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Decision Support System for Determining Extracurricular Interest Using the Naive Bayes Method

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Abstract

The Decision Support System (SPK) is a tool that can help individuals make more effective and efficient decisions. In the context of education, SPK can be used to assist students in determining extracurricular specializations that suit their interests and talents. This research aims to develop an SPK to determine extracurricular specializations for students using the Naive Bayes method. The Naive Bayes method was chosen because of its ability to classify based on probability. The data used in this study include student profiles, academic scores, and student interest in various types of extracurriculars. The results of the study show that the SPK developed can provide recommendations for extracurricular specialization with quite high accuracy. In addition, the system is also easy to use and can help students make more informed decisions.

Introduction

Schools are educational institutions that have the responsibility to provide knowledge, skills and develop them in the form of school activities. In its implementation, there are 3 types of curricular activities that occur in schools, namely intracurricular, co-curricular and extracurricular activities. Extracurricular activities are educational activities outside of class hours aimed at helping the development of students according to their needs, potential, talents, and interests.

SMA Negeri 1 Stabat is a school that allows its students to participate in all kinds of extracurricular activities without skipping lessons. Extracurricular activities that are in accordance with students' interests and talents are important because they are related to the development of education in accordance with their living needs and learning environment. The interests and talents that exist in each student must be directed. Therefore, students' interests and talents must be known to the educational institutions that are accommodated in extracurricular activities (Hidayati, 2020 Umamit, 2021).

The process of selecting extracurricular activities by students at SMA N 1 Stabat is still carried out conventionally, by students filling out the extracurricular registration form distributed by the student affairs section (Nurhasanah et al., 2022; Panjaitan, 2022). The form distributed to students contains student biodata as well as available extracurricular options, namely Scouting, futsal, drumband, volleyball, and basketball. After the form is filled out, it is then collected to the class leader to be given to the student affairs section (Maria, 2021). The mechanism for filling out the form in this way is considered ineffective and causes several

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problems such as the loss of the election form, the form is not distributed to all students, some students do not choose activities (Andika et al., 2020; Nasrullah & Suyatno, 2023).

Extracurricular due to the absence of an examination by the student affairs section, students choose the wrong extracurricular activities that are not in accordance with their character and students who are not in school at the time of the election cannot choose extracurricular activities (Rahman et al., 2023).

Therefore, it is necessary to have a system to support extracurricular specialization decisions for making the right decisions for students (Long, 2020). A decision support system is a computer-based information system that combines individual intelligence sources with component capabilities in the decision-making process. The method applied to this rule support system is the naïve bayes method. The Naive Bayes method is the most popular classification method used with a good level of accuracy.

The naïve bayes method is able to provide an alternative to data management quickly in decision-making by ranking the probability of each data. This is based on previous research entitled "Decision Support System for the Selection of Outstanding Students Using the Web-Based Naive Bayes Method" by (Selfiyan et al., 2019). In the study, a decision support system was built that was used for the selection of outstanding students. By using the Naive Bayes method. This decision support system is formed with the PHP programming language and SQL database (Wihartati & Efendi, 2021). The system takes input in the form of student data, after entering the data, the system will provide an output that decides whether a student deserves the title of outstanding student or not. The resulting system helps in determining the degree of outstanding students.

Based on the explanation above, the researcher raised a study entitled "Decision Support System to Determine Extracurricular Specialization Using the Naive Bayes Method". In this study, the naïve bayes method can be used for venue selection with a multi-criteria system, where the criteria are determined by the school, namely physical ability, height, weight, and basic techniques. The designed system assists schools in determining students' extracurriculars. In addition, efficiency is more accurate and helps in determining students' talent interests to minimize errors in choosing student extracurricular activities.

Methods

In this study, using the research method, Research and Development (R&D) is a systematic process that involves research and development activities to produce products. This process includes pre-research, planning, development, and evaluation stages to achieve specific and useful goals for the community.

