The Decision Support System For The Acceptance of Pencak Silat Athletes in Pra-PON and PUSLATDA Team Selection Using Technique For Other Preference By Similarity To Ideal Solution Method

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ABSTRACT
Pencak Silat is one of the traditional martial arts that originated from Indonesia. The parent of Pencak Silat organization in Indonesia is INDONESIAN PENCAK SILAT ASSOCIATION (IPSI). Pencak Silat is one of the most reliable sports branches at the International-scale Olympics. Proven at the ASEAN GAMES 2018 Olympics and then the Pencak Silat Sports Branch is one of the most gold medal contributor sports with a total of 14 medals. With the increasingly tight competition of Pencak Silat Sports, the trainer desperately needs athletes who fit certain criteria in order to be reliable in a tournament. In this study, the authors wanted to create a Decision Support System to make it easier for coaches to select athletes who fit the criteria set by the trainer. Decision Support System is a computer-based system intended to help make decisions by utilizing certain data and models to solve problems that are not structured and influenced by many factors from human and non-human.

The method used is Technique For Other Preference by Similarity To Ideal Solution (TOPSIS). The TOPSIS method has the ability to provide solutions in determining the best decisions, since this method provides an alternative by determining the shortest distance of positive ideal solutions and the longest distance of negative ideal solutions.

Keywords:
Pencak Silat, Decision Support Systems, Technique For Other Preference by Similarity To Ideal Solution, Web

1. Introduction

1.1 Background

Pencak Silat is one of the traditional martial arts originating from Indonesia. The parent organization of Pencak Silat in Indonesia is IKATAN PENCAK SILAT INDONESIA (IPSI). Pencak Silat is one of the most reliable sports in the International Olympics. Proven at the 2018 ASEAN GAMES Olympics, The Pencak Silat Sport is one of the most gold medal contributor sports with a total of 14 medals. With the increasingly tight competition of Pencak Silat Sports, coaches desperately need athletes who fit certain criteria in order to be relied upon in a tournament. The most important thing for athletes to have is to have hard power, strong physique, high mentality and many more factors that must have fighters who will compete.

Currently coaches still use Microsoft Excel to determine which athletes are eligible to be contested. The effectiveness and effectiveness of the system used is not maximal, Data redudnation often occurs, the calculation of each variable to accept athletes is unfounded. All of these problems resulted in decisions being taken uncertainly on target.

In this study, the authors wanted to create a Decision Support System to make it easier for coaches to select athletes who fit the criteria set by the trainer. Decision Support System is a computer-based system intended to help make decisions by utilizing certain data and models to solve problems that are not structured and influenced by many factors from human and non-human.

The method used is Technique For Other Preference by Similarity To Ideal Solution (TOPSIS). The TOPSIS method has the ability to provide solutions in determining the best decisions, since this method provides an alternative by determining the shortest distance of positive ideal solutions and the longest distance of negative ideal solutions.
1.2 Problem Formulation

Can be concluded from the background above, then the formulation of existing problems are:

1. How to apply Technique For Other Preference by Similarity To Ideal Solution (TOPSIS) in The Decision Support System for Admission of Pencak Silat Athletes in TIMPra-PON and PUSLATDA selection in accordance with the criteria of the trainer.
2. There is no system that can support coaches in selecting athletes who will enter the Pre-PON and PUSLATDA Teams so that the trainer only uses manual calculations.

1.3 Problem Limitation

In order for this research not to expand the problem in writing this thesis, it is necessary batsan-boundaries to simplify the problem, namely:

1. Analyze athlete criteria data based on the criteria requested by the Trainer.
2. Does not discuss about the security of data in the database used.
3. Output results from the system are only the results of the competition of Eligible Athletes entered into the Team that has been calculated using TOPSIS.
4. The System Does not discuss the budget plan for the cost of selection and checking athlete documents.

