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PREFACE

We would like to present, with great pleasure, the first issue of Matrix: Jurnal Manajemen Teknologi dan Informatika in Volume 12, 2022. This journal is under the management of Scientific Publication, Research and Community Service Center, Politeknik Negeri Bali and is devoted to cover the field of technology and informatics management including managing the rapid changes in information technology, emerging advances in electrical and electronics and new applications, implications of digital convergence and growth of electronics technology, and project management in electrical, mechanical or civil engineering. The scientific articles published in this edition were written by researchers from Universitas Komputer Indonesia, Politeknik Negeri Malang, Politeknik Unggul LP3M, PSDKU Politeknik Negeri Malang, Universitas Mulia, and Politeknik Negeri Bali. Articles in this issue cover topics in the field of Information Management and Electrical Engineering including Supplier performance analysis using the Analytical Hierarchy Process (AHP) method, PowerPoint slideshow navigation control with hand gestures using Hidden Markov Model method, Application for data collection and monitoring of COVID-19 patients in Sukorame Community Health Center, E-Learning course design and implementation in fuzzy logic, Implementation of text to speech on web-based broadcasting radio service applications, and Technical analysis of power factor improvement using ETAP 12.6 at Regent Resort & Holiday Inn Canggu. Finally, we would like to thank reviewers for their efforts and hard work in conducting series of review phase thoroughly based on their expertise. It is our hope that the work of the authors in this issue will be a valuable resource for other researchers and will stimulate further research into the vibrant area of technology and information management in specific, and engineering in general.

Politeknik Negeri Bali, 29 March 2022

Editor-in-chief

Gusti Nyoman Ayu Sukerti, S.S., M.Hum.

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Supplier performance analysis using the Analytical Hierarchy Process (AHP) method

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Abstract: This research aims to determine priorities in supplier selection. The determination of this supplier uses the Analytical Hierarchy Process (AHP) method by determining the criteria and sub-criteria of the supplier selection objectives. Each criterion and sub-criteria are arranged in a hierarchical structure and compared by determining the priority scale. The selection of suppliers is based on the largest global weight values. The selected supplier is PT. MMII with a global weight value of 0.280. The global weighted assessment has considered consistency in decision-making based on a consistency index, which must be below 10%. It shows that PT. MMII is selected based on existing criteria and sub-criteria compared to other suppliers. This study contributes to group decision-making involving experts to choose the most appropriate supplier.

Keywords: AHP method, global weight calculation, supplier

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Introduction

Supplier is an important line that is part of the company where the supplier can supply raw materials, both raw and semi-finished, for the company. The company is responsible for making decisions about the selection of suppliers [1]. When choosing suppliers, the company's decision is complex, considering the criteria and sub-criteria. Criteria for selecting suppliers are price, quality, delivery, quantity, and service.

Much research has been done related to choosing an object. The selection uses the Analytical Hierarchy Process as a method. Analytic Hierarchy Process (AHP) is a method or tool for multi-criteria decision making using Expert Choice software, tools in the software will simplify the function of the AHP method [2]. The selection for appropriate technical software used from 6 alternative engineering software in the company criteria is also made according to the AHP method [1]. Companies select the most suitable technology and use additional considerations based on a cost-benefit analysis [3]. Application of AHP in project management to select the best contractor. The hierarchical structure for the prequalification criteria and the contractors who qualify for the project [4]. AHP is also used in the integrated approach of the storage site selection process, where both quantitative and qualitative aspects have been considered [5]. AHP is used for provider selection of a telecommunications system. It is a complex, multi-person, multi-criteria decision problem [6]. AHP compares each criterion's importance and the candidates' values on each criterion to calculate for determining or making the best decision [7-8].

The analytical hierarchy process can be used to select an object. The AHP method is also used to measure productivity. This method is suitable because it considers the criteria and sub-criteria arranged in a hierarchical structure. This supplier selection problem has clear criteria and sub-criteria known to the company. The AHP method can support the company in selecting

suppliers from several alternatives. The supplier decision was made by considering the value of consistency in the experts' answers based on pairwise comparisons between existing criteria and sub-criteria. Experts are people who understand and understand this supplier.

Supplier is a line in which raw and finished goods are delivered to a company or store; Supplier performance reviews can be measured using the Analytical Hierarchy Process (AHP) method. AHP is a useful way to select which suppliers a company should or should not maintain. The choice of this method is considered appropriate compared to other methods since a practical and effective approach allows researchers to solve a complex problem that is not structured into several components in a hierarchical arrangement, allowing them to keep track of training existing suppliers. This method is considered appropriate because it can represent the hierarchy of the supplier itself. The AHP method can also translate or solve unstructured problems into an easy-to-understand or simpler model. This method also uses pairwise comparative assessment performed by experts to obtain a priority scale [9]. The company uses AHP's analysis to select existing suppliers.

Methodology

This study did not use test hypotheses. Instead, it implements individual axioms in a hierarchical analysis (AHP) process. AHP methods generally organize problems in the form of underlying reasoning. By dividing the existing problem into smaller parts, when using AHP, it is divided into two steps: hierarchical design and hierarchical component evaluation [10]. The Analytical Hierarchical Process (AHP) is one of the methods. The most widely used multi-criteria analysis in decision making is the basis for completing the AHP process [11]:

a. Define the decision hierarchy with attributes (criteria) and alternatives (suppliers) representing the relationship.
b. Comparison of Features and Alternatives Using a Dual Comparison Scale Determining the relative importance of attributes and alternatives involves comparing how well options perform with different attributes.
c. Find the maximum eigenvalue (λmax) and CI (conformity index) weights of the attribute and its alternatives.
d. Calculate CR (Correspondence Ratio) = CI/RI where RI is (Randomly Generated Conformity Index).
e. Follow step d, find the total weight, collect all, and perform calculations with Excel software to normalize the weight to get the best supplier. When the best supplier has been found, the company can also compare with other suppliers by adding or removing existing criteria.

A hierarchical structure has no standards or hierarchies of creation. Hierarchy is often based on a combination of ideas, experiences, and views of others that exist. Three things are opposites between one person and another. Therefore, the possibility of creating a non-standard hierarchy is very large. Due to the probability that various cases are very high, thus, the hierarchical structure tends to differ [12]. The scoring scale used in the pairwise comparison questionnaire often refers to the literature. It provides scores from one to nine with appropriate explanations [13]. The odds-scoring scale is greater between one criterion and another. Each incremental significance increases and also represents a value between two adjacent considerations. The RI value is very important for calculating the CR value. In this study, the RI value is adjusted as needed when the criterion is applied for five items. The RI value used is 1.12.

This research focuses on the selection of suppliers. For companies, Suppliers can be correctly identified based on pre-defined criteria. In theory, it seems that an analytical hierarchical process approach can be used to determine priorities, alternatives, or alternatives not defined according to theory Selection is not based on clear criteria, so gaps in this research can lead companies to select suppliers the right way, i.e., an analytical hierarchical process. The novelty of this study lies in calculating the uniformity in global gross weight calculations.

The analytical hierarchical process (AHP) concept is based on a complex problem state of the world, consisting of contrasting elements and various similar elements. Where individual components are often interrelated, the analytical hierarchy method (AHP) complements and assists in making decisions based on characteristics considered representative of all. This set creates various issues related to the resources used. Therefore, a system of priorities is needed

to facilitate this. Appropriate solutions must be found later to create an efficient structure [14]. Analytical Hierarchical Processes (AHP) are among the most widely used tools for decision makers. AHP can describe or solve many criteria. AHP methods to evaluate performance are based on quality, delivery, cost, service, and performance. Features among these criteria Criteria quality is a supplier selection criterion because supplier selection models affect business continuity when analyzing supplier selection issues [15]. Other factors must also be taken into account [16]. The advantages of using the AHP method over other methods are the number of specialists and other problems. It can be managed in a hierarchy of system complexity levels from the lowest (alternative), intermediate (sub-criteria) to the highest level (general), which should be taken into account by the company as 50-90% of the cost. The company's trade was made possible through purchasing activities [17]. Sourcing AHP uses a qualitative and quantitative approach to select the best suppliers. A combination of AHP and linear programs is also useful for viewing tangible and intangible factors. The company was provided with a list of suppliers with suitable capacity and some orders [18].

Criteria that can be compared perfectly cannot be measured. If the threshold is lowered or raised, ratings do not matter. The AHP methodology has a clear principle of dividing the problem into smaller parts. It is easy to carry out such analysis to determine the goal. The most important aspect of AHP analysis is placing parts or variables in a hierarchy and assigning numerical values to each variable, and synthesizing them to select the variable with the highest priority [19]. Thus, the final decision is very accurate. Figure 1 shows the steps of the AHP method.

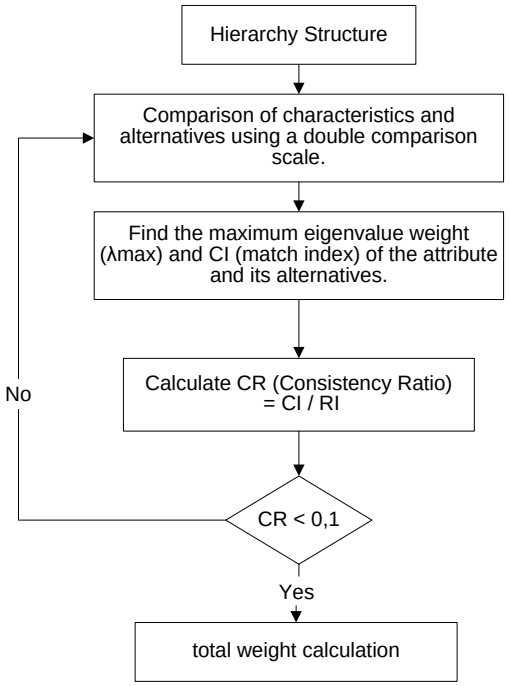

Figure 1. Step AHP method

Results and Discussions

Results

The following is a hierarchy of supplier selection criteria in Figure 2 that has been made based on the interview results.

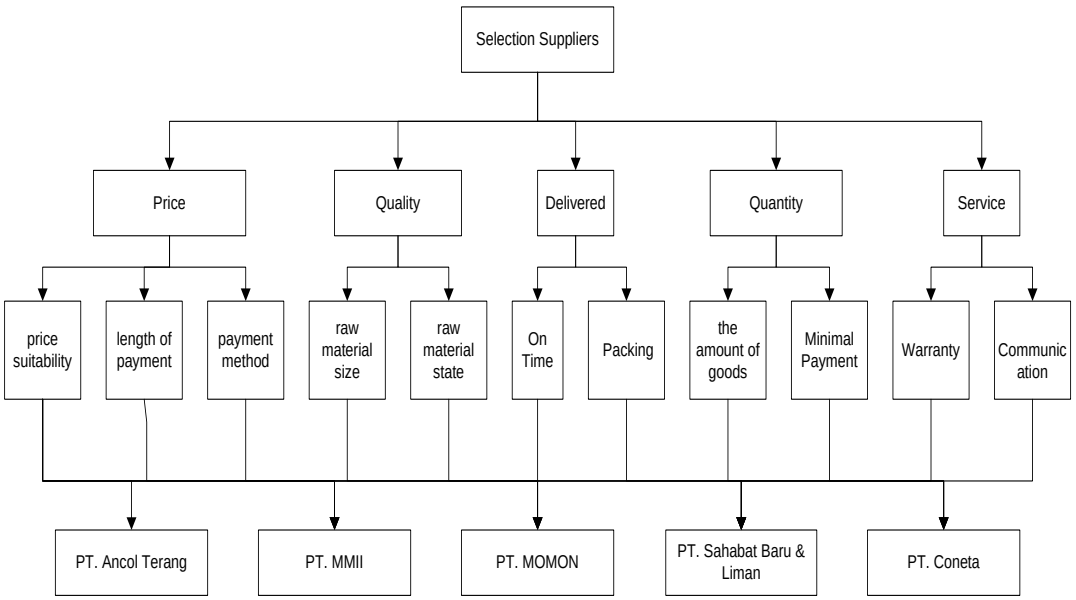

Figure 2. Hierarchy of supplier selection criteria

The criteria and sub-criteria for supplier selection are obtained from direct interviews with the company. After conducting interviews, five main criteria for supplier selection are obtained and 11 sub-criteria. Next, pairwise comparisons are made between the criteria with other criteria and the criteria with their respective sub-criteria. Finally, consistency measurements are made with the criteria below 10% by calculating index random. Decision-making by leaders is often faced with difficult problems because of the variety of decision-making criteria, the weight of considerations, and choices.

Discussions

After the consistency test has been completed, the next step is to calculate a global weight. The global weight calculation is obtained by multiplying all the weights on the criteria, sub-criteria, and alternatives. This calculation aims to see the ranking of the five existing suppliers to select these suppliers. Therefore, the global weight calculation focuses on the multiplication performed on each aspect of the hierarchy. The final result is the sum of each criterion and sub-criteria according to the supplier company (see Table 1). Table 1 shows the total ranking of each supplier where the supplier who got the first rank is PT MMII with a global weight of 0.280. Code S1-S5 are the five companies (alternative), and SK1-SK11 are the sub-criteria suppliers. The following is the order of the five companies, described using a bar chart in Figure 3. The ranking process was conducted by applying the analytic hierarchy process (AHP) method.

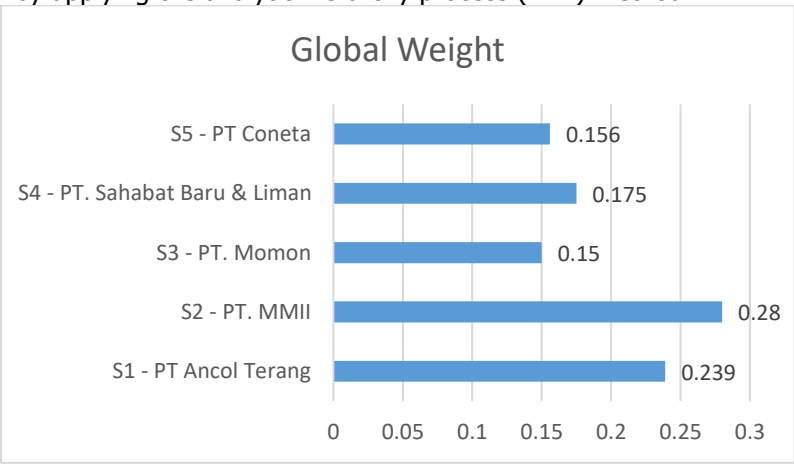

Figure 3. Global weight score

Table 1. Overall global weight

Criteria		Sub criteria		Corporate alternative				
				S1	S2	S3	S4	S5
K1	0.30	SK1	0.13	0.041	0.032	0.014	0.016	0.024
		SK2	0.11	0.037	0.029	0.013	0.015	0.021
		SK3	0.06	0.018	0.014	0.006	0.007	0.010
K2	0.30	SK4	0.08	0.018	0.027	0.015	0.009	0.007
		SK5	0.22	0.053	0.079	0.044	0.027	0.020
K3	0.12	SK6	0.10	0.020	0.034	0.017	0.019	0.010
		SK7	0.02	0.004	0.007	0.004	0.004	0.002
K4	0.13	SK8	0.11	0.016	0.016	0.016	0.031	0.030
		SK9	0.02	0.003	0.003	0.003	0.006	0.006
K5	0.15	SK10	0.04	0.007	0.010	0.005	0.010	0.006
		SK11	0.11	0.021	0.029	0.014	0.031	0.018
Total				0.239	0.280	0.150	0.175	0.156

Conclusion

AHP can be used in the method for making decisions to choose suppliers. The company can choose a supplier based on several prices, quality, delivery, quantity, and service criteria. The results show in the total weight calculation that PT MMII (S2) is the top-performing supplier company with a total score of 0.280. The resulting score is based on the sum of the criteria, sub-criteria, and alternative providers, the total weight calculated. The results of global weight calculations in PT Ancol Terang (S1) with a total score of 0.239. PT MOMON (S3) with a total score of 0.150, PT Central Sahabat Baru & Liman (S4) with a total score of 0.175, and PT CONETA (S5) with an overall score of 0.156.

Suppliers also have advantages on each criterion, so some suppliers have advantages on certain criteria in the company's pricing criteria. Other suppliers can improve and improve the quality, service, quantity, and delivery in providing services to the company. One of the supplier selections can be approached with the Analytical Hierarchy Process method.

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PowerPoint slideshow navigation control with hand gestures using Hidden Markov Model method

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Abstract: Gesture is the easiest and most expressive way of communication between humans and computers, especially gestures that focus on hand and facial movements. Users can use simple gestures to communicate their ideas with a computer without interacting physically. One form of communication between users and machines is in the teaching and learning process in college. One of them is the way the speakers deliver material in the classroom. Most speakers nowadays make use of projectors that project PowerPoint slides from a connected laptop. In running the presentation, the speaker needs to move a slide from one slide to the next or to the previous slide. Therefore, a hand gesture recognition system is needed so it can implement the above interactions. In this study, a PowerPoint navigation control system was built. Digital imaging techniques use a combination of methods. The YCbCr threshold method is used to detect skin color. Furthermore, the morphological method is used to refine the detection results. Then the background subtraction method is used to detect moving objects. The classification method uses the Hidden Markov Model (HMM). With 526 hand images, the result shows that the accuracy of the confusion matrix is 74.5% and the sensitivity is 76.47%. From the accuracy and sensitivity values, it can be concluded that the Hidden Markov Model method can detect gestures quite well as a PowerPoint slide navigation control.

Keywords: background subtraction, hand gesture, hidden Markov model, slide powerPoint, YCbCr

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Introduction

Gestures are the easiest and most expressive communication methods between humans and computers—especially gestures that focus on hand and facial movements. Users can use simple gestures to communicate their ideas with a computer without physically interacting. Techniques such as gesture recognition systems will capture the user's ideas without physical contact and increase the bond between the user and the machine. One form of application between users and machines is in college's teaching and learning process [1].

Along with the development of technology, the teaching and learning process in college will also develop. One of them is the way the speaker delivers material in the classroom. Most presenters nowadays make use of projectors that project PowerPoint slides from a connected laptop. When running his presentation, the speaker needs to slide from one slide to the next or the previous slide. To achieve this, ordinary presenters use several methods, by moving themselves, with the help of operators, or with tools. If the speaker moves the slide by himself, the speaker must walk closer to his laptop and press the keyboard button to operate it. Meanwhile, when using operator assistance, other people's help is needed, and misunderstandings often occur between presenters and operators. And finally, with tools. This tool is shaped like a pen that has a forward and backward button. The problem that often arises with this tool is battery life and the tool suddenly not running. Another method is needed for the speaker to interact with the hardware or laptop.

