the Halal Inspection Institution will submit the results of the examination and testing of the halal product to MUI (Indonesian Ulema Council) by uploading the documents through the SiHalal application.
11) BPJPH will then issue the halal certificate, and businesses can download the digital halal certificate through the SiHalal application

C. Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) method is commonly used in the process of Multi-Criteria Decision Making (MCDM) to determine the weights of each criterion. In addition, Multi-Attribute Decision Making (MADM) methods such as ELECTRE or PROMETHEE are employed to compare and rank alternatives based on predefined criteria. By combining AHP, MCDM, and MADM, decision-makers can structure criteria, assign weights to each criterion, and then compare alternatives by considering complex preferences. This approach creates a comprehensive and systematic method for decision-making, especially in situations involving a large number of factors and complex preferences.

The AHP method is used to assign weights to each criterion for typical Cirebon halal food and test their consistency. In AHP, the concept of eigenvector is utilized to rank the priority of each criterion based on the pairwise comparison matrix. The fact that, as the number of criteria increases, humans cannot maintain consistent pairwise judgments is addressed. This is why the Consistency Ratio (CR), measuring how

inconsistent a decision-maker is in scoring using a scale, was introduced by Saaty [7].

The reason the author chose the AHP method over other multi-criteria decision-making methods is that AHP introduces the Consistency Ratio (CR) to maintain pairwise criterion scoring consistency. The steps to implement the AHP method are as follows.

1) *Arranging a Hierarchy*
Identify relevant criteria for use in assessing alternatives and then organize them into a hierarchy.

2) *Determining the Pairwise Comparison Matrix*
A pairwise comparison matrix is used to determine values for the criteria. The following is the table of the paired comparison value scale [7].

TABLE I
PAIRWISE COMPARISON VALUE SCALE

Value	Meaning
1	Equal Importance
3	Slightly More Important
5	Moderately More Important
7	Strongly More Important
9	Very Strongly More Important
2, 4, 6, 8	Intermediate values if preferences are not entirely clear.

3) Calculate Relative Weights After the pairwise comparison matrix has been established, calculate the relative weights for each element in the same level. This process involves calculating the geometric mean of the columns in the matrix.

4) *Measuring Consistency*
The steps to measure consistency values are as follows:

a. Multiply the values in the first column by the priorities of the first element, and continue this process until reaching the last element.
b. Sum each row and divide it by the priority value of that element
c. Calculate the Consistency Index (CI) based on the formula.

5) Checking consistency in the hierarchy using IR Values

TABLE II
RANDOM INDEX (RI) VALUES FOR $n = 1$ TO $n = 5$

n	Random Index (RI) Value
1	0
2	0
3	0.58
4	0.90
5	1.12

If the obtained Consistency Ratio (CR) is less than 0.1, it can be stated that the results of the AHP method calculations are consistent, and the priority values can be relied upon [7].

D. End User Computing Satisfaction (EUCS)

Information systems can be reliable if they have good quality and can provide satisfaction to their users [8]. End User Computing Satisfaction (EUCS) is a term used to describe how satisfied end users are with the software or system they use regularly. It is a metric used to determine how satisfied or dissatisfied customers are with the use of computer technology or specific software. Evaluation using this method emphasizes end-user satisfaction with technology, assessing five variables: Content, Accuracy, Format, Ease of Use, and Timeliness [9].

E. Likert Scale

Likert Scale is a scale used to measure an individual's or a group's perception, attitude, or opinion about an event or social phenomenon [10]. A sequence of statements or questions is typically presented to respondents, who are then asked to indicate how much they agree or disagree. Likert Scale is quite simple to design and yields reliable scale values [11]. Likert scales usually consist of 5 response options such as strongly agree, agree, neutral, disagree, and strongly disagree. The following is a table of weights for each category.

$$P = \frac{\Sigma \text{ each category} \times \text{weight}}{5+n} \times 100\% \quad (3)$$

TABLE III
LIKERT SCALE

Category	Weight
Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

P: total number of respondents choosing

n: Number of respondents

Research Methodology

1) Problem Identification

In the context of developing a halal food recommendation system for Cirebon, several issues arise that impact user experience in finding Cirebon's halal food. First, limited information about Cirebon's halal food can make it challenging for users to find options that match their preferences. Time constraints lead users to seek quick and efficient solutions in

determining Cirebon's halal food, while high expectations for technology drive them to look for smart and innovative applications.