1.4 Research Objectives

The purpose of writing is:

1. Implement decision support system using TOPSIS method for selection of Pra-PON and PUSLATDA TEAM Athletes.
2. Create a Decision Support System that can make it easier for coaches to select athletes who meet the criteria set by the coach.

1.5 Research Benefits

The benefits of writing this are:

a. For Writer :
   1. Applying the knowledge that has been obtained from lectures.
   2. Understand how to apply the Topsis method in designing a decision support system for the selection of athletes that fit the criteria that have been determined by the coach.

b. For Users :
   1. Provide recommendations to coaches in making decisions from the selection results of the Pra-PON and PUSLATDA Teams objectively.
   2. Make it easier for coaches to determine athletes who fit the criteria to be included in the Pra-PON and PUSLATDA Teams.

1.6 Literature Studies

In this chapter discusses the study of the library and the basis of the theory used to support the writing of the thesis on The Decision Support System for Acceptance of Athletes Pencak Silat in The Selection of Pra-PON and Puslatda Team Using TOPSIS Method (Technique For Other Preference by Similarity To Ideal Solution). Some of the basic theories in question are Decision Support System (SPK), Pencak Silat, Pra-PON, Puslatda, Technique For Other Preference by Similarity To Ideal Solution (TOPSIS).

In the research on Decision Support System in the application of Topis(Technique For Other Preference by Similarity To Ideal Solution) method.In the journal "Decision Support System for Scholarship Recipients at Saniah Aek Songsongan Private Junior High School with Technique For Other Preference by Similarity To Ideal Solution (TOPSIS) Method" There is an equation of calculation because after the calculation in determining the outstanding and poor students by determining the
shortest distance on poverty scholarships and determining the best assessment on the determination of outstanding scholarships.

While in the study "System Supporting The Selection of Athletes Who Deserve to Enter THE TEAM Pencak Silat With Simple Additive Weighting (SAW) Method" has the same topic but differs in the selection of methods. The method used in this research is Simple Additive Weighting (SAW). In this study also discussed about the selection of athletes who are eligible to enter the Pencak Silat team, but in this study only achieved an accuracy rate of 85% (L.; P.; and Mahmudy, 2014)

Then in the next journal reference entitled "Best Employee Determination Decision Support System Using TOPSIS Method" has an equation in the calculation using TOPSIS Method. In a company employees are very important assets in the progress of a company. (Knowledge and Computers, 2018)

1.7 Decision Support System

Decision Support System (SPK) or Decision Support System (DSS) is a system that can provide the ability to solve problems in supporting decisions that are difficult to calculate or select manually or the ability to communicate for problems with semi-structured and unstructured conditions. This system is used to assist a person or User in decision making in semi-structured and unstructured situations where no one knows exactly how to make decisions that should be made. (Turban and Aronson, 2001)

1.8 Technique For Other Preference by Similarity To Ideal Solution (TOPSIS)

Topsis method is one of the methods that are often used to complete decision making practically. Topsis has a concept where the chosen alternative is the best alternative that has the shortest distance from the ideal positive solution and the furthest distance from the negative ideal solution. The more factors considered in the decision-making process, the more relative it is also difficult to make decisions on a problem. (Widayanti and Wijaya, 2016)

The stages in using TOPSIS include creating a normalized decision matrix, creating a normalized weighted decision matrix, determining the ideal positive solution matrix and the negative ideal solution matrix, determining the distance between the value of each alternative and the ideal positive solution matrix and the negative ideal solution matrix, and determining the preference value for each alternative. (Widayanti and Wijaya, 2016)

1.8.1 TOPSIS Proceedure

TOPSIS requires a working rating on each alternative $A_i$ on each normalized $C_j$ criteria, namely:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^n x_{ij}^2}}$$

dengan $i=1,2,\ldots,m$ dan $j=1,2,\ldots,n$ (1)

Description:
$\mathbf{r}_{ij} = \text{normalized matrix } [i][j]$
$x_{ij} = \text{decision matrix } [i][j]$