In the context of Human-Computer Interaction (HCI), gestures can be used to interact with machines. The hand gesture system is fascinating today because of its ease as a form of

interaction carried out by humans. Gesture detection or hand movement can be done with a camera/webcam installed on a laptop [2].

The method used is the Hidden Markov Model (HMM). The HMM method is the most widely used hand gesture recognition method. HMM is a statistical model in which the system being modeled is assumed to be a Markov process with unknown parameters. HMM represents the statistical behavior of a sequence of symbols that can be observed using a hidden state network with transition and emission probabilities. HMM can be used for pattern recognition once hidden parameters are identified using observable data [3]. Based on the explanation above, a hand motion detection application will be made using the Hidden Markov Model method for presenters in navigating PowerPoint slides. So, the presenters do not need to face the problems previously mentioned.

Previous research was conducted by Ying Yin and Randall Davis with the title Real-Time Continuous Gesture Recognition for Natural Human-Computer Interaction. This research was conducted using the Hidden Markov Model method. The Hidden Markov Model method is used to identify human poses [4]. Yanmin Zhu and Bo Yuan with the title Real-Time Hand Gesture Recognition with Kinect for Playing Racing Video Games. This research was conducted using the Hidden Markov Model method. The Hidden Markov Model method is used to control the game Need for Speed [5]. Aakash Anuj, Tanwi Mallick, Partha Pratim Das, and Arun Kumar Majumdar with the title Robust Control of Applications by Hand-Gestures. This research was conducted using the Hid-den Markov Model method and Kinect sensor. The Hidden Markov Model method is used to navigate PowerPoint [2]. Joko Sutopo, Mohd Khanapi Abd Ghani, M.A. Burhanuddin, and Zulwati with the title Gesture Recognition of Dance Chain Code and Hidden Markov Model. This research was conducted using the Hidden Markov Model method and the Chain Code feature extraction. The method is used to classify dance movements [6]. Roberto Pangihutan Situmeang conducted previous research with the title Implementation of the Hidden Markov Model Algorithm for Facial Gesture Recognition. This research was conducted using the Haar Cascade and Hidden Markov Model methods to classify facial cues [7]. Based on the research that has been done above, it will be possible to create a system that can combine hand gestures with the Hidden Markov Model meth-od to create a system that can replace presentation slides on PowerPoint.

Methodology

This study uses a dataset from the Cambridge Hand Gesture Dataset [8], which provides a collection of hand images intending to foster the development of hand pose recognition research. This dataset consists of 900 series of pictures from 9 gesture classes, consisting of 3 simple hand shapes and 3 simple movements. The dataset also has 5 different types of lighting. The dataset is divided into 3 labels based on the formed hand grapples. F label for hands with tight fingers (Flat), S label for hands with open fingers (Spread), and V label for hands with fingers forming the letter V, just like shown in Figure 1.

Figure 1. Gesture F, gesture S and gesture V

In designing this research, a soft device development method is used, namely the spiral model. The Spiral Model is an SDLC model, which combines architecture and prototyping in stages. This model combines the SDLC Waterfall and Iterative models with a significant emphasis on risk analysis. The main problem with the spiral model is determining the right time to make a move to the next stage. The shift to the next stage is still carried out as planned, even though the work in the previous stage has not been completed. The plan is prepared based on statistical

data, which has been received during previous work or even from the experience of a personal developer [9]. First threshold Iteration: Looks for a threshold value. The threshold is used to detect skin color. Different types of thresholds will be compared with each other and tested under certain conditions. The Second is Morphological Iteration: Looking for the right morphological method. Morphology is used to improve the threshold results. Various types of morphology will be compared with each other and tested under certain conditions. The Third is Dataset Iteration: Testing the dataset with the previous methods. The dataset will be separated into test data and training data. Then tested the accuracy with the HMM method. The Fourth is Hand Detection Iteration: Determine hand position by filtering and classifying blob. Test the dataset with real-time imagery. Adding a background subtraction method together with the threshold method. The Fifth is Motion Detection Iteration: Determines the centroid point to detect the user's hand movement. The difference between the points can command the slide to shift. The initial stage of each iteration is a literature study and application analysis based on previous work. The final stage of each iteration is to optimize the application to be lighter and more responsive.

The data is separated into test data and training data. Each data will be pre-processed by looking for a threshold value. The threshold value is used to separate the background color and foreground color which in this study is used to detect skin color [10]. In this study, the value of 64 is used. Different types of threshold will be compared with each other and tested under certain conditions [9]. In the Table 1, the authors compare various color spaces with their respective limits to obtain 3 threshold search methods.

Table 1. Threshold methods

No	Color Space	Threshold Value	Average computation time
1	RGB [11]	R > 95; G > 40; B > 20; Max(R,G,B) - Min(R,G,B) > 15; |R-G| > 15; R > G; R > B;	21,3117 ms / frame
2	HSV [12]	(0 < H < 0,24 || 0,74 > H > 1); 0,16 > S > 0,79;	44,1064 ms / frame
3	YCbCr [13]	78 <= Cb <= 126; 132 <= Cr <= 172;	18,9543 ms / frame

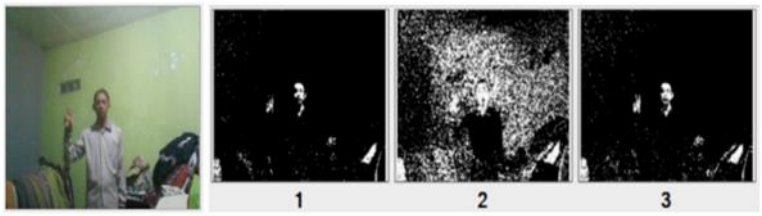


Figure 2. Threshold methods

Based on experiments with various color spaces and threshold values above in Figure 2, the authors decided to use method number 3, namely the YCbCr color space with a threshold value where the Cb value is between 78 to 126 and the Cr value between 132 to 172. The method is chosen based on the resulting image of the threshold that can capture skin color well and has fast computation time.

The next preprocessing is finding the right morphological method. Morphology is used to improve the threshold results. Various types of morphology will be compared with each other and tested under certain conditions. Morphological operations are performed on binary images to remove background noise in the image. The morphological operations used include dilation and then erosion. Thus, only hands that are colored skin are formed from the threshold result.

Then the median filtering was also carried out. The median filter replaces each pixel with a median or "middle value" pixel in the rectangular environment around the center pixel. The pixels of the image border is not changed so that the edge values can be preserved. In a binary image, because the value in the image consists of 2 values, '0' and '1', the more values are automatically taken as the middle value. Since unwanted noise in binary images appears in the

form of tiny white dots on a black background, these white noise pixels will be removed with a median filter, and since the edges are preserved, the contours of the hand are mostly obtained. Thus, facilitating the calculation of the geometry of the hand and radius [14]. In looking for morphological methods, the authors compare various morphological methods to obtain 3 morphological methods.

Table 2. Morphological methods

No	Morphological Method	Information
1	Dilation and erosion [15]	Lots of noise, thin gestures
2	Dilation, erosion, and fill holes [16]	Lots of noise, a form of broken gesture
3	Dilation, erosion and filter median [14]	Little noise, medium gesture form

Based on the experiment with the 3 methods above in Table 2, the authors decided to use method number 3 by using dilation morphology, erosion, and median filter. The choice of method was decided based on the results of the threshold of method 3, which is cleaner with less noise (white spots) and medium hand gesture form. not thin and not dashed

After the dataset is preprocessed using the threshold method and the morphology that had previously been determined. Accord.Net has provided a function to detect a collection of white dots that form a blob, like in Figure 3 below. From the collection of blobs obtained, only the largest blob is extracted as a hand shape. The extraction result is in the form of a binary image.

Figure 3. Binary image

During the pre-processing to blob extraction, researchers realized that not all images were processed/extracted properly. So the researchers decided to sort out the images that could be processed well with those that did not. From 900 data, 526 data were obtained, which could be processed and extracted the shape of the hand. Then each hand shape is divided as training data and test data. 17 test data were taken for each hand shape. Then obtained 475 data as training data and 51 data as test data. The obtained binary image is resized to be smaller. The size of the resize will affect the accuracy of the classification. Then the image is converted into a 1D matrix form. 1D matrix form can be seen in Figure 4.

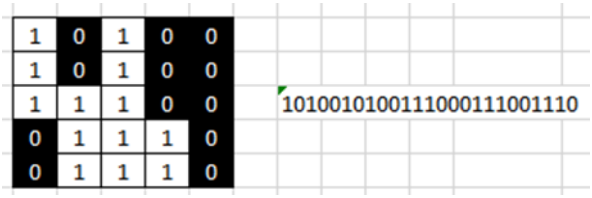


Figure 4. One dimensional matrix

The series of numbers formed will be used in classification using the Hidden Markov Model (HMM). The learning process on HMM can be done repeatedly according to the wishes of the researcher, which will also affect accuracy. The HMM learning process of training data is carried out every time the application runs for the first time. So that the determination of the size of the resize and the number of iterations greatly affects the speed of the application when it is first to run.

The research process endeavor is the dataset is taken from the "Cambridge Hand Data Set." Then the data is separated into test data and training data. Each data will be pre-processed

and the same feature extraction. HMM will classify the results of the extraction of both. The classification results will be used as an assessment of classification accuracy. Second, the data is retrieved from the laptop webcam. Then do pre-processing and feature extraction as before. The extraction results will be classified with the extraction results from the previous training data. The classification results will determine whether the PowerPoint slides are shifted or not. More or less, the process flow can be seen in Figure 5.

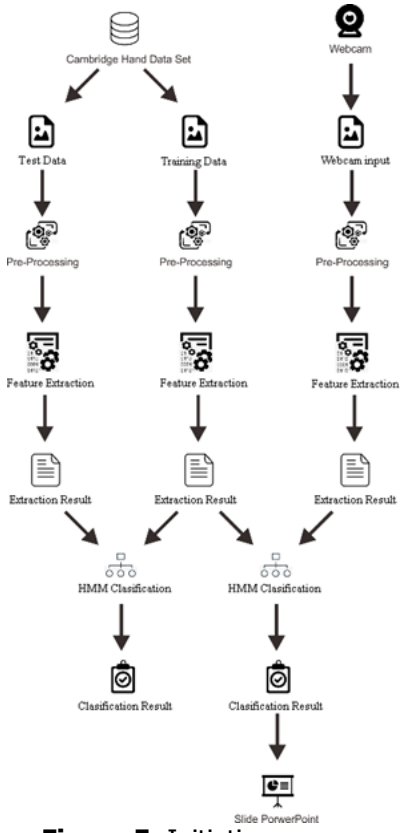


Figure 5. Initiative process

Results and Discussions

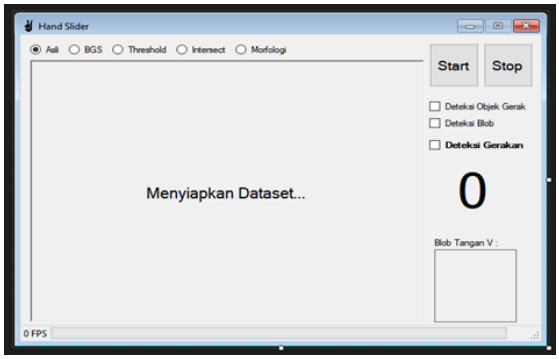


Figure 6. User interface

The background subtraction method is applied to distinguish the background and moving objects. In simple terms, this method works by parsing pixels from the background image and pixels from the foreground image. The background image and the foreground image are converted into a grayscale image, then look for the difference in each pixel of the two images. If the difference in the value of the two pixels exceeds the predetermined value (in this study, the value 64 is used), then the pixel is considered part of a moving object. This method can help reduce complex backgrounds.

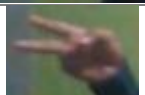
Figure 7. Background subtraction method

The resulting image from the background subtraction in Figure 7 will then be combined with the threshold method. Merging is done by the AND operation. Only white pixels from both the image, the background image, and the foreground image will be displayed as merged pixels. So that the image that is formed is an image which is a combination of white pixels from the two images. Result can be seen in Figure 8.

Figure 8. Combining background subtraction and threshold methods. Background subtraction (A), Threshold (B), Combining result (C)

After being combined, the images are subjected to a morphological process. Detecting the hand's position is done in two ways, namely filtering the blobs and classifying the blobs. The blob is filtered by limiting the width of the blob and the length to width ratio of the blob.

Table 3. Hand distance measurement with camera

Distance	Hand Image	Hand *Blob*
30 cm		
50 cm		
100 cm		
150 cm		
200 cm		
250 cm		

Based on Table 3 above, the hand gesture blob at a distance of 30 cm is not detected properly where the palm part is not fully detected. At a distance of 50 cm to 150 cm, blobs of hand gestures and fingers are well-formed. Meanwhile, at a distance of 200 cm to 250 cm, the fingers begin not to form properly. Therefore, the hand distance to the camera is limited to approximately 50 cm to 150 cm. The detection distance is measured based on the size of the hand blob obtained. At a distance of 50 cm, the blob size is defined as a minimum height of 15 pixels and a minimum width of 35 pixels. At a distance of 150 cm, the blob size is determined with a maximum height of 65 pixels and a maximum width of 125 pixels. The blob ratio will also be measured so that only the horizontal blob is processed. The blob ratio is obtained by dividing the width of the blob and the height of the blob. A blob with a ratio value between 1.25 and 3.0 is selected, which will then be classified.

Then the blob is classified by the HMM method. The Hidden Markov Model, better known as the Hidden Markov Model (HMM), is a statistical model of a system assumed to be a Markov process with unknown parameters. The hidden Markov model has been known to use reinforcement learning and recognition of temporary strands such as words, handwriting, gestures, music, and bioinformatics [17]. In the Hidden Markov Model, a general model is used in modeling the problem. Equation 1 is a general model used in the Hidden Markov Model.

$$\lambda = (A, B, \pi) \quad (1)$$

There is a symbol of lamda (λ) as the Markov model, A as the transition probability, B is the probability of observation, and the symbol phi (π) is the probability of the initial state [18]. Three fundamental problems must characterize the Hidden Markov Model: Problem 1 (likelihood): Determine the proximity value P (O | λ), from HMM λ = (A, B) and the series of observations O. Problem 2 (Decoding): Determining the best-hidden state sequence, from HMM λ = (A, B) and a series of observations O. Problem 3 (Learning): Determine the parameters of HMM A and B from a set of HMM states and a series of observations O.

Each classified blob will form a bounding box around it with a different color, presented in Figure 9. Label F will have a bounding box in red, label S in green and label V in blue. The classified blob with the label V shall be considered a hand.

Figure 9. Blob detection

After getting the hand position, the hand centroid point is obtained by looking for the center of gravity point from the Accord.NET library. The point is then stored in the variable to compare the difference with the centroid point of the next hand. This center of gravity will also determine which hand the user is pointing at. The result of hand detection is shown in Figure 10. The application can detect movement to the right, left, up, and down so that the coordinate points on the X and Y axes will be saved as variables. Each part of the hand is only allowed to perform one specific movement. For example, if the right hand is detected, the only movement to the left is vice versa. The general movements are up and down movements, and individual parts of the hand can perform general movements.

Then the next new frame will also detect the position of the hand and the coordinates of X and Y and stored them in the new variable. Next, we will look for the difference between the old X or Y values. The difference limit needs to be set to reduce the sensitivity of detection that is too fast and avoid the detection of other blobs that are too far from the starting point. The difference between the coordinates of the specific motion required to be considered moving is if the point has a value between half the width of the blob and 2 times the width of the blob. Meanwhile, the general movement is if the point has a value between half of the blob's height and 2 times the blob's height.

If the difference between the new X value and the old X is between the difference margin, then the application gives a command to the right or left to the program depending on the direction of the hand movement. If the hand moves to the left, the application sends the command swipe to the next slide—Vice versa. And if the hand moves up, the application sends a command to go to the initial slide. Hands down, it means going to the final slide. The result of movement detection is shown in Figure 11.

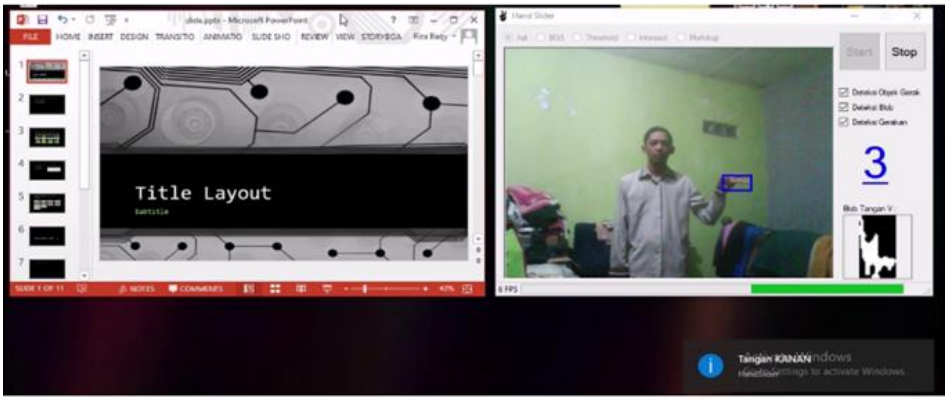


Figure 10. Hand detection

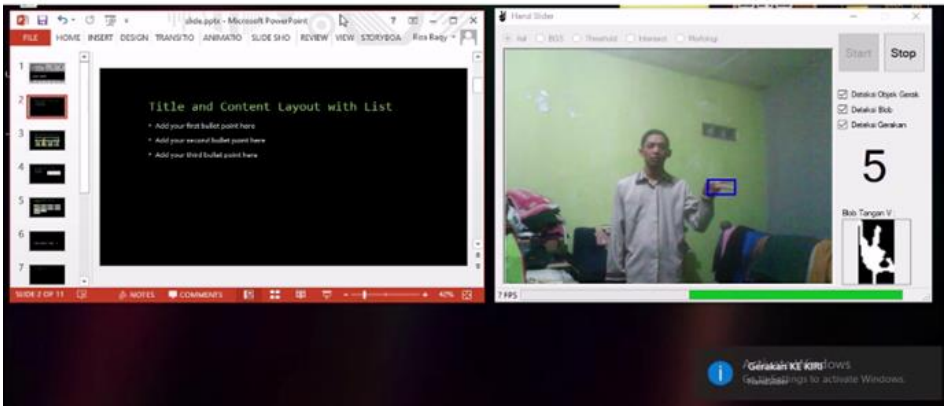


Figure 11. Movement detection

The application has provided a countdown time and notification for the user to determine how long it will take until a motion is detected. A waiting time is provided before making the next movement. Like the difference limit, the waiting time is earmarked to reduce detection errors due to the fast detection process. The duration of time until motion is detected is 5 seconds. The waiting duration is 2.5 seconds if motion is not detected and 5 seconds when motion is detected. A notification will also be displayed intended when the slideshow is displayed on full screen. One form of error detection is when the user actively uses his hands. It is hoped that users will keep a sufficient distance from the camera's detection range so that the camera does not easily detect the user's hand movements. Or by pointing the camera in another direction where the user is not always visible in the camera's distance.