2) Source of Knowledge Determination

In a recommendation system using AHP, criteria are a crucial part of the AHP method. In this study, criteria will be determined by experts. Determining knowledge about Cirebon's halal food will be obtained through websites providing related food data. Collecting data on Cirebon's local food for research purposes.

3) Knowledge Acquisition

Collecting data from tourists and halal Cirebon food, and values for each criterion obtained from websites such as tripadvisor.com for finding alternative values based on user reviews, cookpad.com, opendata.cirebonkab.go.id, data.cirebonkota.go.id, and fatsecret.co.id for nutritional values. Halal certificates data is obtained from the bpjph.halal.go.id website. Here are some example im- ages for collecting food data, references for determining alternative values, and halal certificates.

4) Knowledge Representation

The AHP representation in the Cirebon halal food recommendation system takes the form of a hierarchy containing criteria, sub-criteria, and alternatives.

5) Inference Engine Development

Designing the AHP model for the system structure, such as Data Flow Diagram, Sitemap, Flowchart, database design, and wireframe for the Cirebon halal food recommendation website. This method aims to facilitate the system implementation process.

6) System Implementation

Implementing all designs made in the previous stages. This process aims to build the system from the interface to the recommendation process using the AHP method

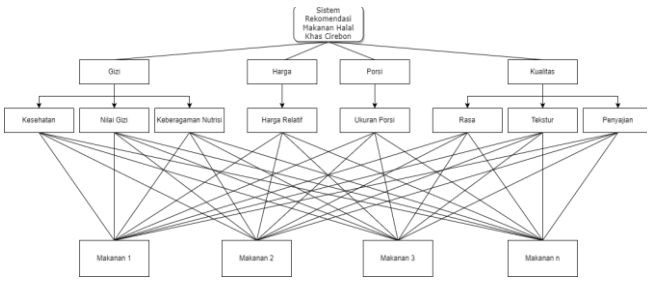

Fig. 1. AHP Method Hierarchy

7) Testing and Evaluation

In this process, the built recommendation system will undergo testing, where the recommendation system web- site will be tested using the EUCS method. Users will fill out a survey to obtain satisfaction scores for the built recommendation system. Reconsideration of the implemented recommendation system.

F. Application Design

Flowchart: A Flowchart is a visual representation that il- lustrates the flow or logical sequence in a system or process. In a flowchart, standard symbols are used to represent activities, conditions, and the logical sequence of the described process. Flowcharts have various applications in different fields, including software development, project management, and business planning. The use of flowcharts helps establish the sequence of steps in a process, identify errors or shortcomings in the system, and improve the overall efficiency of a process. The following is the main flowchart that explains the entire website system

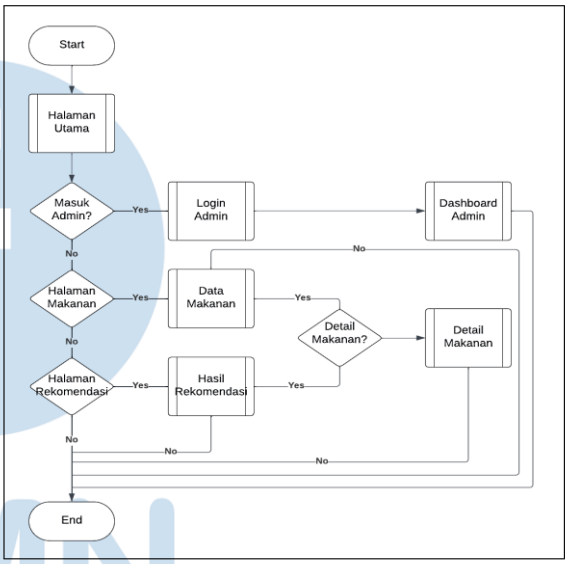

Fig. 2. *Main Flowchart*

G. User Interface Design

1. Main Page

Figure 3 represents the initial page when users access the website for the first time. There is navigation for users to switch to the food page and to the admin login page. There is a navigation button in the middle of the page that will redirect users to the recommendation system page.