Then the ideal positive solution $A^+$ and $A$- negative ideal solution can be determined from the normalized weight rating ($y_{ij}$) as follows:

$y_{ij} = w_{ij}r_{ij}$

where $y^+j = \max y_{ij}$ if $j$ is the value attribute
$y^-j = \min y_{ij}$ if $j$ is the cost attribute

$A^+ = (y^+1, y^+2, \ldots, y^+n)$ where $y^+j = \max y_{ij}$ if $j$ is the cost attribute
$A^- = (y^-1, y^-2, \ldots, y^-n) = \min y_{ij}$ if $j$ is the value attribute (2)

After that, the calculation of $D_i^+$ as an alternative distance from the ideal solution is defined as follows:

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_{ij}^+ - y^+_j)^2} \quad \text{with } i = 1,2,3,\ldots,m \ldots\ldots\ldots\ldots\ldots(3)$$

And the distance to the negative-ideal solution is defined as $S_i^-$:
\[ D_i^- = \sqrt{\sum_{j=1}^{n}(y_{ij} - y_j^-)^2} \quad \text{dengan } j = 1, 2, 3, \ldots, m \quad \text{………(4)} \]

So that alternatives can be determined to find the best alternative based on their relative proximity to the ideal solution \((C_i)\) which is defined as follows:

\[ C_i = \frac{D_i^-}{D_i^- + D_i^+} \quad \text{with } i = 1, 2, 3, \ldots, m \quad \text{………(5)} \]

1.9 Pencak Silat

Pencak Silat is a martial arts sport native to Indonesia. Understanding pencak is a technique of beauty movement by avoiding. Pencak can be contested with the means of achievement, while silat is an element of martial arts techniques to fend off, attack and lock so that opponents can not be demonstrated in public. The parent organization of Pencak Silat in Indonesia is IKATAN PENCAK SILAT INDONESIA (IPSI).

1.9.1 Selection of Pencak Silat Athletes

In this Decision Support System, the criteria used are based on the results of discussions from team trainers, warriors and KONI East Java.

Here is the table of criteria that have been prepared by the trainer that can be seen in table 1.

<table>
<thead>
<tr>
<th>Test</th>
<th>PUSLATDA</th>
<th>Pra-PON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sit up (1 minute 45 inclined)</td>
<td>40 (women), 45 (men)</td>
<td>50 (female), 55 (men)</td>
</tr>
<tr>
<td>2 Ankle flexibility (left and right)</td>
<td>10 cm</td>
<td>15 cm</td>
</tr>
<tr>
<td>3 Sit and Reach flexibility</td>
<td>20 cm</td>
<td>20 cm</td>
</tr>
<tr>
<td>4 3 RM Single leg squat (left and right) with dumbbell</td>
<td>15 kg (male); 10 kg (female)</td>
<td>20 kg (male); 15 kg (female)</td>
</tr>
<tr>
<td>5 Bleep test (MFT)</td>
<td>Level 9 (female); Level 11 (male)</td>
<td>Level 10 (female); Level 12 (male)</td>
</tr>
<tr>
<td>6 Abdominal roll</td>
<td>5 (men – off toes); 10 (women – off knee)</td>
<td>10 (men), 3 (women) – off toes</td>
</tr>
<tr>
<td>7 20 meter sprint</td>
<td>3.2 sec (male), 3.5 sec (female)</td>
<td>3.0 sec (male), 3.3 sec (female)</td>
</tr>
<tr>
<td>8 Juggling (3 balls)</td>
<td>30 sec</td>
<td>60 secs</td>
</tr>
<tr>
<td>9 Triple jump (standing)</td>
<td>50 cm (female), 60 cm (male)</td>
<td>60 cm (female), 70 cm (male)</td>
</tr>
<tr>
<td>10 Square jump (30 secs)</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>11 Russian twist (10 kg male, 5 kg women) - 30 times</td>
<td>11 sec</td>
<td>10 sec</td>
</tr>
<tr>
<td>12 Hamstring (full)</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>13 3 RM Clean and Press</td>
<td>0.8 x body weight (male), 0.5 x bwt (female)</td>
<td>1 x body weight (male), 0.7 x bwt (female)</td>
</tr>
<tr>
<td>14 Rope Climb – no legs</td>
<td>2 x (male); 1 x (female)</td>
<td>3 x (male); 2 x (female)</td>
</tr>
</tbody>
</table>
1.10 PHP (Hypertext Preprocessor)