Accuracy testing in Table 4 was carried out using 475 training data and 51 test data. Testing is carried out with the help of applications that are devoted to conducting training and testing. The test will focus on one of the hand labels, namely the V label. There are 2 test parameters, namely the resize blob size and the learning iteration which are shown in Table 5. The resize sizes tested were 5x5, 10x10, 15x15, 20x20, and 25x25 with normal iterations (100 times).

Table 1. Accuracy test results

	Total			F			S			V		
Size	**T**	**F**	**%**	**T**	**F**	**%**	**T**	**F**	**%**	**T**	**F**	**%**
5	28	23	54,90196	11	6	64,70588	10	7	58,82353	7	10	41,17647
10	26	25	50,98039	13	4	76,47059	6	11	35,29412	7	10	41,17647
15	26	25	50,98039	10	7	58,82353	5	12	29,41176	11	6	64,70588
20	30	21	58,82353	10	7	58,82353	7	10	41,17647	13	4	76,47059
25	26	25	50,98039	11	6	64,70588	2	15	11,76471	13	4	76,47059
30	25	26	49,01961	11	6	64,70588	2	15	11,76471	12	5	70,58824
35	25	26	49,01961	11	6	64,70588	2	15	11,76471	12	5	70,58824
40	28	23	54,90196	11	6	64,70588	4	13	23,52941	13	4	76,47059
45	22	29	43,13725	12	5	70,58824	10	7	58,82353	0	17	0
50	17	34	33,33333	17	0	100	0	17	0	0	17	0
100	26	25	50,98039	11	6	64,70588	3	14	17,64706	12	5	70,58824
125	26	25	50,98039	11	6	64,70588	3	14	17,64706	12	5	70,58824

Table 5. Iteration accuracy test results

Iteration	**Total**			**F**			**S**			**V**		
	T	**F**	**%**	**T**	**F**	**%**	**T**	**F**	**%**	**T**	**F**	**%**
50	23	28	45,09804	13	4	76,47059	10	7	58,82353	0	17	0
100	30	21	58,82353	10	7	58,82353	7	10	41,17647	13	4	76,47059
150	30	21	58,82353	10	7	58,82353	7	10	41,17647	13	4	76,47059
200	30	21	58,82353	10	7	58,82353	7	10	41,17647	13	4	76,47059
250	30	21	58,82353	10	7	58,82353	7	10	41,17647	13	4	76,47059

Based on the test results in Table 4, resize with sizes 20x20, 25x25, and 40x40 have a high accuracy value on the V label, 76.47%. But the author will use a size of 20x20 to save and speed up the process of training and testing the application. Then iteration parameter testing is carried out. The number of iterations tested was 50, 100, 150, 200, and 250 times. Based on the test results in Table 5, iterations above 100 times have a high accuracy value on the V label, 76.47%. But the author will use iterations 100 times to save and speed up the process of training and testing the application.

In evaluating the performance of the algorithm, you can use a confusion matrix reference. The Confusion Matrix represents the prediction and actual (actual) conditions of the data generated by the algorithm. We can determine accuracy, precision, sensitivity, and specifications [19]. There are 4 terms as a representation of the result of the classification process on the confusion matrix. The four terms are True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN).

Table 6. Confusion matrix

		Prediction		
		F	S	V
Actual	F	10	4	3
	S	4	7	6
	V	2	2	13

Based on Table 6, it can be determined the calculation of accuracy, precision, and sensitivity to the V label. Label V is positive data while label F and label S are negative data. Results should be clear and concise. The results should summarize (scientific) findings rather than provide data in great detail.

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} = \frac{13 + (10 + 4 + 4 + 7)}{10 + 4 + 3 + 4 + 7 + 6 + 2 + 2 + 13} = \frac{38}{51} = \mathbf{74,5}\%$$

$$Sensitivity = \frac{TP}{TP + FN} = \frac{13}{13 + (2 + 2)} = \frac{13}{17} = \mathbf{76,47}\%$$

The efforts to improve accuracy were made by reducing the dataset to 330 datasets, consisting of 300 training data and 30 test data. Reduced data is ambiguous data. For example, the image resulting from the threshold label F resembles the image resulting from the threshold label V. Thus, the data should be eliminated.

Table 7. Confusion matrix improved accuracy

		Prediction		
		F	S	V
Actual	F	7	3	0
	S	0	9	1
	V	1	3	6

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} = \frac{6 + (7 + 3 + 0 + 9)}{7 + 3 + 0 + 0 + 9 + 1 + 1 + 3 + 6} = \frac{25}{30} = \mathbf{83,33}\%$$

$$Sensitivity = \frac{TP}{TP + FN} = \frac{6}{6 + (1 + 3)} = \frac{6}{10} = \mathbf{60}\%$$

Based on Table 7, the elimination resulted in an increase in the accuracy value from 74.5% to 83.33%. But the detection of the V label is getting worse. This is due to the decrease in the sensitivity value from 76.47% to 60%. So that researchers continue to use the initial dataset with a sensitivity of 76.47% in the application.

Motion detection testing was carried out with 3 different subjects (S1-S2-S3) by counting the hand movements needed to shift the entire slide. A total of 5 slides (5 moves) will be tested to detect left and right movements. And for the up and down movements are also 5 movements using the right hand.

Table 8. The test results shifted the slides

Movement Direction	Number of Moves			Minimum Movements	Maximum Movements
	S1	S2	S3		
Left	5	8	10	1	5
Right	10	10	7	1	4
Up	9	6	7	1	3
Down	6	6	8	1	3

Based on the test results in Table 8, the slides can be shifted by performing one motion. The difference in the number of movements is influenced by several factors, which are the lighting position and movement speed. The light source position can affect the skin tone detection received by the camera and can lead to false detection or detection failure. Movement speed that is too fast will cause objects to look blurry, which will result in failed detection.

Conclusion

The result shows that the accuracy of the confusion matrix is 74.5%, and the sensitivity is 76.47%. From the accuracy and sensitivity values, it can be concluded that the Hidden Markov Model method can detect gestures quite well as a PowerPoint slide navigation control.

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Application for data collection and monitoring of COVID-19 patients in Sukorame Community Health Center

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Abstract: The significant increase in COVID-19 cases in Indonesia in May-July 2021 overwhelmed health workers. One of the efforts to monitor the spread of COViD-19 disease is collecting data on patients and proper monitoring. For example, the Sukorame Community Health Center, Mojoroto Kediri, does not yet have an application to record and monitor COVID-19 patients. Data collection is currently done manually by writing in books and excel. This study designed and built a data collection and monitoring application for COVID-19 patients to help Puskesmas staff obtain more accurate patient data and monitor the related patient data. This study implements the waterfall method, including system requirements, design, implementation, verification, and maintenance. The results of this study are the applications that can help and facilitate Community Health Center in collecting data on COVID-19 as a form of effort in overcoming and preventing the spread of COVID-19 in the work area of Sukorame Community Health Center, Kediri City. Based on the user satisfaction questionnaire results, 75% of users consisting of staff and heads of community health centers were helped by this application.

Keywords: COVID-19 applications, community health center, web application

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Introduction

COVID-19 (Coronavirus Disease 2019) is a disease caused by a new type of coronavirus (SARS-CoV-2) which began to spread in early 2020 [1]. This virus was first discovered at the end of December 2019 in Wuhan, China, and then infected approximately 217 countries worldwide with a total of 218,946,836 [2]. Meanwhile in Indonesia, based on data from the COVID-19 Task Force as of September 2, 2021, there were 4,116,890 confirmed cases, 3,813,643 recovered and 134,693 deaths [3]. On September 2, 2021, there were 8955 confirmed cases, according to data from the covid19.go.id website. The distribution of covid 19 is primarily on the island of Java, particularly in the provinces of DKI Jakarta and West Java, as indicated in Figure 1.

Common symptoms in people infected with the virus are fever over 38 degrees Celsius, dry cough, and shortness of breath. COVID-19 is spread from an infected person when coughing, sneezing, talking, singing, or breathing through small particles through the nose or mouth. These liquid particles vary in size, from larger airway droplets to smaller sprays. The virus can enter the mouth, nose, or eyes, most likely when having direct or close contact with a distance of less than 1 meter with an infected person. Aerosol transmission may occur indoors, crowded, poorly ventilated areas where infected people spend more time with others. So on reducing the spread of the virus by applying the 3M Sanitary Protocol, namely, wearing a maker, maintaining distance, and washing hands properly and cleanly.

Figure 1. The spread of COVID-19 in Indonesia, on September 2, 2021
(Source: https://covid19.go.id/peta-sebaran-covid19)

Based on the Decree of the Minister of Health of the Republic of Indonesia Number HK.01.07/MENKES/413/2020 concerning Guidelines for the Prevention and Control of Coronavirus Disease 2019 [4] the operational definition of COVID-19 cases used in the practice of collecting data on COVID-19 cases is Suspected Cases. Probable Cases, Confirmed Cases, Close Contacts, Travelers, Discardedm Completed Isolation and Death. For Suspected Cases, Probable Cases, Confirmed Cases, Close Contacts, the terms used in the previous guidelines are People Under Monitoring (ODP), People Without Symptoms (OTG) Patients Under Monitoring (PDP).

1. Suspected Case
   A person who has one of the following criteria:
   a. Persons with Acute Respiratory Infections (ARI) and in the last 14 days before the onset of symptoms have a history of travel or living in a country/territory of Indonesia that reports local transmission
   b. People with one of the symptoms/signs of ARI and in the last 14 days before symptoms appeared had a history of contact with confirmed/probable cases of COVID-19.
   c. People with severe ACI / severe pneumonia require hospitalization and no other reason based on conclusive clinical features.
2. Probable Case
   Suspected cases with severe ARI/ARDS/died with a convincing clinical picture of COVID-19 and no RT-PCR laboratory results.
3. Case Confirm
   A person who has tested positive for COVID-19 in an RT-PCR laboratory test. The approval cases are divided into :
   a. Confirmed cases with symptoms (symptomatic)
   b. Confirmed asymptomatic cases (asymptomatic)
4. Close Contact
   Persons who have been exposed to possible or confirmed cases of Covid-19. Relevant contact history includes:
   a. Personal/surroundings contact with possible or confirmed cases within a radius of 1 meter and 15 minutes or more
   b. Direct physical contact with possible or confirmed cases (eg, handshaking, holding hands)
   c. Persons directly managing potential or confirmed cases without the use of standardized PPE
   d. Other situations indicating exposure are based on a local risk assessment carried out by the local epidemiological investigation team (explanation attached).
      In possible or confirmed cases that are symptomatic (symptomatic) to find close contact, the exposure time is calculated from 2 days before the onset of symptoms and up to 14 days after symptoms. In finding close contacts in confirmed asymptomatic cases, the contact period was calculated from 2 days before and 14 days after the sampling date from the confirmed case.

5. Traveler:
   A person who has entered the country from abroad or traveled within the country in the last 14 days.
6. Discarded
   It will be dropped if it meets any of the following criteria:
   a. Suspect with negative duplicate RT-PCR results for two consecutive days> 24 hours
   b. A person in close contact who has completed 14 days of quarantine
7. End the insulation
   Complete insulation if it meets any of the following criteria:
   a. Confirmed asymptomatic (asymptomatic) cases without RT-PCR observation with an additional ten days of self-isolation since diagnostic confirmation sampling.
   b. Probable / confirmed cases with symptoms (symptomatic) that RT-PCR did not monitor were ten days from the start date plus at least three days after no fever symptoms and respiratory distress.
   c. Possible / confirmed cases with symptoms (symptomatic) with adverse 1X RT-PCR monitoring plus at least three days after the absence of fever and respiratory problems symptoms.
8. Death
   COVID-19 deaths for surveillance purposes are confirmed/probable cases of COVID-19 who died.

One way to handle COVID-19 in Indonesia is by finding cases at the entrance and in the region. Case finding activities at the entrance are aimed at identifying the presence or absence of cases through state entrances, either through air/seaports or border areas (checkpoints). Meanwhile, case-finding activities in the region can be carried out at the first level of health services as well as in the community. What is meant by "region" is the administrative area of the province and district/city [5].

Sukorame Public Health Center is one of the leading healthcare providers in Kediri, striving to provide public health and critical individual health efforts, prioritizing advocacy and prevention efforts to achieve the highest levels of public health in Kediri. Sukorame Health Center is involved in community management and settlement in the Kediri district. Hemorrhagic officials will review, report, escalate and respond to any evidence of Covid-19 that requires an immediate response. The response to control is by identifying and tracking contacts, sending, communicating, and breaking the transmission chain.

In handling cases, if probable or confirmed cases are found, the health center or known as "puskesmas" will dig up information by tracing people who have close contact with probable and confirmed patients. The close contact period is calculated based on the provisions of the Minister of Health Decree that has been described previously. From the results of tracing the close contacts obtained, the health center officers will collect data and monitor for 14 days on residents with close contact status and will change the status based on the development of conditions during observation.

From the analysis of the situation that has been described, there are problems faced by Sukorame Community Health Center, namely the absence of a computerized system that can assist health center officers in recording and monitoring [6] the operations of COVID-19 cases. The Puskesmas still uses the conventional method by using stationery and excel applications in collecting data on COVID-19 cases. So that the data collection process is not systematic and inefficient in terms of functionality and time.

Several studies that have relevance to the development of the COVID-19 Application include the research with the title "Creating a Covid-19 Patient Reservation Application At Muhammadiyah Hospital Bandung" [7]. This study aims to develop an online registration application; The results of this application indicate a change in the Covid-19 patient registry. What originally led patients to go to the hospital for registration became online, through electronic devices connected to the Internet. Meanwhile, Erni Rihyanti conducted research in 2020 entitled "Development Of Android-Based Mobile Learning Applications For Covid-19 Patients ". This study aims to The Mobile Learning Application for the Help of Covid-19 sufferers aims to make it easier for anyone to learn about the Aid of Covid-19 Patients. This application can be used using mobile devices anytime and anywhere [8]. There is research related to data collection and monitoring

titled "Web and android-based application for monitoring tuberculosis (TB) patients in Kediri City" to collect data of TB patients and monitor its medication [9].

Methodology

1. Data Collection Methods
   The method of collecting data or information used in this study is as follows :
   a. Interview
      The interview method is carried out by asking questions to related parties. In this case, the speakers were the Sukorame Community Health Center's head and staff. Based on the interviews that have been conducted, it can be concluded that currently, the health office needs an effective system to collect and monitor COVID-19 data, and can be accessed anytime or anywhere using internet technology. The system that is currently running is still using the manual method, namely recording treatment information on paper. This is considered less effective and efficient if we look at the availability of existing technology. That is why it is necessary to create an application to collect and monitor COVID-19 patients' data that can increase effectiveness and efficiency.
   b. Literature Review
      A literature study is a method of data collection carried out by searching, reading, and collecting documents as references such as books, articles, and final project literature related to selected topics related to the object of research. So it gets a useful theoretical overview helps analyze and design as well as write this report.
2. System Development Methods
   This study implements the waterfall method [10], which consists of several phases as shown in Figure 2, including system requirements analysis, system design, program code writing, program testing, and program implementation and maintenance, which are explained below:

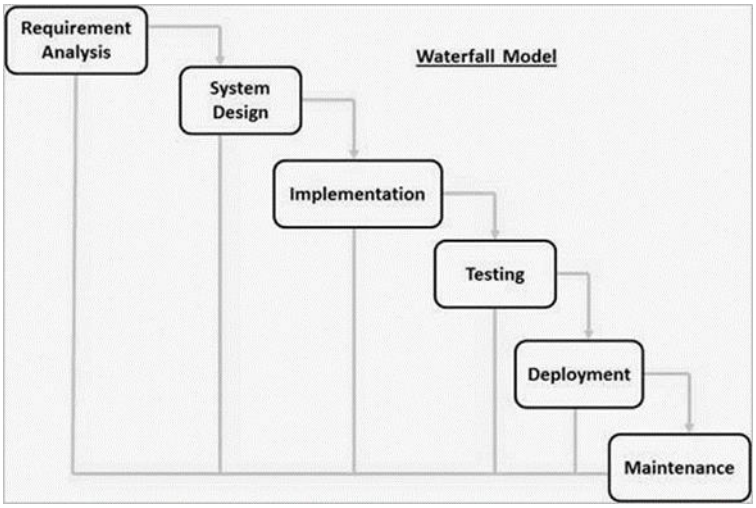

Figure 2. Waterfall model

   A. System Requirements Analysis
      At this stage, an analysis of the system requirements is performed. Data were collected through interviews or bibliographic studies. Interviews were conducted with several people, namely the Sukorame Community Health Center officials. In addition, they conducted a bibliographic study as described in previous studies. In this phase, a user requirements document is created, or it can be said that it is data related to the user's preferences when creating the system. Finally, this document serves as a reference for the analysis system to be translated into the programming language.
   B. System Design
      The design process will translate the requirements into a software design that can be estimated before coding is made. This process focuses on data structures, software architecture, interface representations, and procedural details (algorithms). The system

design stage will produce a document called a software requirement. Programmers will use this document to carry out system creation activities.

C. Writing Program Code
Coding is the translation of designs into a computer-recognized language by a programmer who translates user transactions. This phase is the actual phase of working with the system because it maximizes computer usage. An application has been developed in a website for an administrator, a Community Health Center employee, and the Director of the Sukorame Community Health Center. Tests are performed on the previously created system when the coding is complete. The purpose of testing is to find design flaws and then correct them.

D. Program Testing
This stage is the final step in making a system. After analyzing, designing, and coding the system that has been used by the user. In this case, system testing is carried out by Community Health Service Officers, and The Head of Sukorame community health center.

E. Maintenance
Software that is difficult to deliver to customers will change. These changes may be related to errors because the software needs to adapt to the environment (new peripherals or operating systems) or because the customer needs functional development.

3. Functional Requirement
Functional requirements are system process requirements that run according to the user functions of the system. For the web application, this system has three users, namely system administrator, community health center officer, and The Head of Sukorame community health center.

Table 1. Functional requirement

User	Requirements
System Administrator (web)	- Manage District, Sub-district, and Medical Facilities Data
Community Health Center Officer(web)	- Submit and manage patients' data - Manage report data
The Head of Sukorame Community Health Center (web)	- See report data of the patient - See recapitulation data of the patient

4. System Architecture
In this research work, we develop a web-based application for collecting and monitoring COVID-19 patients which has a system architecture as shown in Figure 3. The application is divided into web applications and mobile applications. There are three user levels in the web application namely; The System Administrator, the Community Health Center Office, and The Head of Suko-rame Community Health Center.