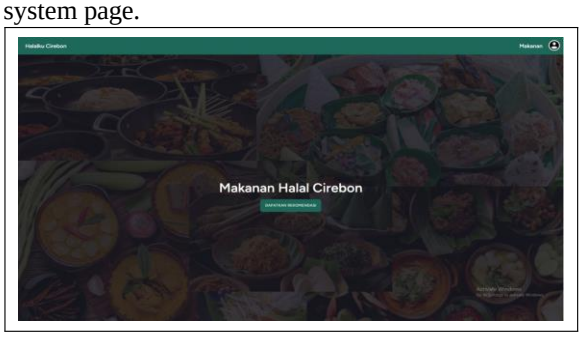

Fig. 3. Main Page

2. Food Page

Figure 4 is the food page when users access the website using the food button in the navigation. The food page will display all food data and brief information such as name, description, image, and food type in the form of cards. On the food card, there are navigation buttons for users to switch to the detailed page of the selected food. There is also navigation for users to switch to the recommendation page

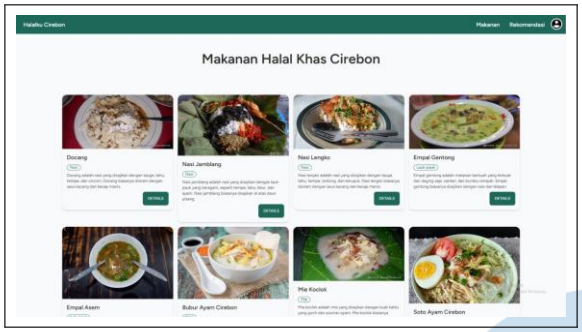

Fig 4. Food Page

3. Food Detail Page

Showing the food detail page for users. On the detail page, it will display all the information about the food data, such as name, description, image, food type, price, and even a button for users to switch to Google Maps for the restaurant that provides the selected food

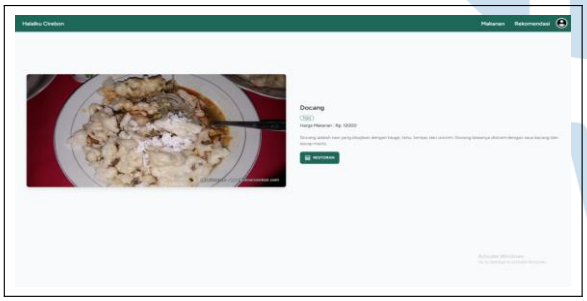

Fig. 5. Food Detail Page

4. System Recommendation Page

In Figure 6, there is a slider to receive ratings from users for each importance value, which will then be used to recommend suitable foods based on user preferences.

Fig. 6. System Recommendation Page

5. Recommended Food Page

In Figure 7, it shows the page displaying recommended food results for users. On this page, the recommended food data for users will be presented

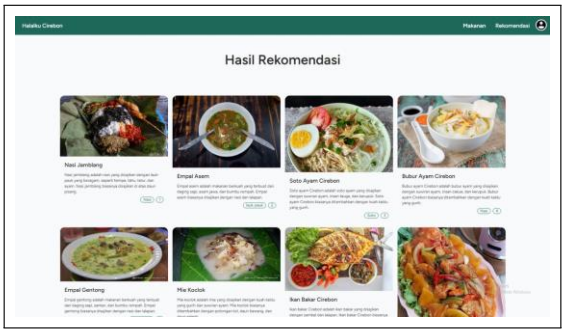

Fig. 7. Recommended Food Page

6. Login Page

Illustrated in Figure 8 is the admin login page. On this page, the admin needs to fill out the login form, and upon completion, the admin will be redirected to the dashboard

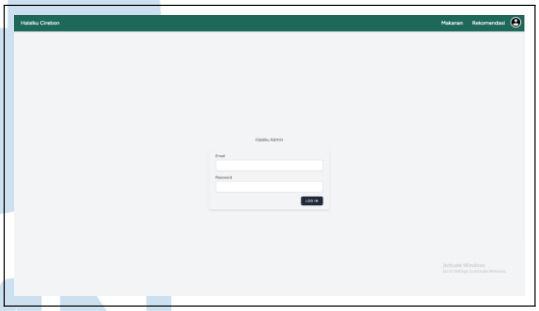

Fig. 8. Login Page

7. Dashboard Page

Depicted in Figure 9 is the admin dashboard page for managing food data and ratings. On this page, there are two navigation buttons: one leading to the food data page and the other to the food rating data page.