PHP is an Open Source server-side web programming language. PHP is a script that integrates with HTML and is on the server (server side HTML embedded scripting). PHP is a programming language that can be used to form a dynamic website page. Dynamic is the page that will be displayed when the page is requested by the User. This mechanism causes the information received by the User to be up to date. All PHP scripts are executed on the server where the script is run. (Subagja, 2018)

1.11 XAMPP

XAMPP is free software that supports many operating systems, is a compilation of several programs whose function is as a stand-alone server (localhost), which consists of apache HTTP Server programs, MySQL Data Base, and language translators written with PHP and Perl programming languages. The name XAMPP stands for X (any four operating systems), Apache, MySQL, PHP, Perl. (Ratasari, 2018)

1.12 Database

In simple language, a database is a structured set of data stored on a computer systematically so that it can be checked using a computer program to obtain information from the database. Database understanding is a data storage system where the stored data has been inputted in a storage system. (Pamungkas, 2017)

1.13 Flowchart

Flowchart is a graphical depiction of the steps and sequence of procedures in the design of a program. Flowchart helps analysts and programmers solve problems into smaller segments and helps in analysing other alternatives to operations.

Flowcharts consist of data flowing through the systems and processes that transform that data. Data and processes in flowcharts can be described online or offline. (Nuraini, 2015)

1.14 UML (Unified Modeling Language)

UML is a method of visual modeling as a means of designing and or creating object-oriented software because UML is a visual language for modeling object-oriented languages, so all elements and diagrams based on uml object oriented paradigm also provide writing standards on the system. UML consists of several diagrams namely usecase diagram, class diagram, activity diagram, sequence. (Hendini, 2016)

1.15 Black Box Testing

Black Box Testing method is one of the methods that are often applied because only the lower limit and upper limit of the expected data, the estimated amount of test data can be calculated through the number of entry data fields to be tested, the entry rules that must be met and the case of the upper and lower limits that meet. And with this method can receive unexpected data input then cause the stored data is less valid.

Figure 1.1 describes how black box testing is implemented. (Cholifah, Yuliansingsih and Sagita, 2018)
2. Research Method

A research must have a working concept and a research framework in which consists of steps and explanations in order for the research to run well and targeted. In this chapter will explain the Research Methodology, where in this study use Flowchart diagram as a concept and research framework such as figure 3. Following.

![Flowchart Research Methodology](image)

**2.1 Problem Analysis**

To be able to understand the problems in the system of supporting the selection decisions of Pencak Silat athletes in the Pra-PON and PUSLATDA Teams. The first step in this stage is to conduct a Literature Study, decipher the problem, identify the problem. Furthermore determine the purpose of research, selection data retrieval and criteria data.

**2.1.1 Literature Studies**

there are two stages in the Literature Study. the first stage is to do a comparison of each previous research journal and the next stage is collecting data and information on how to make the system. Researchers conducted direct observations at KONI East Java for data collection and reading books as a reference in conducting research and literature that supports the creation of the system.

**2.1.2 Determining Goals**

At this stage explain the objectives to be achieved in this research. In this study the targets achieved, especially those that can overcome the problems that exist in the selection of athletes Pencak Silat and can facilitate the selection process of athletes who will prove the selection of acceptance in the Pra-PON and PUSLATDA Teams.