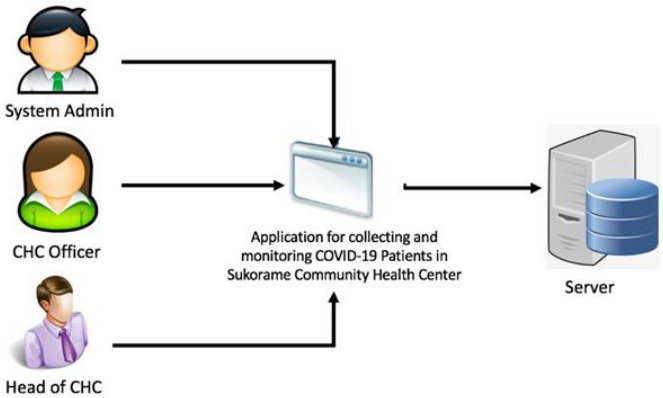

Figure 3. System architecture

For the system architecture, the head of the health center view patient reports from the database server, admins can manage data to be displayed by the system, officers can input patient data into the system.

5. Use Case Diagram
In this COVID-19 patient data collection and monitoring application, there are 3 main users, namely the system admin user who has the authority to add master data, the officer (CHC Officer) user who has the authority to add COVID-19 patient data, and the head of CHC user who has the authority to view the data patient report as illustrated in Figure 4.

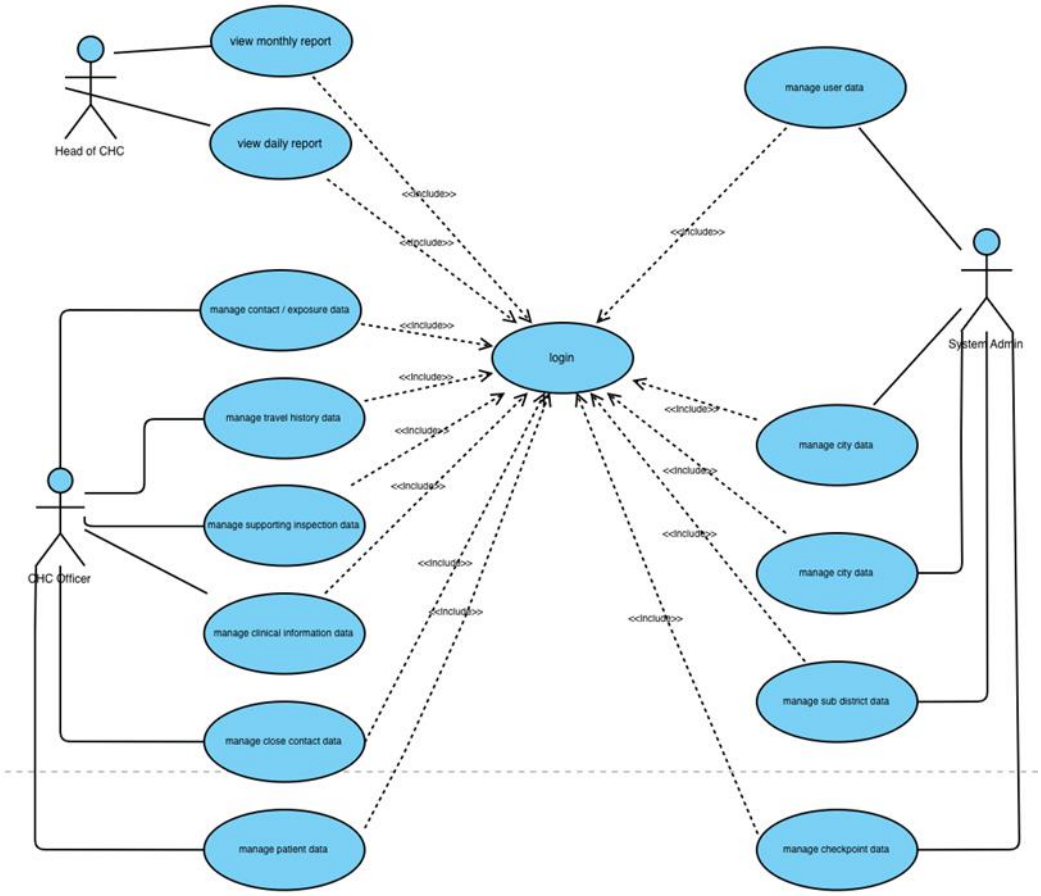

Figure 4. Use case diagram

6. Entity Relationship Diagram
In an application, ERD is the underlying structure of a database system and is used to illustrate the data model concept that happens to the system that is being built. Figure 5 illustrated the relationship between the tables, which provides an overview of each system's related processes.

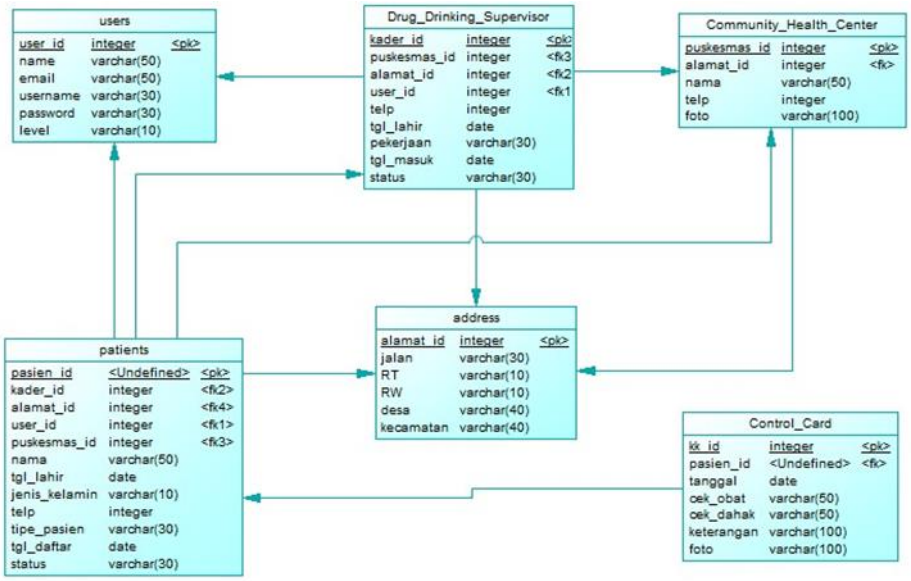

Figure 5. Entity relationship diagram of an application

The relationship between the tables describes a database that is useful for storing data needed to build applications. Here's a more complete explanation.

a. The city table has the city_id attribute as the primary key, city_name.
b. The sub-district table has the kec_id attribute as the primary key, district_name.
c. The kelurahan table has the kel_id attribute as the primary key, kelurahan.
d. In the user table has the attribute peng_id as the primary key, name, email, username, password, photo, level.
e. In the patient table, the attribute nik is the primary key, name, parent_name, date of birth, age, age_b, gender, occupation, address, rt, rw, no_telp, longitude, latitude, kat, note.
f. The p_support table has the penj_id attribute as the primary key, tgla, tmpa, hsla, tglb, tmpb, hslb, tglc, tmpc, hslc, tgld, tmpd, hsld, tgle, tmpe, hsle, tmp, jng, hg, tmpg, hslg.
g. In the examination_place table has the tmp_id attribute as the primary key, place_name.
h. In the clinical table it has the clinical_id attribute as the primary key, date of symptoms, fever, fever, status, cough, runny nose, throat, breath, head, weakness, muscle pain, nausea, abdomen, diarrhea, others, pregnancy, diabetes, heart disease, hypertension, malignancy, g_immunology, G_kidney, g_liver, COPD, others2, diag_1, diag_2, diag_3, diag_4, diag_5, st_rs, nama_rs, log-in_rs.
i. In the table r_perj1 has the attribute perjl1_id as the primary key, status, country, city, date_perj, date_arrival.
j. In the table r_perj2 has the attribute perjl2_id as the primary key, status, prov, city, tgl_perj, tgl_tiba.
k. In the table r_perj3 has the attribute perjl3_id as the primary key, status, prov, city.
l. In the table r_perj4 has the attribute perjl4_id as the primary key, status, name, address, relationship, initial date, end date.

Results and Discussions

The results of the development of a web-based data collection and monitoring of COVID-19 patients in Sukorame Health Community Center application are described in the section below.

Results

Administrator Page

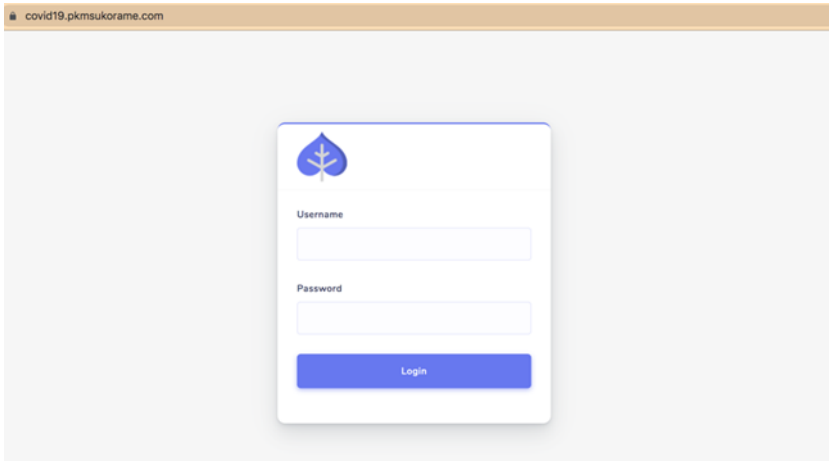

Figure 6. Login page

The display of the initial login page for all user levels is shown in Figure 6. When the username and password are wrong, it will display a warning.

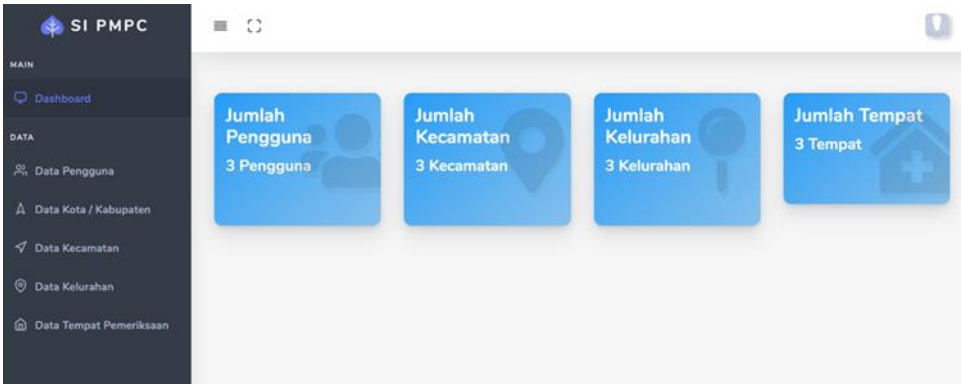

Figure 7. Home of administrator page

Figure 7 shows the dashboard of the admin. The page will be displayed when successfully logged in as admin. As illustrated in the figure there is some menu to manage user data, city, district, sub-district, and medical facilities data.

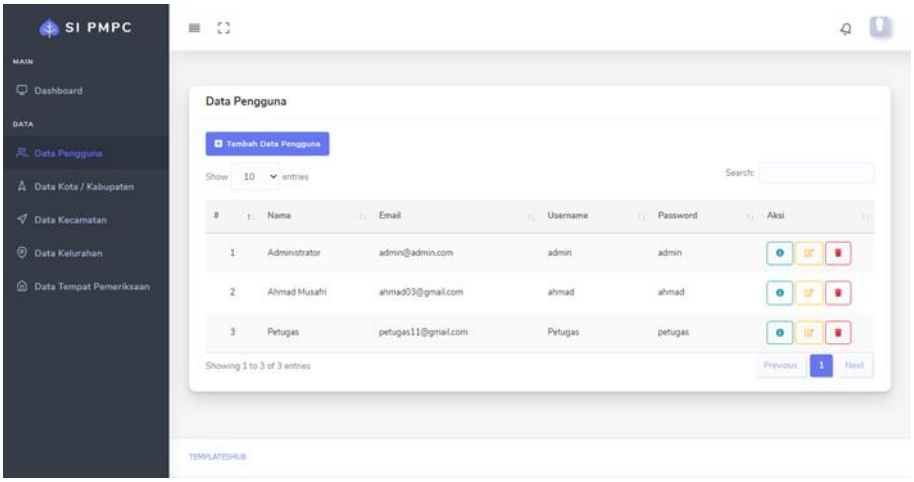

Figure 8. User data page

In this menu, the user data page is a page to display user data. Admin can add data in the form of name, email, username, password. On the user data page, there is an edit data action, view data, and delete data, which is shown in Figure 8.

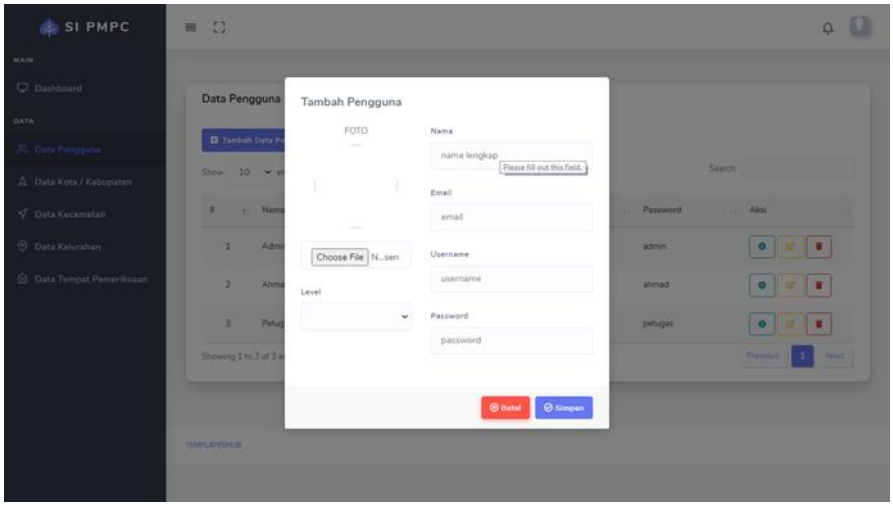

Figure 9. Add user data

The page for adding user data is shown in Figure 9. On this page, the admin can add data by filling in the data, when it is finished and saved then click the save button, if not click cancel.

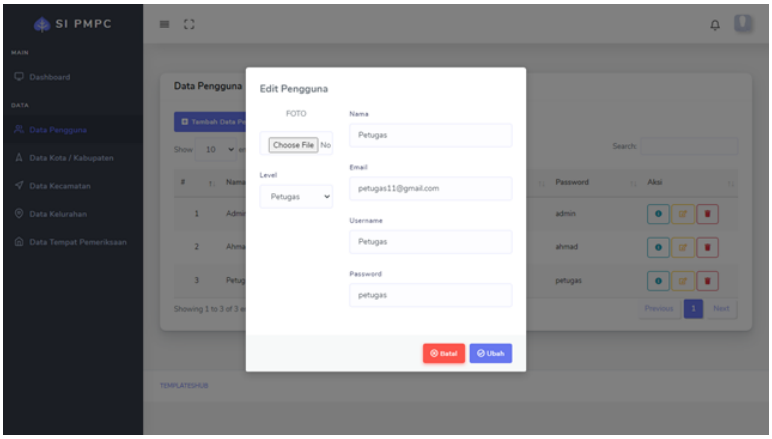

Figure 10. Edit users data

Figure 10 shows the page to edit user data. On this page, the admin can edit user data when there is a data change.

Sukorame Community Health Center Officer Page

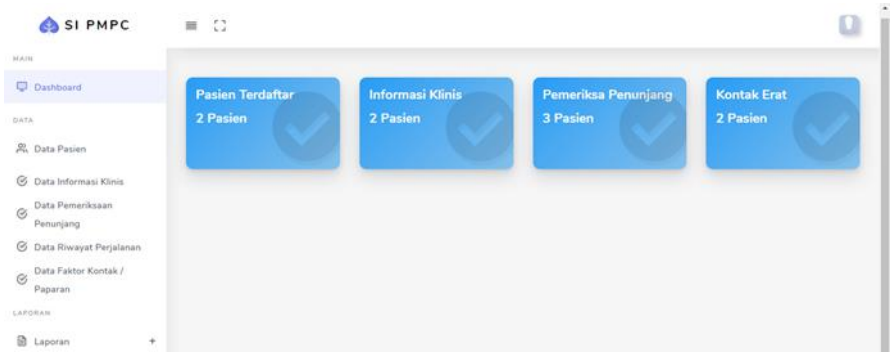

Figure 11. Community health center officer dashboard

The officer dashboard is a page to display the number of patients, patient clinical information, supporting examinations, and close patient contacts which are illustrated in Figure 11.

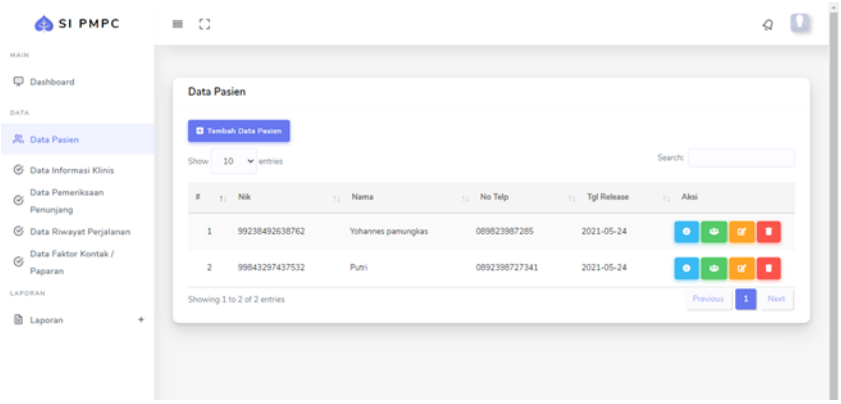

Figure 12. Patients data page

Figure 12 is a page to display patient data. Officers can add data that contains some details of the patient's profile. On the patient data page, there is an action to edit data, view data, and delete data.