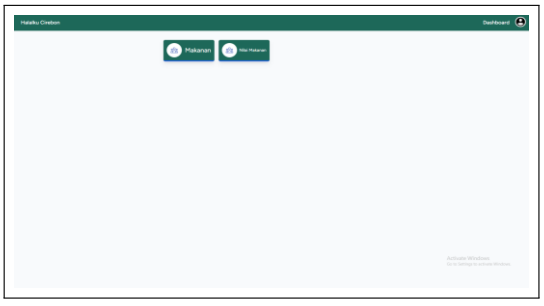

Fig. 9. Dashboard Page

8. Food Dashboard Page

Depicted in Figure 10 is a page displaying all food data and information in the form of a table. On this page, there are three navigation buttons for the admin:the ”Add Data” button, the ”Edit” button, and the ”Delete” button. The ”Add Data” button will redirect the admin to the add food data page, the ”Edit” button to the edit food data page, and the ”Delete” button to delete the selected food, as shown in Figure 11.

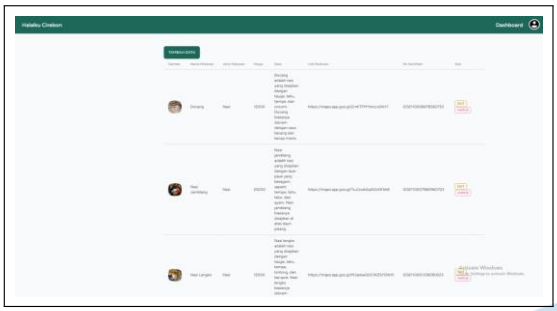

Fig. 10. Food Dashboard Page

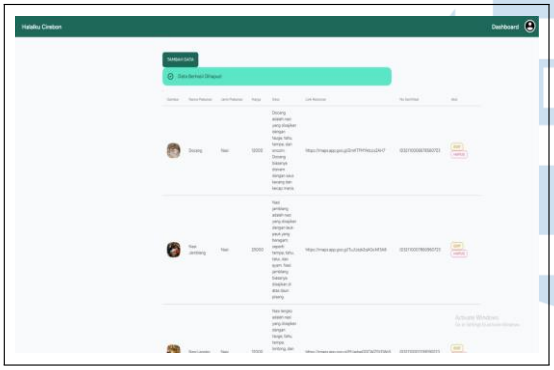

Fig. 11. Delete Food Data

III. Result and Discussion

A. Validation and Evaluation Test

This test is conducted to find out whether the results of the recommendation system calculations match the results of manual calculations. The goal of this test is to ensure that the recommendation system is functioning correctly. In the manual calculation, four criteria are used: price, quality, portion, and nutritional value of the food, as shown in Table 4.

TABLE IV Criteria Table

Code	Description
H	Price
K	Quality
G	Nutrition
P	Portion

Table 5 is a criteria comparison matrix table that has been converted from user input as in the example in Figure 16. The values entered by the user will be calculated manually and using the system. Table 6 is the result of matrix normalization in the criteria comparison matrix table.