**2.1.3 Data Retrieval**

In a decision making system, data is needed as input and output parameters in processing data. In the Decision Support System for the selection of Pencak Silat athletes using this...
TOPSIS Method, researchers conducted external data retrieval, data required include SitUp data, Ankle Flexibility, Sit and Reach Flexibility, 3 RM single Leg Squat with dumbbell, Beep Tets (MFT), Abdominal Roll, 20 Meter Sprint, Juggling, Triple Jump, Square Jump, Russian Twist, Hamstring, 3 RM Clean and Press, Rope Climb-no Leg. Data taken from KONI East Java Coach, data as criteria to meet the needs of Decision Support System and have accuracy in the data. The data used is the data of KONI athletes in East Java, Pencak Silat sports.

2.2 Analysis of TOPSIS Method

After the data is collected, data processing will be carried out to adjust the data activities to be processed in the TOPSIS method consisting of several stages, namely defining the problem and determining the criteria of the desired solution, determining the decision matrix, solution matrix, alternative, and reference values with the aim of qualifying the acceptance of Pencak Silat Athletes in the Pra-PON and PUSLATDA Teams.

2.2.1 Topsis Method Calculation

a. Determine the weight of each criterion

<table>
<thead>
<tr>
<th>Code</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>7</td>
</tr>
<tr>
<td>C2</td>
<td>4</td>
</tr>
<tr>
<td>C3</td>
<td>3</td>
</tr>
<tr>
<td>C4</td>
<td>6</td>
</tr>
</tbody>
</table>

b. Decision matrix

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>A2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>A3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

c. Normalized decision matrix

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0.639602</td>
<td>0.485071</td>
<td>0.267261</td>
<td>0.816497</td>
</tr>
<tr>
<td>A2</td>
<td>0.639602</td>
<td>0.485071</td>
<td>0.534522</td>
<td>0.408248</td>
</tr>
<tr>
<td>A3</td>
<td>0.426401</td>
<td>0.727607</td>
<td>0.801784</td>
<td>0.408248</td>
</tr>
</tbody>
</table>

d. Normalized weighted matrix

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
e. Ideal solution matrix

Table 6. Ideal solution matrix

<table>
<thead>
<tr>
<th>Attribute</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>4.477215</td>
<td>2.910428</td>
<td>2.405351</td>
<td>4.898979</td>
</tr>
<tr>
<td>A-</td>
<td>2.98481</td>
<td>1.940285</td>
<td>0.801784</td>
<td>2.44949</td>
</tr>
</tbody>
</table>

f. Alternate weighted value distance with positive ideal solution

Table 7. Alternate weighted value distance with positive ideal solution

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0.941176</td>
<td>2.571429</td>
<td>0</td>
<td>1.874195</td>
<td>D1+</td>
</tr>
<tr>
<td>A2</td>
<td>0.941176</td>
<td>0.642857</td>
<td>6</td>
<td>2.753912</td>
<td>D2+</td>
</tr>
<tr>
<td>A3</td>
<td>2.227273</td>
<td>0</td>
<td>6</td>
<td>2.868322</td>
<td>D3+</td>
</tr>
</tbody>
</table>

h. The proximity of each alternative to the ideal solution

Table 9. Preference value

<table>
<thead>
<tr>
<th>C</th>
<th>Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>0.60481</td>
</tr>
<tr>
<td>V2</td>
<td>0.380873</td>
</tr>
<tr>
<td>V3</td>
<td>0.39519</td>
</tr>
</tbody>
</table>

2.3 System Design

At the design stage of the system researchers used design using the Unified Modelling Language (UML) modeling language. In designing this software, UML is defined by Use Case, Activity, Sequence, and Class Diagram diagrams.
2.4 Software Implementation

At this stage, researchers will do how to create interfaces and design systems for the selection process of Pencak silat athletes in The Pra-PON and PUSLATDA Teams. Researchers use PHP programming language, while for data management using MySQL. Input from the system is data from athlete test results obtained from KONI East Java and Weighting of each criteria. The output of the system is the result of data selection from the highest to lowest rankings in each team.