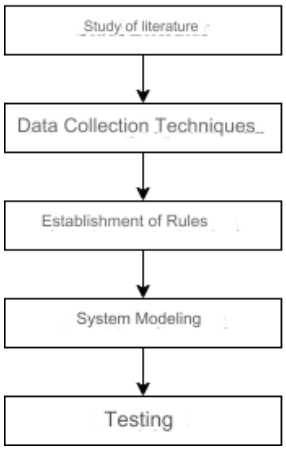

Figure 1. Research Stages

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The stages in this study include: (1) Literature study, carried out to gather knowledge by studying literature sources to be used as a reference for data related to the research to be carried out; (2) The data collection technique, the data collection stage carried out by the author is to make observations. Observation is a data collection technique that involves directly and systematically observing and recording events or actions performed by individuals or groups; (3) The formation of rules, used to define the search process or determine identity. It can be seen that there are four criteria in determining the selection of extracurriculars, namely the value of physical ability, height, weight, and basic techniques based on a predetermined order; (4) System modeling, is a form of simplification of very complex elements and components to facilitate the understanding of complex information. The system model that has been designed in the form of a flowchart below:

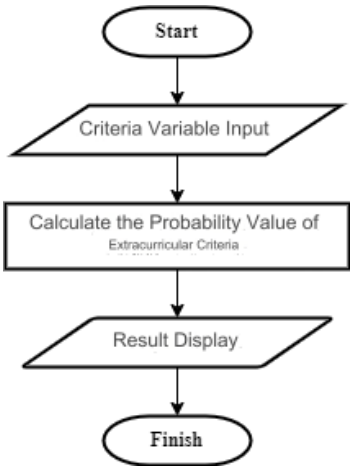

Figure 2. Naive Bayes Flowchart

Testing, which is the stage where the application will be run to find out if the system is in accordance with the goals to be achieved. This stage involves measuring to make the system workable against the desired goal, and is carried out using a trial method, where the results are compared with the system's findings

Results and Discussion

Naïve Bayes' Calculation

This stage is the stage of problem analysis, this analysis is a compilation of the analysis of the system to be developed and the system to be decided. The data collected are in the form of data on height, weight, physical ability, basic techniques and types of extracurricular along with rules from Bayes' Theorem and other supporting data.

Table 1. Criteria Table

Extracurricular Criteria	
Criteria	**Information**
C1	Physical Ability
C2	Height
C3	Weight
C4	Basic Techniques

Some of the parameters in the calculation system for determining extracurricular criteria are as follows:

Physical abilities

Height is often an important factor in some types of extracurriculars, especially those related to certain sports. For example, in sports like basketball or volleyball, height can be a

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significant competitive advantage. Weights for physical ability criteria can be given in the range of 0.6 to 0.9. Historical data shows that students with better physical abilities tend to be more successful and more satisfied with their extracurricular choices. Therefore, giving higher weight to physical abilities can improve the accuracy of SPK predictions.

Table 2. Physical Ability

Physical Ability Criteria		
Rentan	**Information**	**Value Weight**
>=90	Very Good	0,9
>=80	Good	0,8
>=70	Enough	0,7
<60	Low	0,6

Basic Techniques

Basic techniques refer to the basic abilities required for a particular extracurricular. Mastery of basic techniques allows students to adapt and develop more quickly in extracurricular activities. It is also an indicator of natural interest and talent in the field. Weights for basic engineering criteria can be given in the range of 0.6 to 0.9. Mastery of basic techniques not only affects current performance but is also the basis for further skill development in the future. The high weight shows the importance of this aspect in preparing students to face challenges and competitions in extracurricular.

Table 3. Basic Techniques

Basic Engineering Criteria		
Rent	**Information**	**Value Weight**
Excellent	Very Good	0,9
Good	Good	0,8
Enough	Enough	0,7
Bad	Low	0,6

Height

Height is often an important factor in some types of extracurriculars, especially those related to certain sports. Height affects the ability of participants to master game techniques and strategies that require high range or speed. Weights for height criteria can be given in the range of 0.6 to 0.9. A weight value between 0.6 to 0.9 indicates that height has a significant influence, but does not completely dominate the decision. This takes into account that while height is important, there are still other factors to consider in determining extracurricular specializations.