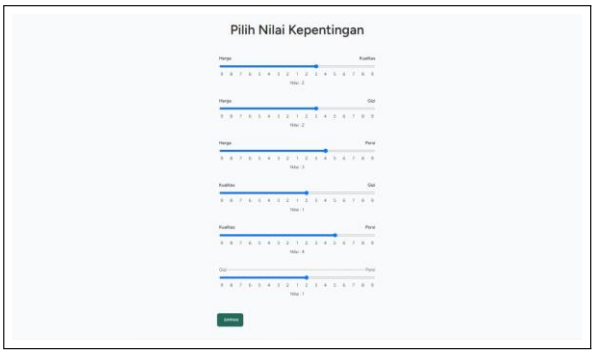

Fig. 16. Value Form User Input

TABLE V
Comparison Matrix Table

Column 1	H	K	G	P
H	1	0,333	0,333	0,25
K	3	1	0,5	0,2
G	3	2	1	0,5
P	4	5	2	1
Total	11	8,333	3,833	1,95

TABLE VI
Matrix Normalization

Column 1	H	K	G	P
H	0,09090	0,04	0,08695	0,12820
K	0,27272	0,12	0,13043	0,10256
G	0,27272	0,24	0,26087	0,25641
P	0,363636	0,6	0,52173	0,51282
Total	1	1	1	1

TABLE VII
Criteria Code

Criteria	Total	Average/Criterion Weight
H	0,34607	0,08651
K	0,62572	0,15643
G	1,03000	0,25702
P	1,99819	0,49954

$$\text{Criteria Weight}_K = \frac{0.27272 + 0.12 + 0.13043 + 0.102564}{4} = 0.15643 \quad (5)$$

$$\text{Criteria Weight}_G = \frac{0.27272 + 0.24 + 0.26086 + 0.25641}{4} = 0.25702 \quad (6)$$

$$\text{Criteria Weight}_P = \frac{0.36363 + 0.6 + 0.52173 + 0.51282}{4} = 0.49954 \quad (7)$$

Then, finding the maximum eigenvalue (lambda max) by summing each criterion weight, which is multiplied by the total of each criterion in the previous comparison matrix

$$\lambda_{Max} = (0.08651 \cdot 11) + (0.15643 \cdot 8.33333) + (0.25702 \cdot 3.83333) + (0.49954 \cdot 1.95) = 4.21650$$

The obtained value of lambda max is used to find the consistency index (CI) or consistency index. The CI value can be calculated by subtracting lambda max from the number of criteria and dividing by the number of criteria minus 1. The calculation can be seen as follows

$$CI = \frac{4.21650 - 4}{4 - 1} = 0.07226 \quad (8)$$

$$CR = \frac{0.07226}{0,9} = 0.08029 \quad (9)$$

TABLE VIII
FOOD VALUE

Criteria	Value Weight
Price	0.08651
Quality	0.15643
Nutrition	0.2575
Portion	0.49954

TABLE IX
FOOD VALUE WEIGHT TABLE

Food Name	H	K	G	P
Nasi Lengko	0.19376	0.10558	0.13243	0.14198
Empal Gentong	0.21407	0.15057	0.11447	0.19111
Nasi Jamblang	0.11489	0.15189	0.17708	0.1190
Mie Koclok	0.14280	0.12021	0.14490	0.14698
Empal Asem	0.09896	0.18080	0.19286	0.18548
Ikan Bakar Cirebon	0.11430	0.19891	0.09544	0.07673
Ikan Asam Manis Cirebon	0.07824	0.07437	0.10469	0.08553
Tahu Gejrot	0.04294	0.07375	0.07513	0.08219

Table of food value weights based on each criterion.

$$\text{Nasi Lengko} = (0.19376 \times 0.08651) + (0.10558 \times 0.15643) + (0.13243 \times 0.25702) + (0.14198 \times 0.49954) = 0.13830$$

$$\text{Empal Gentong} = (0.21407 \times 0.08651) + (0.15057 \times 0.15643) + (0.11447 \times 0.25702) + (0.19111 \times 0.49954) = 0.16702 \quad (11)$$

$$\text{Nasi Jamblang} = (0.11489 \times 0.08651) + (0.15189 \times 0.15643) + (0.17708 \times 0.25702) + (0.1190 \times 0.49954) = 0.138754 \quad (12)$$

$$\text{Mie Koclok} = (0.14280 \times 0.08651) + (0.12021 \times 0.15643) + (0.14490 \times 0.25702) + (0.14698 \times 0.49954) = 0.14189 \quad (13)$$