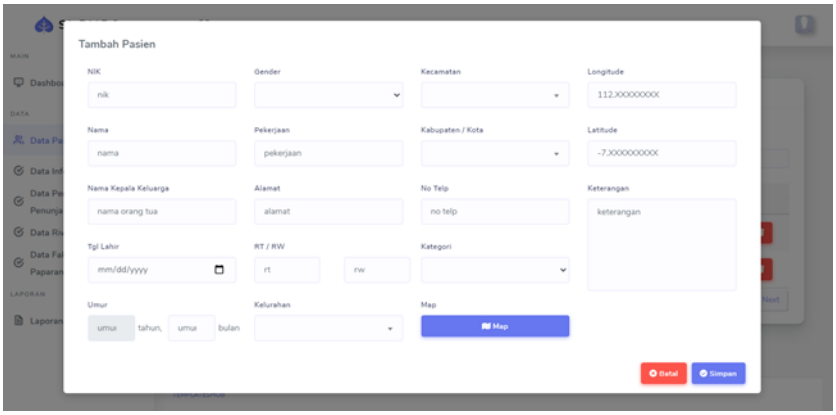

Figure 13. Add patient data

Figure 13 shows the page to add patient data. On this page, the officer can add data by filling in the data, when it is completed and saved then click the save button, if not click cancel.

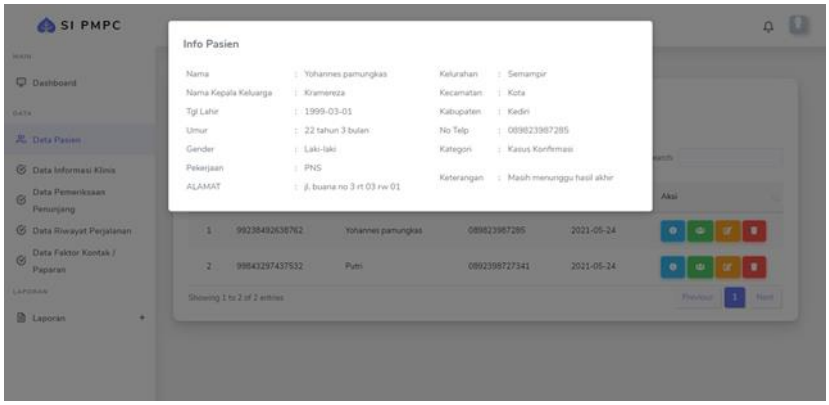

Figure 14. Show the detail of patient data

On this page, officers can view patient info, to view details of the patient's profile, this process is illustrated in Figure 14.

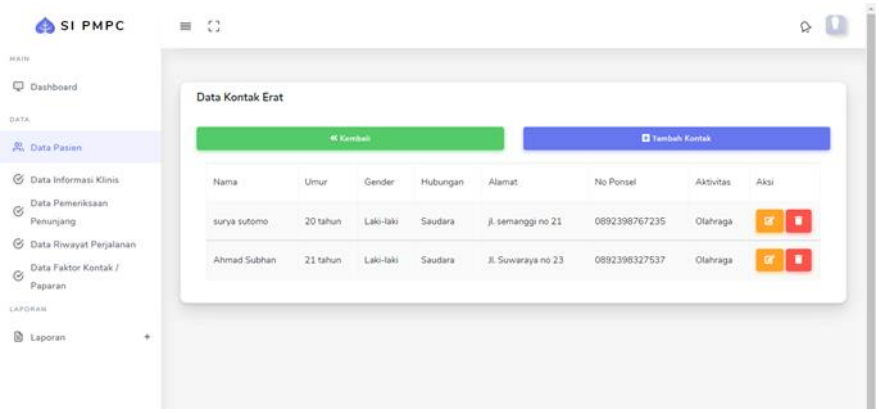

Figure 15. Close contact data page

Figure 15 displays Close contact data page is a page to display close contact data for each patient. Officers can add data that contains several details of patient profiles exposed from previous patients. On the close contact data page, there is an edit data action, view data, and delete data.

Discussions

Black box testing is used to determine whether the application features are well developed or not by trying all the available features, as shown in the table below:

Table 2. Blackbox testing result

No	Scenario	Expected Result	Valid / Not Valid
1	Open the web application	The application shows the login screen	Valid
2	Show Administrator Dashboard	Administrator Dashboard successfully displayed	Valid
3	Show District dan Sub-District Data	Menu District dan Sub-District successfully displayed	Valid
4	Delete District dan Sub-District Data	The selected data can be removed from the database.	Valid
5	Show Community Health Center Staff Menu Dashboard	Community Health Center Staff Menu Dashboard successfully displayed	Valid
6	Show Patient Data	The application shows the patient data	Valid
7	Add, edit and Delete patient Data	Successfully add, edit or delete patient data.	Valid
8	Show report data	The report data successfully displayed	Valid

As we can see in the table, all functional requirements can be fulfilled in the application and run well, for example, the essential functions of patient data management where the community health center staff can add, edit and delete the details of patient data.

Conclusion

This research was successfully built as an Application for collecting and monitoring COVID-19 Patients in Sukorame Community Health Center. The website application has three user levels: ad-min, Community Health Center officer, and The Head of Community Health Center. All the

functions of the application are running well and fulfilled user requirements. Based on the results of the user satisfaction questionnaire, 75% of users were helped by this application to monitor COVID-19 patients.

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E-Learning course design and implementation in fuzzy logic

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Abstract: The goal of e-learning in fuzzy logic courses is to assist students in the learning process, create menu structures and simple operation techniques, and create prototypes for e-learning in fuzzy logic courses. The difficulty of students in implementing what they have learned stems from the fact that the advent of e-learning can make it simpler for students to access material that they do not comprehend. In this study, an analytic learning prototype was used as the research approach. The outcomes of e-learning products based on online apps in this fuzzy logic course can be used as learning material. The menu structure developed in this e-learning is a home page with an introduction to e-learning, a site page with participants, calendars, and notes. Pages that can be used to grow the network and courses are the most significant aspects of e-learning. E-learning includes material, discussion, forums, quizzes, and other activities. The findings of the validation by media specialists on this e-learning application are pretty good, indicating that it is suitable for use. According to the results of material expert validation, the material used is excellent, suggesting that it is ideal for use in fuzzy logic courses. The limited test results for Informatics study program students were in the very good category, indicating that this e-learning tool was simple to use.

Keywords: design, digital learning, e-learning course, fuzzy logic, implementation

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Introduction

Internet technology is rapidly evolving and has extended to every corner of the globe. It is employed by numerous countries, institutions, and specialists for various objectives, including education [1]. Learning is defined as teachers and students working together to attain specific goals [2]. There must be aspects of objectives, teaching materials, procedures, and assessments that are indivisible units [3]. Article 31 paragraph (2) of Law Number 20 of 2003 Concerning the National Education System specifies that remote education serves the purpose of delivering educational services to community groups that are unable to attend face-to-face or regular teaching. This assertion is repeated in Article 31 paragraph (2) of Law No. 12 of 2012. Distance education strives to extend access and facilitate higher education in teaching and learning, in addition to offering higher education services to community groups that cannot attend face-to-face or regular schooling.

Meanwhile, according to Government Regulation of the Republic of Indonesia Number 17 of 2010 concerning Management and Implementation of Education (article 118 paragraph 1), distance education aims to increase the expansion and equity of access to education, as well as to improve the quality and relevance of education. According to this situation, Article 2 of the Regulation of the Minister of Education and Culture of the Republic of Indonesia number 24 of 2012 concerning the Implementation of Distance Education in Higher Education states that distance education aims to increase the expansion and equitable distribution of access to quality and relevant education as needed. E-learning is defined as any teaching and learning that employs electronic circuits to give learning content, interaction, or direction [4].

It is easier for students to learn when they have access to the internet [5]. Due to the difficulties in adopting existing distant learning, users rarely use it [6]. According to data received from Informatics Study Program students, out of 100 students, some courses must employ

distance or online learning, which contains more theory than practice. The students in the 60 fuzzy logic course chose to perform online since it can make it easier and faster to access, particularly in materials that explain the theory and work examples. As many as 25 pupils disagreed with the existence of online distance learning because they couldn't immediately ask the lecturer if they had any questions. Because these two learning modalities are connected, 15 other pupils require them.

Other factors that cause these students to be opposed to distance learning include a limited internet network, computer equipment, smartphones, cameras, audio, etc. This fuzzy logic course's e-learning development is designed to make the content being studied easy to understand. There are examples and illustrations of each material offered in this e-learning, such as a movie on fuzzy logic material. Framework and Bootstrap are the software packages used. This software has various advantages, including the following: it has very comprehensive, a logical design display, and it can be used at all levels of schooling.

To participate in online learning, it is also necessary to have tenacity, discipline, independence, and a high level of responsibility for all of the regulations that apply to the teaching [7]. Primarily if the online courses being pursued are from another country. Of course, it is also necessary to be fluent in English. Because the content offered is frequently quite dense, especially if it leads to a better comprehension of the topic. The notion of sharing learning resources has been adopted and improved throughout the previous few decades using information technology media such as Electronic Learning, Virtual Learning, Mobile Learning, and so on [8].

E-Learning, in general, refers to Online Courses with a large number of open registrations that include admission administration services and material, design [9], access points, application methods, and a definition of success [10]. Elearning technology is the latest online learning craze and a viable alternative to traditional higher education programs [11].

Following this occurrence, E-learning has brought about a transformation in the education sector in a short period, opening up prospects for new pedagogies and business models [12], providing thousands of students with accessible, high-quality education. Because of this open access, people from all over the world can enroll in E-learning [13]. Documents, video recordings, and other technologies are used in e-learning to impart course or training content to an unlimited number of students at any time. There are no restrictions on student attendance or training requirements. Fuzzy logic courses, like E-learning in general, use web-based learning resources, online assessment systems, online laboratories, instructor training and assistance, and preparation tests to get an Industrial Standard Certificate [14]. As a student enrolled in an online course, I have made people aware that learning in an online class is not as simple as previously assumed. It's considerably more challenging than simply designing and preparing online courses for students. Given that all instructional materials are available online, it takes tenacity, time discipline [15], independence, and a strong feeling of responsibility to study the content and complete the tasks (assignments and tests) required before receiving a certificate of completion [16].

Methodology

The method used in this research is Learning Analytic Prototype, namely by performing several steps or stages as follows:

1. Identify user needs. At this stage, discussions are held to determine user needs between lecturers and students. Users can describe the exact and desired system requirements.
2. Make a prototype design. At this stage, the researcher makes a prototype of the desired system requirements.
3. Testing the Prototype. At this stage, the user can test the e-learning system that has been provided and the user can provide suggestions or feedback.
4. Fix Prototype. At this stage, researchers make improvements and modifications according to user input.
5. Implementation. After the evaluation is done and the system is in accordance with the wishes of the user. Then the system can be implemented in fuzzy logic courses.

A model can be applied in fuzzy e-learning courses as follows:

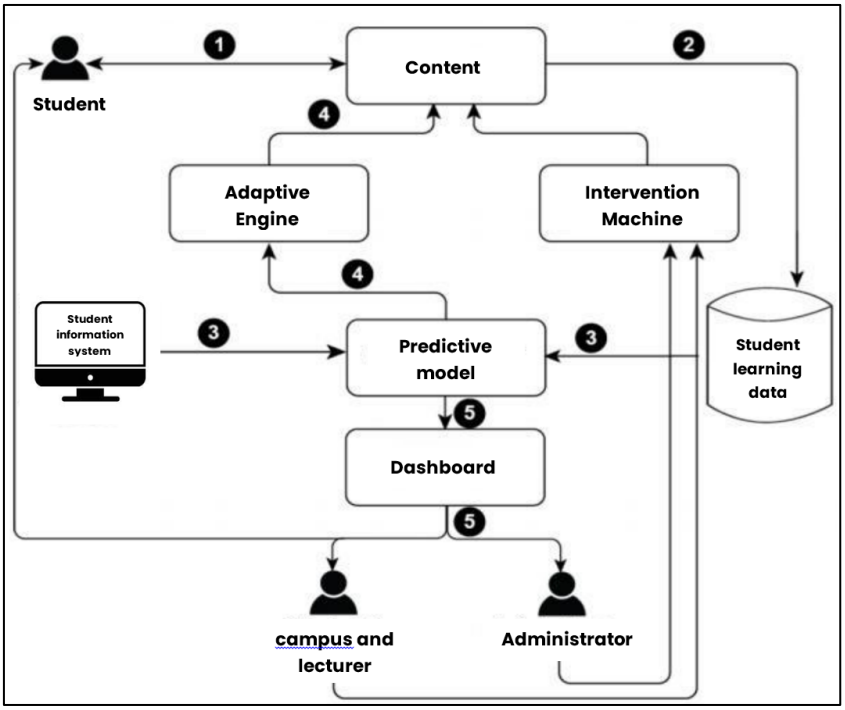


Figure 1. Learning system model implementation of learning analytics

The learning process carried out using the help of an online learning system supports extracting student data during the learning process. The data is processed using LA, which is then used to improve the PBM process. The LA implementation in the adaptive learning system model includes 6 (six) principal components, which can be seen in Figure 1.

1. Content manager: assisting students in providing content and assessment tools to support the learning process
2. Student learning data: store all records of student activities and behavior while interacting in the system
3. Predictive Model: combines demographic and behavioral data of students so that it can be used to track student learning progress to predict their future performance and various potential problems that may be encountered;
4. dashboard: Using the Predictive Model's output to be presented in a dashboard that other users easily understand.
5. Adaptive Engine: utilizes information from Predictive Model results to select teaching materials that can be adapted to the needs and performance of students in various levels of conditions; and
6. Intervention Machine: assisting teachers/instructors, administrators, and system developers in taking over the automated system for the learning needs of students in specific contexts.

Adaptive engine for learning, also known as adaptive teaching, is an educational method that uses computer algorithms as well as artificial intelligence to orchestrate the interaction with the learner and deliver customized resources and learning activities to address the unique needs of each learner.

Results and Discussions

Result

Students who intend to use this e-learning must register as users to access it. The user is divided into three categories in this development: user, administrator, and lecturer. Users in this topic are students enrolled in fuzzy logic courses who can only access material, work on questions, and ask questions in the forum. The admin user serves as e-learning management by

inspecting, maintaining, and enhancing services, among other things. This website's lecturer users organize resources, give assignments, manage grades, provide student attendance lists, and engage in online chat. Resources and activities are the two fundamental components of e-learning. Resources include instructional resources in various formats, whereas activities include activity facilities that students can use. Indonesian and English are the languages used in this e-learning. In the e-learning used, students have the option of selecting the language of delivery. Expert validation is required for products that have been designed for this application system to be used. An instrument for assessing the system's performance is needed for verification to media professionals. There are 15 assessment items in the assessment instrument. The validation results from media specialists received a score of 60 and were classified as very good.

The learning system that has passed the validation results of media experts and material specialists and is usable then moves on to the limited testing stage. The test was carried out on 100 students from the informatics studies program's fuzzy logic course. The test results yielded an average score of 80 on outstanding criteria, indicating that this e-learning system is simple to use.

Discussions

Because this e-learning program is housed on a university server, users only need to enter their email addresses and password. Users do not need to install or manage complicated menus because everything is ready to use and easily manageable based on their needs. So creating e-learning is not difficult; anyone can do it. Before creating e-learning, some equipment, such as a computer/ laptop and internet access and different devices such as cameras and audio devices, should be provided. The homepage, menu page, and material options are all highly significant menu areas in this e-learning. The user is guided to the content of e-learning, an overview of the courses to be studied, and so on. In addition to this home menu, there is a university logo, the main menu, the language to be used on the website, navigation, an overview of the material to be studied, and so on. Users who follow the course, a calendar, notes, news, and pages that can be used to develop the network can all be found on the menu page. The context menu is the most significant because the menu on this menu allows students to access the material they will learn. Students can communicate with fellow students or lecturers in addition to the material on this menu. Materials that can be viewed can be entered in various formats, but for this test, the researchers only included ppt, pdf, and video formats. Quizzes, chat, forums, online presentations, and other activities are among those that can be carried out in e-learning. Students are encouraged to be engaged in interacting about the content to be studied due to this.

In the Learning Management Process system shown in Figure 2, lecturers can enter excel format values with data import facilities, which will then be processed by the system according to a predetermined format. The results of the input performed can also be searched to speed up the data being found. And on the student page, students can see the results obtained in real-time and correctly.

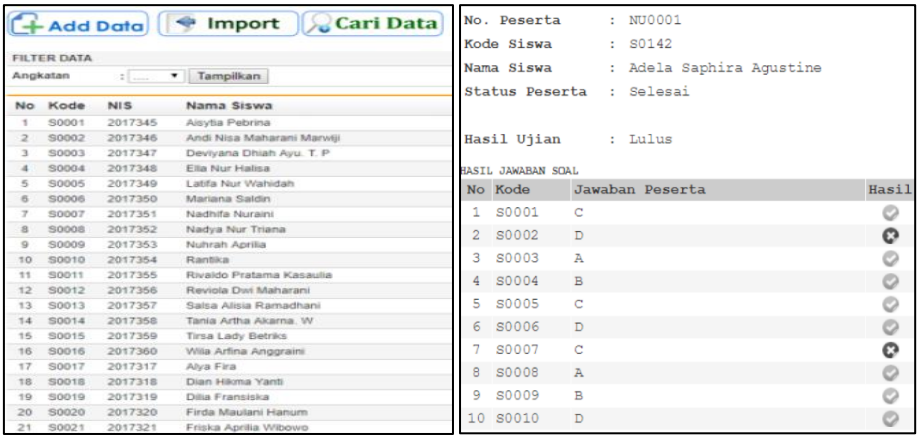


Figure 2. Fuzzy logic learning management process

As figure 2, using the fuzzy system, users with the admin or officer category can add student data according to previously registered and operational data. If there is data that is not active, students cannot access the e-learning system until the student is dynamic Back.

The system can also manage exam results in real-time and automatically according to a predetermined time at the admin level. The exam process has been completed so that the grade or graduation predicate can be known by students directly and transparently.

Building e-learning necessitates interactive activities between students and lecturers, such as chat, forum discussion, and virtual meet. The results of media expert validation reveal that the final product is usable. To create engaging and appealing e-learning, three criteria must be met when building e-learning: simple, personal, and fast [17]. In making this e-learning, the researcher condensed the navigation into three main parts: home, site page, and course. Because the language employed or the message transmitted was not effectively delivered, communication did not receive the total value; to overcome this to be more communicative, the researchers fixed it by simplifying the message and making the language easier.

The presentation that is less appealing to pupils, resulting in a value in attractive and straightforward characteristics that is not optimal. To simplify and attract students to e-learning, this is accomplished by exhibiting portions of video examples that entice students to access it. In terms of interactivity, there is a lack of interaction between other students and lecturers. Developing e-learning necessitates interaction activities between students and teachers, such as chat and discussion/forum. As instructed by media professionals, media, chat, and discussions are included in this e-learning. Some of the characteristics of developing a learning site or an e-learning website include that the explanation technique is effective, transparent, and easily understood by learners through pictures, examples, and demonstrations [18].

The following is a table relation and e-learning display in the fuzzy logic course, in Figures 3 and 4.