2.5 Testing

Testing stage is the determination stage to find out if the implementation of Decision Support System with TOPSIS method is in accordance with the objectives to be achieved. This test stage uses the Black Box Testing method to identify errors in the system. So it can be known whether the TOPSIS method can be an alternative result of determining the determination of eligible athletes in the Pra-PON or PUSLATDA teams.

3. Results And Discussion

In this chapter will discuss about how the author designed the system and software implementation based on the results obtained from the analysis of the system created.

3.1 Designing a System Using UML

In the process of Supporting The Decision Supporting The Acceptance of Pencak Silat Athletes in the Selection of Pra-PON and PUSLATDA Teams we need to design a system by forming a DSS architecture using UML (Unified Modeling Language). This method is used to design every process that will be done by the system. designing using Use case Diagram, Class Diagram, Activity Diagram, Sequence Diagram.

3.2 Implementation of User Interface

Interface design is an important thing in designing a system, because the appearance of the interface is one of the important media in supporting the interaction between user and system built. In the design of the interface in this system consists of five forms, among others, the main page form, criteria data form, alternative data form, matrix value form, Topsis result form. Here is an overview of the interface structure of the system shown in figure 14.
In figure 14. explains how users will interact with the system. When opening the system, the main page will appear containing four menus, namely Data Criteria menu, Alternative Data menu, Matrix Value menu, Topsis Result menu. The design of User Interface will be described as follows.

3.2.1 Implementation of the Main Page Interface

The Home page menu is the first view user sees in running this system. On the main page there are four menus that can be used by the User. The design of the main page of the system is depicted in figure 15.

3.2.2 Implementation of Data Interface Criteria

Data Criteria menu page is a page where Users can add the criteria needed in selecting martial arts athletes. The criteria data page menu is depicted in figure 16.

3.2.3 Implementation of Alternative Data Interfaces

Alternative data page menu is a page where User can view and add alternative data. The alternative data page menu is depicted in figure 17.

3.2.4 Matrix Value Page Implementation
The matrix value page menu is a page where Users can add matrix values to any alternatives that have been added previously. The matrix values menu is depicted in figure 18.

3.2.5 Implementation of Calculation Results Page

Topsis result menu page is a menu where Users can see the calculation results using the Topsis method. The topsis result menu page is depicted in figure 19.

3.3 Black Box Testing

Black Box testing is done by testing every activity contained in the System. Testing and test results for the Black Box System in the table 10.

<table>
<thead>
<tr>
<th>Testing</th>
<th>Expected realization</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Menu Page</td>
<td>View the selected Page</td>
<td>Success</td>
</tr>
<tr>
<td>Criteria Data Page</td>
<td>To add and remove data</td>
<td>Success</td>
</tr>
<tr>
<td>Alternate Data Page</td>
<td>To add and remove data</td>
<td>Success</td>
</tr>
<tr>
<td>Matrix Values Page</td>
<td>To add and remove data</td>
<td>Success</td>
</tr>
<tr>
<td>Calculation Results Page</td>
<td>Can calculate topsis</td>
<td>Success</td>
</tr>
</tbody>
</table>

4. Conclusions And Suggestions

4.1 Conclusion

Based on analysis, design, and implementation of Decision Support System for selection of martial arts athletes in Pre-PON and PUSLATDA Team using Technique For Other Preference by Similarity To Ideal Solution (TOPSIS) method that this system can work as expected by researchers. This Decision Support System can also calculate Topsis results based on the criteria determined by the Team Manager. At the end of the calculations have also been applied to the number of athletes who are eligible to qualify for Team selection. This system has been built and designed using Sublime Text to manage program code by using PHP programming language (Hypertext Preprocessor) and using MySQL for database management. This research resulted in a system that can run on Windows 7 to Windows 10.
4.2 Suggestions

After discussing some of the above conclusions, it can be suggested that for the design of this system is recommended to develop a web-based system to be made an Android-based system design.

References