$$\text{Empal Asem} = (0.09896 \times 0.08651) + (0.18080 \times 0.15643) + (0.19286 \times 0.25702) + (0.18548 \times 0.49954) = 0.17916 \quad (14)$$

$$\text{Ikan Bakar Cirebon} = (0.11430 \times 0.08651) + (0.19891 \times 0.15643) + (0.09544 \times 0.25702) + (0.07673 \times 0.49954) = 0.10391 \quad (15)$$

$$\text{Ikan Asam Manis Cirebon} = (0.07824 \times 0.08651) + (0.07437 \times 0.15643) + (0.10469 \times 0.25702) + (0.08553 \times 0.49954) = 0.08809 \quad (16)$$

$$\text{Tahu Gejrot} = (0.04294 \times 0.08651) + (0.07375 \times 0.15643) + (0.07513 \times 0.25702) + (0.08219 \times 0.49954) = 0.07566 \quad (17)$$

The product of the criteria weights and the obtained food values will be sorted from the highest to the lowest. The top 6 values will be selected and displayed as food recommendations for the user

TABLE X
FINAL VALUE TABLE

Food Name	Final Value	Rank
Empal Asem	0,17916	1
Empal Gentong	0,16702	2
Mie Koclok	0,14189	3
Nasi Jamblang	0,138754	4
Nasi Lengko	0,13830	5
Ikan Bakar Cirebon	0,10391	6
Ikan Asam Manis Cirebon	0,08809	7
Tahu Gejrot	0,07566	8

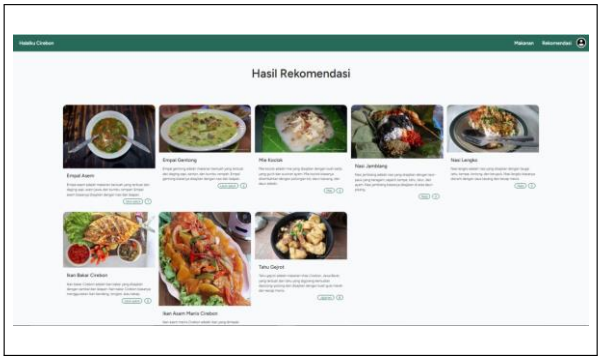

Fig. 17. System Recommendation Results

B. User Satisfaction Test

The second test was conducted by distributing a questionnaire to assess user satisfaction and ease of use of the recommendation system. The questionnaire consisted of 5 questions covering aspects of content, accuracy, format, ease of use, and timeliness. The distributed questionnaire received a total of 35 responses.

1. *Content:* From the results of the first question, the majority of respondents, 34 respondents, agreed or strongly agreed with the statement. Specifically, 12 respondents agreed, 22 respondents strongly agreed, and only 1 respondent answered neutrally

((0×1) + (0×2) + (1×3) + (12×4) + (22×5)) / 5*35 = 91,71%

From the results of the second question, the majority of respondents, 31 respondents, agreed or strongly agreed with the statement. Specifically, 15 respondents agreed, 16 respondents strongly agreed, and only 4 respondents answered neutrally.

((0×1) + (0×2) + (4×3) + (15×4) + (16×5)) / 5*35 = 86,86%

$$\text{Final Score Index} = \frac{91,71\% + 86,86\%}{2} = 89.29 \quad (18)$$

2. *Accuracy:* From the results of the first question, the majority of respondents, 33 respondents, agreed or strongly agreed with the statement

((0×1) + (0×2) + (2×3) + (20×4) + (13×5)) / 5*35 = 86,29%

Based on the results of the second question, no respondents answered strongly disagree or disagree. Two respondents answered neutrally, 15 respondents answered agree, and 18 answered strongly agree.

((0×1) + (0×2) + (2×3) + (15×4) + (18×5)) / 5*35 = 89,14%

$$\text{Final Score Index} = \frac{86,29\% + 89,14\%}{2} = 87,715\% \quad (19)$$

3. *Format:* From the results of the first question, the majority of respondents, 32 respondents, agreed or strongly agreed with the statement. Specifically, 17 respondents agreed, 15 respondents strongly agreed, and only 3 respondents answered neutrally

((0×1) + (0×2) + (3×3) + (17×4) + (15×5)) / 5*35 = 86,86%

From the results of the second question, the majority of respondents, 32 respondents, agreed or strongly agreed with the statement. Specifically, 12 respondents agreed, 20 respondents strongly agreed, and only 3 respondents answered neutrally.