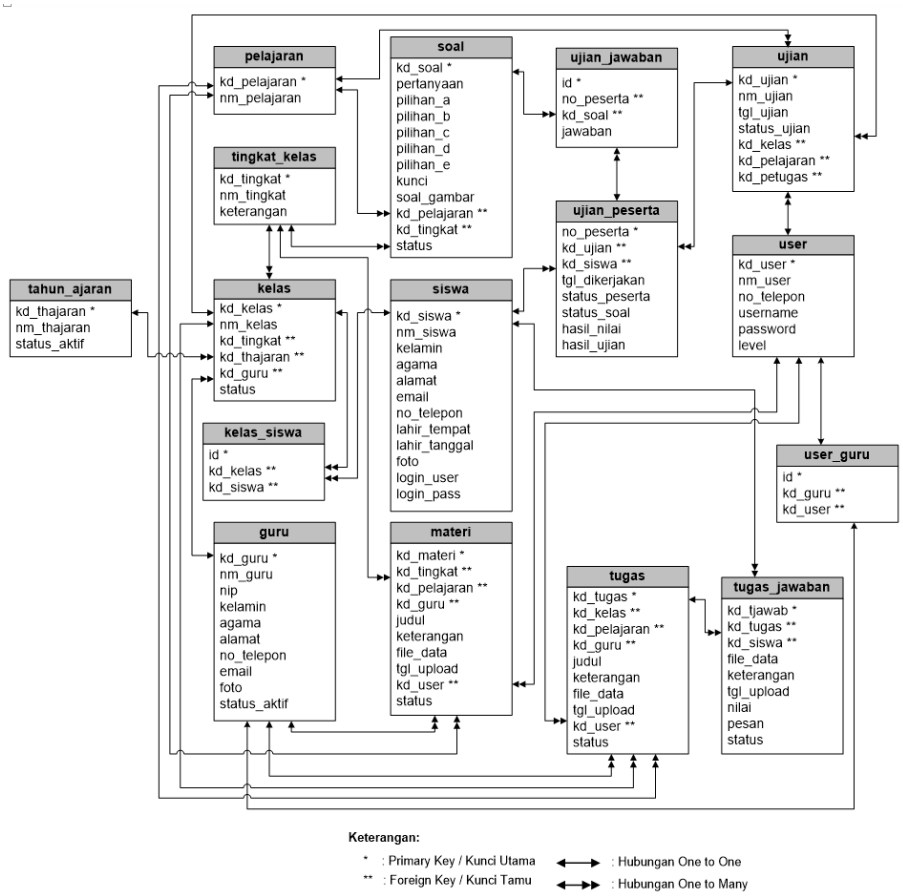
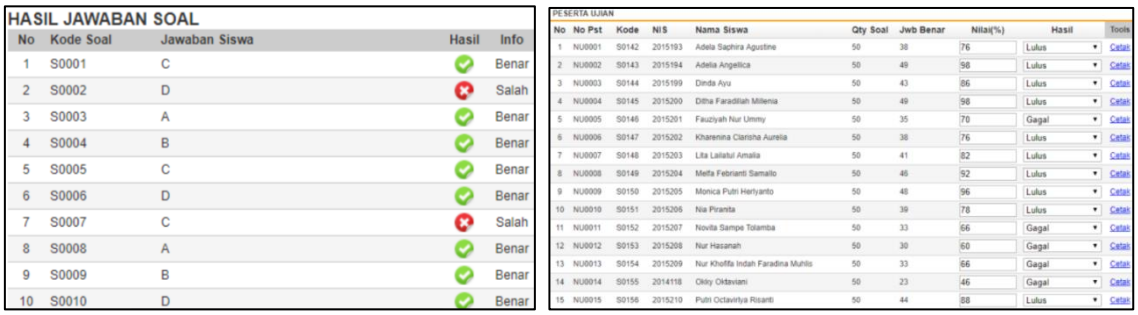


Figure 3. Fuzzy course e-learning system table relation

In the table, the relationship shows the access rights that flow in the e-learning system. the relationship is a relationship between tables in the database made using Indonesian following the application of the e-learning application system on the campus. The relation describes a collection of data that can be obtained and stored from the main sources so that e-learning activities can be recorded and documented regularly and accessed at any time and at any time by the user. All the built relationships are aimed to meet the requirement so that the data does not experience redundancy and has a clear direction.



HASIL JAWABAN SOAL

No	Kode Soal	Jawaban Siswa	Hasil	Info
1	S0001	C	✓	Benar
2	S0002	D	✗	Salah
3	S0003	A	✓	Benar
4	S0004	B	✓	Benar
5	S0005	C	✓	Benar
6	S0006	D	✓	Benar
7	S0007	C	✗	Salah
8	S0008	A	✓	Benar
9	S0009	B	✓	Benar
10	S0010	D	✓	Benar

PESERTA UJIAN

No	No Pst	Kode	NIS	Nama Siswa	Qty Soal	Jwb Benar	Nilai(%)	Hasil	Tools
1	NU0001	S0142	2015193	Adela Saphira Agustine	50	38	76	Lulus	Catat
2	NU0002	S0143	2015194	Adelia Angelica	50	49	98	Lulus	Catat
3	NU0003	S0144	2015199	Dinda Ayu	50	43	86	Lulus	Catat
4	NU0004	S0145	2015200	Ditha Faradilah Millenia	50	49	98	Lulus	Catat
5	NU0005	S0146	2015201	Fauziyah Nur Ummy	50	35	70	Gagal	Catat
6	NU0006	S0147	2015202	Kharenina Clarisha Aurelia	50	38	76	Lulus	Catat
7	NU0007	S0148	2015203	Lita Lailatul Amalia	50	41	82	Lulus	Catat
8	NU0008	S0149	2015204	Meifa Febrianti Samallo	50	46	92	Lulus	Catat
9	NU0009	S0150	2015205	Monica Putri Heriyanto	50	48	96	Lulus	Catat
10	NU0010	S0151	2015206	Nia Piranita	50	39	78	Lulus	Catat
11	NU0011	S0152	2015207	Novita Sampe Tolamba	50	33	66	Gagal	Catat
12	NU0012	S0153	2015208	Nur Hasanah	50	30	60	Gagal	Catat
13	NU0013	S0154	2015209	Nur Kholifa Indah Faradina Muhlis	50	33	66	Gagal	Catat
14	NU0014	S0155	2014118	Okky Oktaviani	50	23	46	Gagal	Catat
15	NU0015	S0156	2015210	Putri Octavirlya Risanti	50	44	88	Lulus	Catat

Figure 4. Display of fuzzy logic e-learning results

The display shows the results obtained by students, which can be seen directly after the exam process, and these results are not the results of one semester's learning but only the results of the exam for each subject. The results displayed cannot be changed by students and cannot be changed by lecturers before carrying out gradual clarification to the authorities according to the data to be corrected.

Conclusion

The results obtained can be concluded that fuzzy logic e-learning can run as targeted and expected. E-learning can provide real-time and transparent results, so no longer have to worry about data loss and delays. Fuzzy logic courses using e-learning media can be more interactive in the learning process, and lecturers construct material and knowledge. In this case, new approaches to learning technology are very well and quickly. The e-learning system can also be applied to all courses, which can then be adapted to the curriculum material, and everything can be done quickly by the application system.

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Technical analysis of power factor improvement using ETAP 12.6 at Regent Resort & Holiday Inn Canggu

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Abstract: Due to the increase of inductive load will cause a decrease in the power factor which in turn affects the distribution of electrical energy. The power factor improvement method was chosen by the Regent of Resort & Holiday Inn Canggu to meet the PLN Standard, SPLN 70-1, namely: the power factor must be > 0.85 is to install a capacitor bank. In addition to increasing the power factor, the installation of this capacitor bank is also expected to reduce power losses and voltage drops and avoid excess kVARh charges imposed by PLN. Through calculations and simulations using the ETAP 12.6 application, it is obtained that; To increase the power factor close to 0.95, 900kVAR power is required from the capacitor bank installed in LVMDP1 and LMPDP2 to compensate for the reactive power of 875.44 kVAR and 860.92 kVAR, respectively. The capacity of the capacitor bank required for LVMDP1 and LVMDP2 is 19.85 x 10-3 Farad, with a capacity value for each step of 2.20 x 10-3 Farad. By installing a capacitor bank on LVMDP1 and LVMDP2, it can increase the power factor to 0.94 and 0.95 respectively, and reduce the percentage of reactive power usage to active power to 34.3% and 34.7%.

Keywords: capacitor bank, power factor, reactive power

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Introduction

In general, the loads that exist in the distribution network can be divided into two forms i.e., capacitive loads and inductive loads. Capacitive loads absorb active power and emit reactive power so that the voltage rate is delayed and the current wave position shifts ahead of the voltage wave (leading). Inductive loads absorb active power and reactive power so that the current rate is delayed and the current wave position shifts behind the voltage wave (Lagging). If the inductive load is higher, the power factor will decrease. This situation will increase power losses and reduce power distribution capacity [1].

This condition is experienced by Regent Resort & Holiday Inn Canggu, a five-star hotel located in the Canggu area of Bali. The electricity needs at this hotel are met using 2 distribution transformers with a capacity of 2000 kVA and 2 LVMDP (Low Voltage Main Distribution Panels), namely LVMDP1 and LVMDP2 to supply loads in the hotel such as chillers, air conditioners, freezers and motors, electric motor as driving the deep well pump, heat pump, primary pump and return pump, which is all inductive loads. A large number of inductive loads causes a decrease in the power factor which will have an impact on the decrease in power distribution capacity in this hotel.

In addition, a decrease of power factor leads to an increase in reactive power. If the percentage of reactive power to active power is greater than 62% then the hotel is threatened with additional costs of excess reactive power consumption (kVAR) by PLN [2].

To overcome this situation, it is necessary to increase the power factor. There are three different ways to improve the power factor which are widely used in industrial systems i.e.: static capacitor, synchronous condenser, and phase advancer.

In order to improve the power factor, static capacitors are installed parallel to the equipment running on low power factor. The leading current drawn by such capacitors neutralizes

or corrects the lagging reactive component of the load current. The static capacitors have many advantages since they are lightweight, easy to install, have low losses, and require lesser maintenance. However, the disadvantages are quite notable where if the voltage is exceeded then the capacitors will be damaged quickly and their repair would be costly. They also have a shorter service life (8-10 years).

Another way to improve the power factor is to use a 3-phase synchronous motor which is over excited and runs on no load. This setup is known as the synchronous condenser. The interesting part is that the synchronous motor can operate under leading, lagging, or unity power factors. If there is an inductive load present, then the condenser will be connected to the side of the load and will act as a capacitor to correct the power factor. The synchronous condenser has many advantages since it requires low maintenance, can run for up to 25 years, and is not affected by harmonics. However, its disadvantages include the high maintenance, cost, and noise. It also requires additional equipment to start the motor as it has no self-starting torque.

The last method that helps improve power factor is by using an AC exciter also known as a phase advancer. However, this can only be used for induction motors because the stator windings of the motor draw current that lags 90° behind the voltage and results in a low power factor. The only way to get rid of this problem would be to use an external source that would provide exciting ampere-turns. The phase advancer helps in solving the problem when it is connected to the rotor circuit of the motor. The exciting ampere-turns provided by the advancer are at the slip frequency. A leading power factor can also be obtained by providing more ampere-turns. The main advantage of using a phase advancer includes a reduced amount of reactive power drawn by the motor. It can also be used in places where a synchronous condenser is unacceptable. However, the phase advancer cannot be used for motors below 200 H.P. which is uneconomical.

Because of its many advantages over the other 2 methods such as lightweight, easy to install, have low losses and require lesser maintenance, producing lesser noise, lower cost and more suitable with most of the loads of the system then the static capacitor chosen as power factor improvement in this study. One type of static capacitor that is famously implemented in power systems is the capacitor bank.

By installing a proper capacitor bank, it is expected that the power factor will increase to fulfill the SPLN 70-1 (PLN Standard), i.e.: the power factor value >0.85 [3]. Improving the power factor through the installation of a capacitor bank will avoid excess kVARh costs [4].

The studies of power factor improvement by adding capacitors have been developed in many scientific research works as described in the following summary. The addition of capacitors to a load of Minimarket electricity is proven to affect the current and power factor of electrical load. The more precise the value Capacitors are added, the higher the value of the electrical load power factor close to 1 [1]. By doing power factor improvement of 565 kVAR can decrease reactive power value and increases the active power, resulting in total active and reactive power consumption almost the same value, and new load additions can be made without adding PLN capacity [5]. Additional Capacitor bank can increase the Power Factor from 0.82 to 0.98 distribution feeder of Sutami 23 Lampung [6]. The power factor is improved from 0.87 lag becomes 0.96 lag by adding a shunt capacitor capacity of 80 kVAr (10 kVAr x 8 Step) Digital Regulator (APFC) 8 step [7]. To increase the power factor to 0.95, 5, a 6172.33 kVAR capacitor of banks must be installed for the main feeder AA, and a 5388.88 kVAR capacitor of banks must be installed for main feeder AA 8 to keep the quality power produced was more optimal [8]. By installing a capacitor bank, the value of power losses on the Barata feeder can be reduced from 4.33 kW to 3.247 kW and 6.627 kVar to 4.947 kVar. Then the power factor which was initially 0.83 became an average of 0.97 in the network system [9]. The installation of capacitors can increase the power factor by 11% to 0,95 (exceeding the minimum average power factor determined by the PLN electricity tariff adjustment) and in addition, the load current decreased 12% from 442.3 A to 389.5 A [10]. Power factor correction will result in the reduction of maximum demand (KVA or KW) and affect the annual saving over the maximum demand charge [11]. After installation of a 1200 KVAR capacitor bank, the power factor increases to 0.99, the amount of power that can be supplied with that power factor is 1600 KW. So that with the application of a capacitor bank, the power factor can be increased and the power supplied will be higher and the power quality will be better [12]. The installation of capacitor banks is useful to improve the power factor from 0.76 to 0.97 by calculating the value of the compensator reactive power

corresponding using software ETAP (electrical transient analysis program) [13]. Increasing power factor beyond 0.8 (lagging) using capacitor banks though improves the r.m.s voltage and reduces the power loss but invariably leads to an increase in switching transients which is undesired for optimized [14]. Improvement of power factor makes the utility companies get rid of the power losses while the consumers are free from low power factor penalty charges. By installing suitably sized power capacitors into the circuit the Power Factor is improved and the value becomes nearer to 0.9 to 0.95 system performance [15]. Installation of 35kVAR capacitor bank in the electric installation of rectorate building can improve the quality of system power factor from 0.682 to 0.840 [16]. The applications of capacitor banks on the substation reduce the reactive power flow and reduce the losses in square proportion. As result, improvement in power factor from 0.474 to 0.94 and reactive power reduce 74.7 to 14.7 in stage – 7 [17].

All these above studies confirmed that additional capacitors into the electric system able to improve the power factor and reduce the reactive power (kVAR) effectively. This will certainly have an impact that the installation of capacitor banks as a method of increasing the power factor will be increasingly popular and increasingly chosen in industrial power systems.

However, the method of increasing the power factor with the addition of a capacitor bank is very popular, but for the case at Regent Resort & Holiday Inn Canggu, an in-depth study is still needed. Moreover, in the case at Regent Resort & Holiday Inn Canggu, the study analysis that will be carried out using the help of the ETAP application is first time conducted. It is expected to help management determine the capacity of the capacitor needed to increase the power factor to 0.95 and reduce reactive power to avoid fines imposed by PLN. The results of the study are expected to help convince the management that the selection of the method is appropriate to provide optimal results.

In this paper, the deep study of power factor improvement at Regent Resort & Holiday Inn Canggu through the installation of a capacitor bank will be carried out with help of the ETAP 12.6 application program. Through simulation using ETAP, it will be known the value of the power factor improvement obtained through the installation of a capacitor bank to meet the standards set by PLN.

Methodology

This research was conducted at Regent Resort & Holiday Inn Canggu which is located at Jl. Batu Bolong Beach 93 XX, Canggu, North Kuta, Badung in the period from April to June 2021. While data collecting as input of this study was obtained from (a). Field Observation i.e.: technical specification of the transformer, type, length of the conductor, load, etc; (b). Literature review to collect data from various relevant sources such as books, journals, and regulations related to power factor improvement; and (c). Interview with the related parties at the study object.

The stage of work carried out in this study includes:

First, collecting and reviewing the relevant data related to power factor improvement, including setting up the power factor target.

Second*:* conducting simulation using ETAP 12.6 application and performing technical analysis.

The flow process of ETAP 12.6 Simulation of power factor improvement at Regent Resort & Holiday Inn Canggu is shown by flow chart in Figure 1, which is in brief described as follow:

1. Entering data into the ETAP 12.6 program. The data that are required include the length of the conductor, type of conductor, size of the conductor, and load data to be installed on LVMDP1 & LVMDP2.
2. Calculate the initial power factor (Cos φ_1) at LVMDP1 & LVMDP2 using the ETAP 12.6 application.
3. Calculate the size of the capacitor bank for reactive power compensation LVMDP1 & LVMDP2 with the target power factor to be achieved is 0.95.
4. Calculate the capacity of the capacitor bank on LVMDP1 & LVMDP2.
5. Simulating the installation of a capacitor bank using the ETAP 12.6 application to determine the power factor of LVMDP1 & LVMDP2 after installing a capacitor bank. If the power factor value is> 0.85 then the power factor value is following PLN standards, the process is complete. Meanwhile, if the power factor value is < 0.85, then a re-calculation is carried out.

Third, conducting technical analysis and discussion. And finally, compose the conclusion.

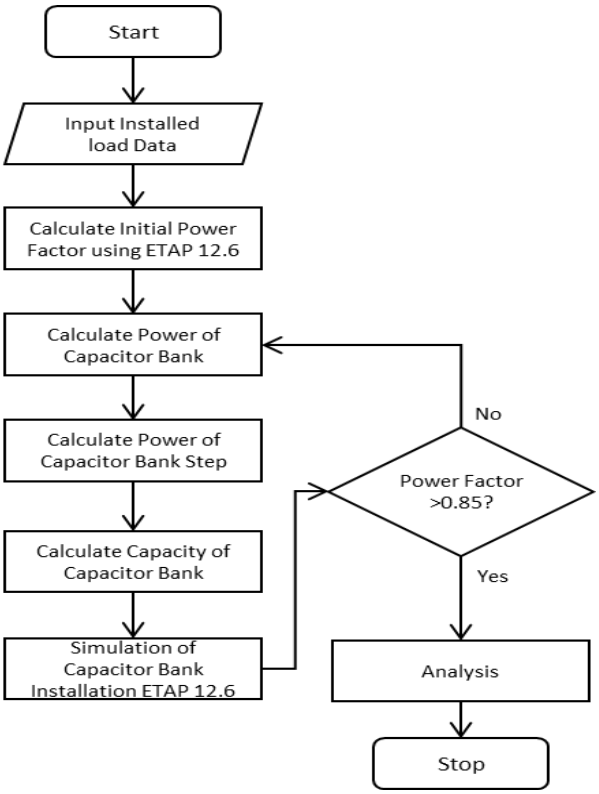

Figure 1. Power factor improvement flowchart

Results and Discussions

Results

Technical Data

1. Single Line Diagram

As one of the important required supporting data, below is the single-line diagram of the Canggu Regent Resort & Holiday Inn electrical system as shown in Figure 2.