((0×1) + (0×2) + (3×3) + (12×4) + (20×5)) / 5*35 = 89,71%

$$\text{Final Score Index} = \frac{86,86\% + 89,71\%}{2} = 88,285\% \quad (20)$$

4. Easy of Use: From the results of the first question, the majority of respondents, 34 respondents, agreed or strongly agreed with the statement. Specifically, 20 respondents agreed, 14 respondents strongly agreed, and only 1 respondent answered neutrally.
((0×1) + (0×2) + (1×3) + (20×4) + (14×5)) / 5*35 = 87,43%

From the results of the second question, the majority of respondents, 33 respondents, agreed or strongly agreed with the statement. Specifically, 14 respondents agreed, 19 respondents strongly agreed, and only 2 respondents answered neutrally.

((0×1) + (0×2) + (2×3) + (14×4) + (19×5)) / 5*35 = 85,14%

$$\text{Final Score Index} = \frac{87,43\% + 85,14\%}{2} = 86,285\% \quad (21)$$

5. Timeliness: From the results of the first question, the majority of respondents, 32 respondents, agreed or strongly agreed with the statement. Specifically, 22 respondents agreed, 10 respondents strongly agreed, and only 3 respondents answered neutrally.
((0×1) + (0×2) + (3×3) + (22×4) + (10×5)) / 5*35 = 84%

From the results of the second question, the majority of respondents, 34 respondents, agreed or strongly agreed with the statement. Specifically, 14 respondents

agreed, 20 respondents strongly agreed, and only 1 respondent answered neutrally.

((0×1) + (0×2) + (1×3) + (14×4) + (20×5)) / 5*35 = 90,86%

$$\text{Final Score Index} = \frac{84\% + 90,86\%}{2} = 87,43\% \quad (22)$$

C. Final Score

After calculating all the questions, an average calculation is performed to determine the final score. The calculation results can be seen as follows

$$\text{Final Score} = \frac{89,9\% + 87,71\% + 88,28\% + 86,28\% + 87,43\%}{5} = 87,92\% \quad (23)$$

The result of the final percentage calculation is 87.628%, indicating that the respondents strongly agree with the use of the website from the Cirebon typical halal food recommendation system.

IV. CONCLUSION

The halal food recommendation system for the Cirebon region has been designed and built using the Analytical Hierarchy Process method. This system is developed using PHP and JavaScript programming languages, as well as Laravel, React, and MySQL frameworks. The recommendation values generated by this system are consistent with manual calculations. The user satisfaction level is measured by distributing a Google Form questionnaire consisting of 10 questions, filled out by 35 respondents. The measurement of user satisfaction using the End User Computing Satisfaction method resulted in a percentage of 87.92%. After conducting the research, the following suggestions can be implemented for future system development: implementing Collaborative Filtering methods based on ratings and experiences of visitors who have dined in specific local eateries and adding features from applications or websites based on existing research gaps.

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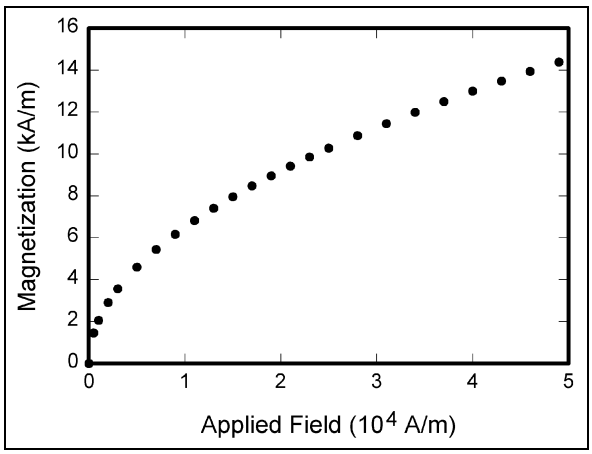

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