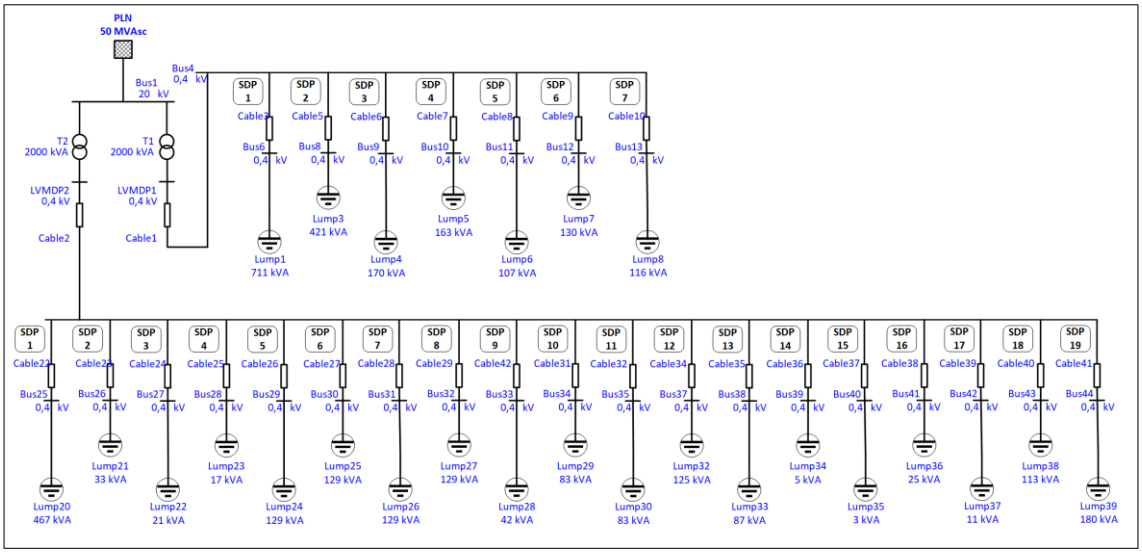

Figure 2. Single-Line diagram

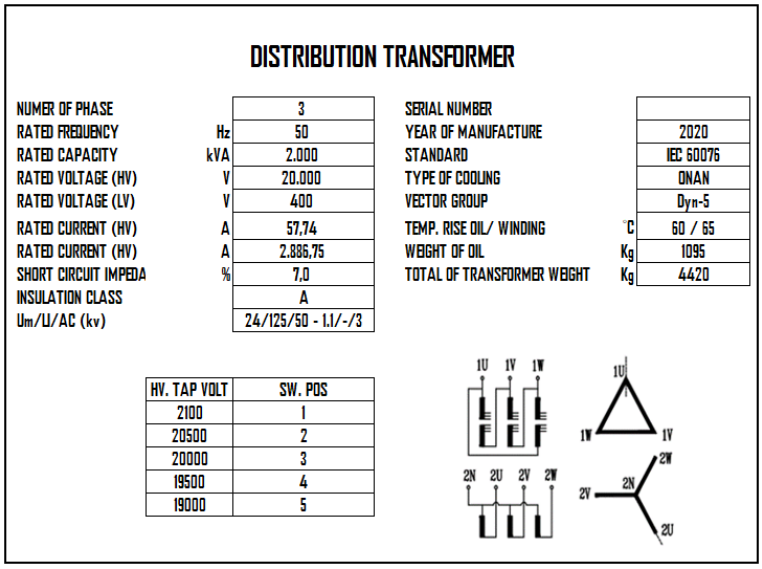

Figure 3. Transformer data

2. Transformer Data

Referring to the planning data obtained from the contractor, the transformer to be used at Regent Resort & Holiday Inn Canggu consists of 2 distribution transformers with a capacity of 2000 kVA each. Details of the transformer data are shown in Figure 3.

3. Conductor Specification

The conductor data that is to be used to distribute electrical power from LVMDP1 and LVMDP2 to each SDP panel (Sub Distribution Panel) are shown in Table 1 and Table 2.

Tabel 1. LVMDP1 conductor specification

No	SDP (Sub Distribution Panel)	Cable Type	Cable Size	Cable Length (m)
1	SDP1	NYY	4(4x1x300) + (1x150) mm2	270
2	SDP2	NYY	2(4x1x500) + (1x150) mm2	25
3	SDP3	NYY	(4x1x240) + (1x120) mm2	40
4	SDP4	NYY	2(4x1x150) + (1x95) mm2	75
5	SDP5	NYY	(4x1x300) + (1x120) mm2	100
6	SDP6	NYY	(4x1x300) + (1x150) mm2	105
7	SDP7	NYY	(4x1x240) + (1x120) mm2	175

Tabel 2. LVMDP2 conductor specification

No	SDP (Sub Distribution Panel)	Cable Type	Cable Size	Cable Length (m)
1	SDP1	NYY	4(4x1x300) + (1x150) mm2	300
2	SDP2	NYY	(4x25) + (1x16) mm2	25
3	SDP3	NYY	(4x10) + (1x10) mm2	30
4	SDP4	NYY	(4x10) + (1x10) mm2	40
5	SDP5	NYY	(4x1x240) + (1x120) mm2	45
6	SDP6	NYY	(4x1x240) + (1x120) mm2	50
7	SDP7	NYY	(4x1x240) + (1x120) mm2	55
8	SDP8	NYY	(4x1x240) + (1x120) mm2	60
9	SDP9	NYY	(4x35) + (1x16) mm2	20
10	SDP10	NYY	(4x1x95) + (1x50) mm2	20
11	SDP11	NYY	(4x1x95) + (1x50) mm2	20
12	SDP12	NYY	(4x1x150) + (1x95) mm2	30
13	SDP13	NYY	(4x1x95) + (1x50) mm2	30
14	SDP14	NYY	(4x6) + (1x6) mm2	20
15	SDP15	NYY	(4x4) + (1x4) mm2	20
16	SDP16	NYY	(4x16) + (1x6) mm2	90
17	SDP17	NYY	(4x6) + (1x16) mm2	100
18	SDP18	NYY	(4x120) + (1x70) mm2	180
19	SDP19	NYY	(4x1x150) + (1x95) mm2	200

4. Load Recapitulation

The 3-phase load of each SDP is shown in Table 3 and Table 4.

Table 3. Load of LVMDP1

No	SDP (Sub Distribution Panel)	Load (KVA)
1	SDP1	711
2	SDP2	421
3	SDP3	178
4	SDP4	163
5	SDP5	107
6	SDP6	138
7	SDP7	116
	Total Load	1834

Table 4. Load of LVMDP2

No	SDP (Sub Distribution Panel)	Load (KVA)
1	SDP1	467
2	SDP2	33
3	SDP3	21
4	SDP4	17
5	SDP5	129
6	SDP6	129
7	SDP7	129
8	SDP8	129
9	SDP9	42
10	SDP10	83
11	SDP11	83
12	SDP12	125
13	SDP13	87
14	SDP14	5
15	SDP15	3
16	SDP16	25
17	SDP17	11
18	SDP18	113
19	SDP19	180
	Total Load	1811

ETAP Simulation Results

1. Initial ETAP simulation before adding capacitor bank

After all the technical data above is inputted into the ETAP Application, the following is the output of the simulation results (before adding the capacitor bank) as shown in Table 5 and Single-Line Diagram in Figure 4.

Table 5. ETAP simulation output (initial status, before adding capacitor bank)

No	LVMDP Name	Power (kW)	Reactive Power (kVAR)	Current Load (A)	PF (Power Factor)	%kVAR/ KW
1	LVMDP1	1266	1289	2785.9	0.7	101.8%
2	LVMDP2	1245	1268	2736.7	0.7	101.8%

Table 5 shows that the reactive power consumption for LVMDP1 and LVMDP2 are 1289kVAR (or 101.8% compared to active power) and 1268kVAR (or 101.8% compared to active power) and the power factor is 0.7% respectively. The use of reactive power far exceeds the 62% requirement and the power factor is lower than 0.85 as stipulated in the Regulation of the Minister of Energy and Mineral Resources (Permen ESDM No.: 07 Tahun 2010) so that will be imposed by PLN [2].

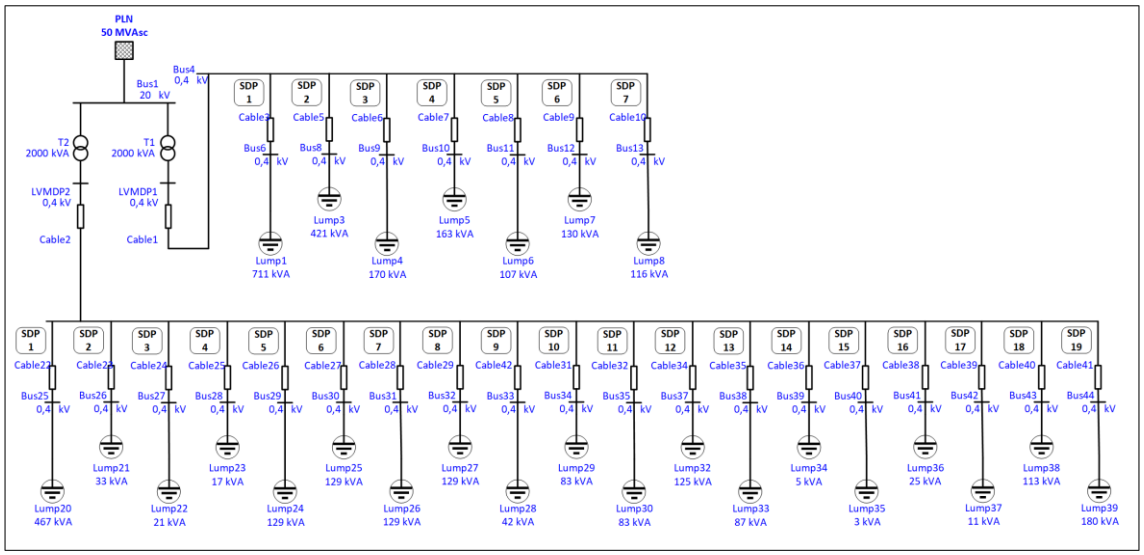

Figure 4. Single-Line diagram DTAP output simulation (before adding capacitor bank)

Calculation of the amount of power in the capacitor bank

By setting the power factor target value to be achieved at 0.95, the calculation of the amount of power in the capacitor bank can be described as follows:

Reactive Power Compensation Calculation in LVMDP1

From the ETAP simulation results in LVMDP1, the active power is 1266 kW with a power factor value of 0.7. To achieve a power factor target of 0.95, the following is calculations that are to be performed:

Reactive Power of Capacitor Bank can be calculated by the following formula [18]:

$$Qc = P (\tan \varphi 1 - \tan \varphi 2) \quad (1)$$

where,

P : Active power of load (Watt)
Cos φ1 : Initial power factor (before compensation)
Cos φ2 : Expected power factor
Qc : Capacitor Reactive power (kVAR)

It was known that P (active power) was 1226 kW, initial Power Factor (Cos φ1) was 0.7 (so that we can calculate φ1 = 45.57˚), target Power Factor (Cos φ2) was 0.95 (so that we can calculate φ2 = 18,19˚), by using formula (1), we can calculate Reactive Power of Capacitor Bank as follow:

$$Q_C = P (\tan \varphi_1 - \tan \varphi_2) = 875.44 \text{ kVAR}.$$

Reactive Power Compensation Calculation in LVMDP2

From the ETAP simulation results in LVMDP2, the active power is 1245 kW with a power factor value of 0.7. To achieve a power factor target of 0.95, the following is calculations that to be performed:

It was known that P (active power) was 1245 kW, initial Power Factor (Cos φ1) was 0.7 (so that we can calculate φ1 = 45.57˚), target PF (Cos φ2) was 0.95 (so that we can calculate φ2 = 18,19˚), by using formula (1), we can calculate Reactive Power of Capacitor Bank as follow:

$$Q_C = P (\tan \varphi_1 - \tan \varphi_2) = 860.92 \text{ kVAR}.$$

Calculation of Power at Step Capacitor Bank

If we are going to install a capacitor bank in the electricity network, a PFR (Power Factor Controller) is needed. PFC functions to regulate the work of the contactor from each step of the capacitor bank so that the reactive power that will be supplied to the network or system can work according to the required capacity. If there is a change in load it will automatically correct the power factor according to the specified target. So that it is necessary to determine how many steps are used in the LVMVP1 & LVMDP2 capacitor banks. To find out how much power the capacitor bank at each step, can be performed by the following calculations.

Calculation of Power Steps on Capacitor Banks in LVMDP1

To determine the power of the capacitor bank from each step, it can be calculated by the following formula [18]:

$$Qstep = \frac{Qc\ (total)}{Number\ of\ Step} \quad (2)$$

Referring to the results of the previous calculation, the total power of the capacitor bank that is needed to compensate for the reactive power in LVMDP1 is 875.44 kVAR. If it was selected to use a 9-step capacitor bank, then the Power of each Step, $Qstep$ = 97.27 kVAR.

Since the capacitor capacity available in the market is closest to 100 kVAR per step, using 9 step capacitor banks so that the total power of the capacitor bank that will be required in LVMDP1 is 900 kVAR.

Calculation of Power Steps on Capacitor Banks in LVMDP2

Referring to the results of the previous calculation, the total power of the capacitor bank that needed to compensate the reactive power in LVMDP2 of 860,92 kVAR, using a 9-step capacitor bank. Then by using formula (2), then the power of each Step Capacitor Bank in LVMDP2, $Qstep$ = 95.65 kVAR.

Since the capacitor capacity available in the market is closest to 100 kVAR per step, using 9 step capacitor banks so that the total power of the capacitor bank that will be required in LVMDP1 is 900 kVAR.

Calculation of Bank Capacitor Capacity

The calculation of the required Capacitor Bank Capacity in LVMDP1 & LVMDP2 is described as follows.

a. Calculation of Bank Capacitor Capacity in LVMDP1

The capacity of the capacitor bank can be calculated with the following formula [18]:

$$C = \frac{Qc}{V^2\ x\ \omega} \quad (3)$$

Where,
C : Capacitor capacity (Farad)
Qc : Reactive power of Capacitor (VAR)
V : Three-phase voltage (Volt)
Ω : 2πf

Based on previous calculations, the required reactive power of the capacitor bank in LVMDP1 is 900 kVAR. So by using the formula in equation (3), the capacity of the capacitor bank in LVMDP1 can be calculated as follows:

$$C = \frac{Qc}{V^2\ x\ \omega} = \frac{Qc}{V^2\ x\ 2\pi f} = \frac{900\ x\ 10^3}{380^2\ x\ 2x3.14x50} = 19.85 \text{ x } 10^{-3} \text{ Farad}$$

By using a 9-step capacitor bank with a power capacity for each step of 100 kVAR, then the required capacitor bank capacity for each step on LVMDP1 is 2.21 x 10^{-3} Farad.

b. Calculation of Bank Capacitor Capacity in LVMDP2

Based on previous calculations, the required reactive power of the capacitor bank in LVMDP2 is 900 kVAR. So by using the formula in equation (3), the capacity of the capacitor bank in LVMDP1 can be calculated as follows:

$$C = \frac{Qc}{V^2 \, x \, \omega} = \frac{Qc}{V^2 \, x \, 2\pi f} = \frac{900 \, x \, 10^3}{380^2 \, x \, 2x3.14x50} = 19{,}85 \text{ x } 10^{-3} \text{ Farad}$$

By using a 9 step capacitor bank with a power capacity for each step of 100 kVAR, then the required capacitor bank capacity for each step on LVMDP2 is 2.21 x 10^{-3} Farad.

2. ETAP Simulation after adding capacitor bank

Simulation results of the ETAP 12.6 application on the electrical system at Regent Resort & Holiday Inn Canggu with the addition of a capacitor bank in LVMDP1 & LVMDP2 are shown in Figure 5 and Table 6 below.

Table 6. ETAP simulation output (after adding capacitor bank)

No	LVMDP Name	Power (kW)	Reactive Power (kVAR)	Current Load (A)	PF (Power Factor)	%kVAR/ KW
1	LVMDP1	1301	443	2045.4	0.94	34.1%
2	LVMDP2	1281	420	2003.7	0.95	32.8%

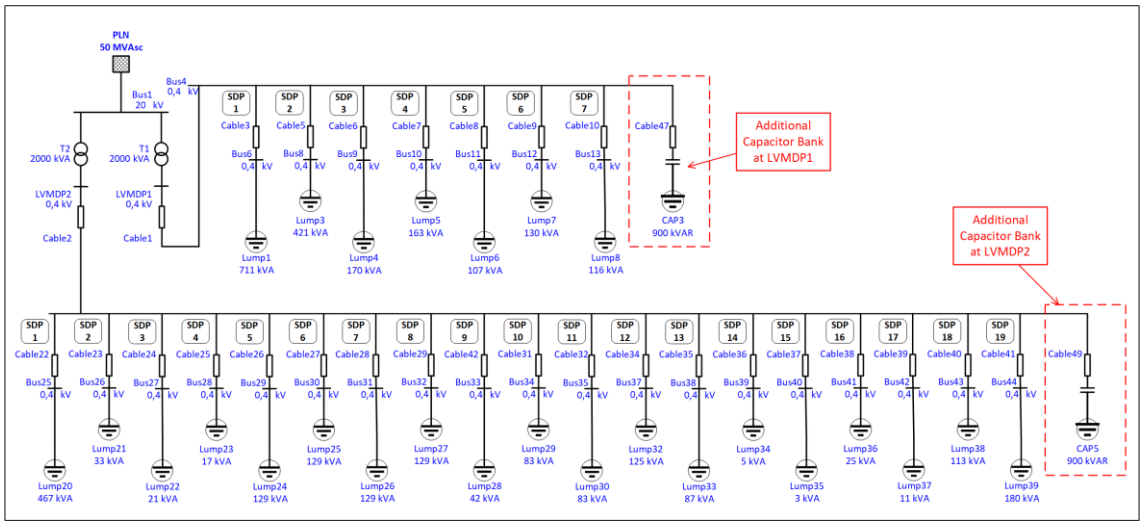

Figure 5. Single-Line diagram DTAP output simulation (after adding capacitor bank)

Table 7. ETAP 12.6 Simulation result before and after additional capacitor bank

LVMDP Name	Power (kW)			Reactive Power (kVAR)			Load Current (A)			Power Factor (PF)		
	Before	After	% Change	Before	After	% Change	Before	After	% Change	Before	After	% Change
LVMDP1	1266	1301	2.8%	1289	443	-65.6%	2785.9	2045.4	-26.6%	0.7	0.94	34.3%
LVMDP2	1245	1281	2.9%	1268	420	-66.9%	2736.7	2003.7	-26.8%	0.7	0.95	35.7%

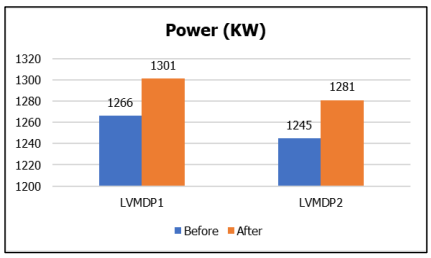

Figure 6a. Power (kW) – before and after

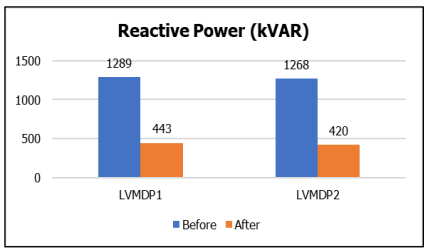

Figure 6b. Reactive power (kVAR) – before and after

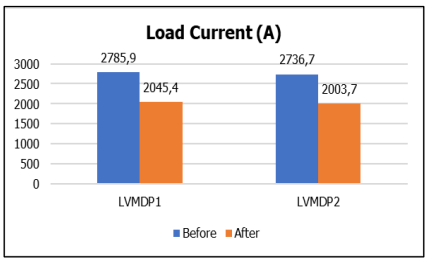

Figure 6c. Load current (A) – before and after

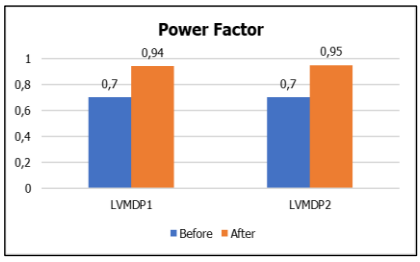

Figure 6d. Power factor – before and after

If we compare the ETAP 12.6 simulation results for the Regent Resort & Holiday Inn electrical system before and after the addition of Bank Capacitors on LVMDP1 and LVMDP2, the results are as shown in the table 7 and graphs on Figure 6a, 6b, 6c, and 6d.

Discussions

Referring to table 7 and figures 6a, b, c, and d, by comparing the situation of the hotel's electrical system, the installation of capacitor banks on LVMDP1 and LVMDP2 has the following effects:

First, increase in active power by 2.8% on LVMDP1 from 1266kW to 1301kW and by 2.9% on LVMDP2 from 1281kW to 1281kW.

Second, decrease in load current by 26.6% on LVMDP1 from 2785.9A to 2045.9A and by 26.8% on LVMDP2 from 2736.7A to 2003,7A. This decrease in load current has a very positive impact on reducing losses from the hotel's electrical system.

Third, a significant reduction in reactive power by 65.6% on LVMDP1 (from 1289kVAR to 443kVAR) and by 66.9% on LVMDP2 (from 1268kVAR to 420kVAR). So that the percentage of reactive power consumption to active power is 34.1% for LVMDP1 (443kVAR against 1301kW) and 32.8% for LVMDP2 (420kVAR for 1281kW).

The power factor increased significantly by 34.3% in LVMDP1 (from 0.7 to 0.94) and by 34.7% in LVMDP2 (from 0.7 to 0.95).

Finally, the decrease in the percentage of usage from reactive to active power to 34.1% and 32.8% respectively, and an increase in power factor to 0.94 and 0.95, respectively, for LVMDP1 and LVMDP2 caused the electrical system at Regent Resort & Holiday Inn to have complied with the provisions stipulated in the Regulation of the Minister of Energy and Mineral Resources. No. 07 of 2010 to avoid the fines imposed by the PLN.

Conclusion

To improve the electrical power factor of Regent Resort & Holiday Inn from 0.7 according to the target close to 0.95 it requires 900kVAR power from capacitor bank that installed on LVMDP1 and LMPDP2 to compensate the reactive power of 875.44 kVAR and 860.92 kVAR respectively.

The capacity of capacitor bank those required on LVMDP1 and LVMDP2 is 19.85 x 10-3 Farad, with capacity value for each step 2.20 x 10-3 Farad.

Based on the simulation result, installation of capacitor bank on LVMDP1 and LVMDP2 able to improve the power factor become 0,94 and 0,95 respectively and reduce the percentage usage of reactive power to active power become 34.3% and 34.7% so that the hotel to avoid the fines imposed by the PLN.

The studies conducted in this research only focus on technical analysis, therefore in the future, it is recommended to conduct an additional study on the economical aspect. So that we will have a more comprehensive study that will be useful for all related stakeholders and give a contribution to industrial power systems.

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Implementation of text to speech on web-based broadcasting radio service applications

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Abstract: Radio broadcasting is a source of information for the public. In delivering information, the broadcaster must read the text of the news before it is transmitted through a radio transmitter. Implementing a text-to-speech conversion can help solve this problem. The purpose of this study is to develop a Broadcasting Service Application by implementing text to speech on a Web-Based Radio Broadcasting service application that can convert data/ information in text form into information in the form of voice. This paper does not discuss text-to-speech conversion techniques but emphasizes how to apply text-to-speech conversion techniques in web-based broadcasting service applications, especially news and music data management. This application utilizes web hosting services and Google voice services to convert text data into voice. The method used is Analyzing the application system of Broadcasting Radio services, Application of Text to speech (TTS), which functions to convert text into sound before being transmitted to broadcasting stations and to test the response of the conversion results and data management to the quality of the design. The process carried out in this system, namely retrieval of text data from the news database, converting text data into sound, adjusting the volume of music and sound information, and updating the status of the text data that has been broadcast. Based on application testing carried out with the Black Box Testing Method, all functional applications have been running well and are now successfully operationalized.

Keywords: broadcasting, data management web, music playlist, text to speech

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Introduction

News in the form of text in Indonesian must be read aloud every time a broadcast is made. This reading job requires manpower and 24 hours of service time to optimize information to the public. A support service that can assist in converting news in the form of text into sound is needed. For this reason, it can be realized by a computer-based application that can receive data in the form of text, convert text into sound and manage to broadcast both news and entertainment in the form of music/songs.

A research entitled Retrieval of Mandarin Broadcast News Using Spoken Queries has been done and reported that voice data is stored in a database, news broadcasting is done by taking from a database that stores voice data [1]. On the other hand, the use of text-to-speech converters has developed with applications in various fields, such as the use of reading text on a computer display, reading electronic mail, reading story scripts. But the use of a text to speech converter has not been applied to broadcast radio news in real-time in text format from the database.

Some research on the application of the text to voice has been carried out [2]-[6]. This study discusses the conversion from text to speech and vice versa from speech to text (speech recognition). Text-to-speech conversion has been widely developed both from conversion technology, phonemes, and variations from various languages in the world. But the application of the text to speech conversion has not yet been implemented in broadcasting especially Indonesian-language radio broadcasting.

This application is expected to overcome problems in delivering information and entertainment services in the broadcasting world 24 hours a day.

Methodology

The waterfall model takes the fundamental process activities of specification, development, validation, and evolution [7]. The model can be represented as separate process phases such as requirements specification, system and software design, implementation, unit testing, integration, system testing, operation, and maintenance. The planning stages in this research are:

1. Data collection
   The necessary data collection is carried out by conducting literature/literature studies and interviews. Literature study which includes literature concerning text to speech (TTS) and radio broadcasting management. In this step, we study the application structure of web-based radio broadcasting services such as data formats, algorithms, and existing music management.

2. System Design Analysis
   Analysis of the system design in the form of a design for the development of Radio Broadcasting Support Applications with the application of the text to speech (TTS). The purpose of implementing the text-to-voice conversion is intended to facilitate the management and management of information. The analysis was carried out on the insertion of coding which functions to change the format of the text into a voice which is done repeatedly. analysis was also carried out on the length of the converted text to the iteration time.

3. Database Creation
   Based on the database design that has been outlined in the system design that has been made, identification of the entities involved is carried out. Each - each entity has an attribute that describes the entity itself. The identified entities will be used to support application development and implementation of text to voice conversion.

4. Interface Creation
   The interface design is a user interface design that will be used by application users to interact with the system to be built. This interface will be implemented into a Radio Broadcasting Support Application. The interface is designed specifically for the use of the Indonesian language because implementation is planned for radio broadcasting in Indonesia.

5. Program code generation
   After the database and interface creation stages are complete, proceed with the program code generation stage. The program code to build this web-based system uses a web editor and requires XAMPP software as a local web server.

6. Testing
   At this stage, testing is carried out on a web-based application system that has been created by uploading it to a web server connected to the internet network. Testing is carried out to ensure the system built is running as expected. If an error occurs, then repairs are made to the system.

7. Evaluation
   At this stage, an evaluation of the system is carried out on the success of the service support system that has been developed.

Results and Discussions

Information processing architecture can be seen in Figure 1 [8]. Text data from newsagents/reporters are sent and stored in the database. Development application includes data/news retrieval in the form of text from the database, conversion of text data into speech, management of song and information settings, and news updates that have been converted to the database.

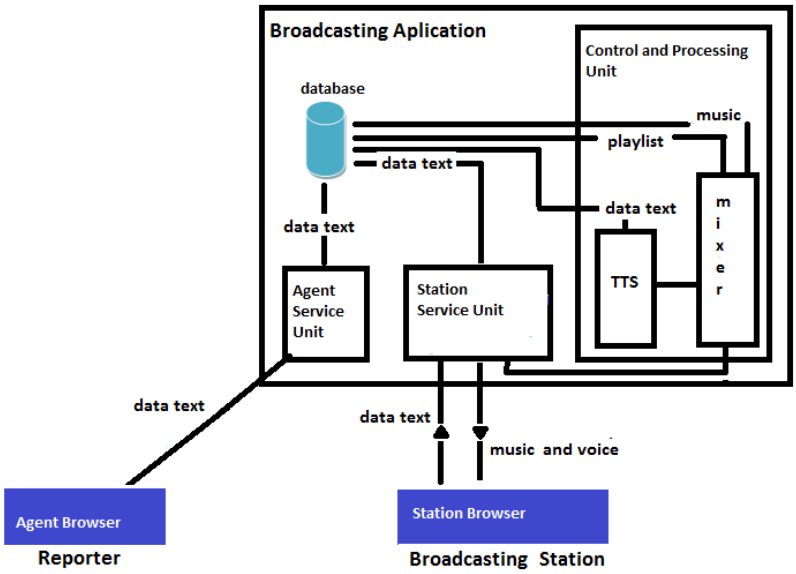

Figure 1. Information processing architecture

1. Retrieval of data/news in the form of text from the database based on the news that enters the database from field agents/reporters who work to find news in the community. The data taken are the name of the agent and news according to the status of the data that has not been converted.
2. Conversion of text data into voice is done by using facilities from Google to obtain voice using an Indonesian voice translator.
3. The sound produced by the translator is then superimposed on the music. When the sound is played, the music volume is set to decrease with a scale of 15% of normal sound so that information/news is heard clearly but there is still music. After the information/news is played, the music sound is set to normal again (100%). The resulting sound is then forwarded to the radio broadcasting transmitter.
4. The converted data/news is synced back to the database with the status converted so that it is not read again as a news queue.

The process will repeat itself from data/news retrieval to the synchronization stage and will run automatically every ten seconds to anticipate news queues that accumulate. Figure 2 describes the sequence of processes carried out in the application of the text-to-speech conversion method and settings with music.

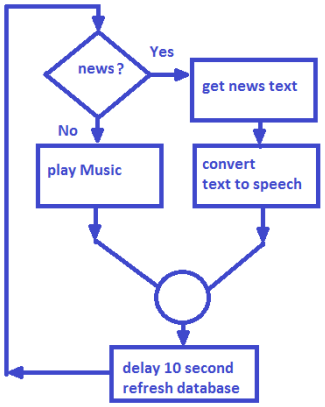

Figure 2. Chart of the TTS implementation process

The implementation of the design into coding for looping can be seen in the following program list [8],[9]. The loop is set to 10000 ms via the setInterval function.

```
setInterval(myLoop, 10000);
function myLoop(){
   myMusik_VolUnInterupt();
   myDBRefresh();
   if ((news !='') & (news!=news)){
            myTTS();
           };
};
```

Update data in the database is placed in a function named myDB_status, which functions to change the status of the news if the news text data has been converted to sound. News that has updated its status will not be read as a news queue.

```
function myDB_status(){
        $.ajax({
                type: 'POST',
                url: "update.php",
                data: {id:this['id']},
                dataType:'json',
                success: function() {}
               });
        };
```

The function used to convert text data into voice can be seen in the following coding list [10].

```
function myTTS (){ tts=news+". "+agent+" ,report";
    myMusik_VolInterupt();
  responsiveVoice.speak(
            tts,
            "Indonesian Female",
              {
                pitches: 1,
                rates: 1,
                volumes: 1,
              }
           );
  news=news; news='';
  myDB_status();
 };
```

It can be seen that the converted text is a combination of news text, followed by the name of the agent/reporter and ending with the word 'report'. When the news in the form of sound is played, the music volume is changed to 15% of normal sound. This setting is placed in a function named myMusik_VolInterupt();

Interface Display

The interface display of the Broadcasting Radio Service Support Application with the application of the Web-based text-to-voice conversion method that has been developed in this study can be seen in Figure 3. Some texts and news on the interface use Indonesian text because the interface is designed specifically for the application of radio broadcasting in Indonesia. The choice of translator also converts to Indonesian.

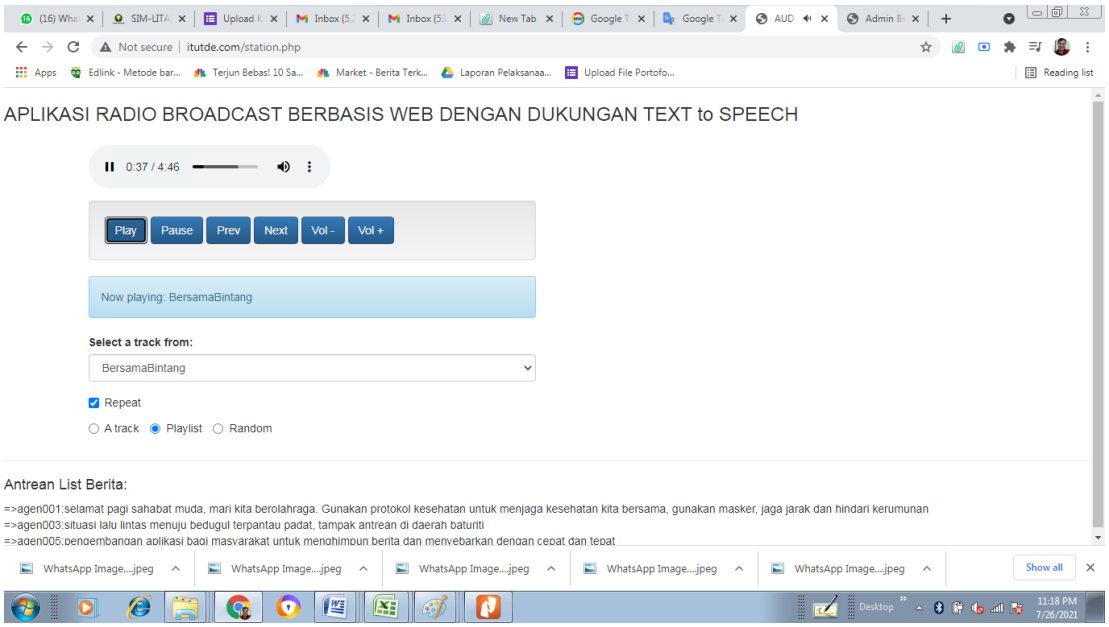

Figure 3. Broadcasting station application page

On the Broadcasting Station application page is an operator service page that displays the broadcast music list settings and news queue information. On this page, you can arrange music that is sorted by music data stored in the database. This music arrangement is like a playlist in general.

The news queue is retrieved from the news database with unconverted status. This news queue is converted, broadcast, and synchronized in turn according to the order of the table.

Application Testing

Functional testing of Text to Voice Data conversion

Application testing is carried out to determine the performance after the application of the text to voice conversion method on the Web-based Broadcasting Radio Service Support Application that has been developed. Application testing using the Black Box Testing method focuses on the functional specifications of the software.

Application testing is done with simulation data by inputting news data from newsagents/field reporters. The news was sent 10 times from 5 different agents. The length of the news is set to a maximum of 15 words. This input stage is done to observe the response of the application to convert the latest news that enters the system. In this test, it is expected to obtain a response from text to voice conversion.

The summary of the application test results is shown in Table 1. Black Box Testing focuses on the functional specifications of converting text to speech in software. Based on the results of system testing, functionally the application has been running well.

Functional Testing of Data Management and Synchronization

Application testing is carried out to determine the performance of music and news settings that are broadcast, as well as synchronization of the status of the news queue in the database. Testing the application uses a test method similar to the stage 1 test, but with varying text length simulations (variation between 10 to 20 words). Determination of 10 to 20 words adjusted to set the repetition of database retrieval of 10 seconds. An average of 15 words is obtained by analogy, each word consists of 5 to 15 letters, so that an average of 10 letters per word is obtained 150 letters for one news. In this test, it is expected to get the synchronization setting time to the database.

Table 1. Functional testing of TTS conversion and Data Update.

class	item	result
Application Running	Operator function	*Valid*
	Show music options and settings	*Valid*
Music Management	Choose music	*Valid*
	Set music playback	*Valid*
Sending News	Display news in text form	*Valid*
Conversion Function	Convert text data to voice	*Valid*
Update Data Function	The system automatically changes the news status after text data were converted	*Valid*

Application testing focuses on the functional specifications of synchronizing music management with news in the form of sound and synchronizing news status updates in the database. Based on the results of system testing using the Black Box Testing method, functionally the application has been running well.

Conclusion

The development that has been carried out on the application to support radio broadcasting services is in the form of converting text data in the form of news from a database (news with an average word length of 15 words and the iterative process of retrieving news from the database every 10 seconds), music and news management, synchronizing news queue status. This application was developed with the hope of reducing the burden on operators and broadcasters in disseminating information to the public.

This application for supporting radio broadcasting services has also been tested and shows that the functionality of the application has been running well.

Furthermore, this application can be developed for internet-based voice information services at campus locations, factories, and emergency services for motorists and others.

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