Table 4. Height

Height Criteria		
Rentan	**Information**	**Value Weight**
>=170	Very Good	0,9
>=160	Good	0,8
>=150	Enough	0,7
<150	Low	0,6

Weight

Weight is an important indicator in assessing a person's physical condition. Weight affects performance and injury risk in various physical activities. Weight balance is also important

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in activities that require agility and strength. Weights for weight criteria can be given in the range of 0.6 to 0.9. Setting a high weight on these criteria helps in selecting students who have a lower risk of injury, thereby improving the safety and sustainability of their participation in extracurricular activities.

Table 5. Weight

Weight Criteria		
Rent	**Information**	**Value Weight**
>=70	Very Good	0,9
>=60	Good	0,8
>=50	Enough	0,7
<50	Low	0,6

Weight Value

From the criteria mentioned, the level of importance of the criterion is determined based on the weight that has been determined in the form of Bayesian numbers. Here are the match ratings for each criterion:

Table 6. Weight Value

Weight Value	
Bayesian Number	**Value**
Low	0,6
Enough	0,7
Good	0,8
Very Good	0,9

Extracurricular Alternatives

Alternative designation is an important step to ensure that each student is placed in the extracurricular that best suits their interests and abilities. Here are the extracurricular alternatives marked with A1 to A5:

Table 7. Alternative Forms

Extracurricular Alternatives	
Alternative	**Extracurricular**
0.85-0.9	Basket
0.80-0.84	Volley
0.75-0.79	Futsal
0.70-0.74	Drumband
0.60-0.69	Pramuka

Bayes calculation trials are applied to extracurricular criteria to obtain results from each extracurricular. The steps to calculate Bayes include:

Determine the probability value, first define the probability of each evidence for each hypothesis based on the existing sample data using the Bayesian probability formula.

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C1 = 0.8 = P(E|$H1$)

C2 = 0.6 = P(E|$H2$)

C3 = 0.9 = P(E|$H3$)

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C4 = 0.8 = P(E|$H4$)

To find the universe can be summed from the above hypothesis:

$$\sum_{k=a}^{n} = C1 + C2 + C3 + C4$$

ADINDA FARRA DILLA

C1 = 0.8 = P(E|$H1$)

C2 = 0.6 = P(E|$H2$)

C3 = 0.9 = P(E|$H3$)

C4 = 0.8 = P(E|$H4$)

$\sum_{k=a}^{n} = 0.8 + 0.6 + 0.9 + 0.8 = 3.1$

After obtaining the addition above, the formula for calculating the universe is as follows:

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$P(H1) = \frac{H1}{\sum_{k=1}^{n}} = \frac{0.8}{3.1} = 0.2580$

$P(H2) = \frac{H2}{\sum_{k=1}^{n}} = \frac{0.6}{3.1} = 0.1935$

$P(H3) = \frac{H3}{\sum_{k=1}^{n}} = \frac{0.9}{3.1} = 0.2903$

$P(H4) = \frac{H4}{\sum_{k=1}^{n}} = \frac{0.8}{3.1} = 0.2580$

Determine the probability value of the hypothesis P (Hi) after the value of P (Hi) is known, the probability value of the hypothesis H regardless of any evidence.

$$\sum_{k=a}^{n} = P(Hi)\ x\ P(E|Hi)$$

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$\sum_{k=a}^{n}$ = (0.2580*0.8) + (0.1935*0.6) + (0.2903*0.9) + (0.2580*0.8)

= 0.2064+0.1161+ 0.2612+0,2064

= 0,7901

Determining and finding the value P (Hi | E) or the probability of hypothesis Hi is true if given evidence E.

$P(Hi|E) = ex =$ $\frac{P(E|Hi) * P(Hi)}{\sum_{k=a}^{n}}$

ADINDA FARRA DILLA

$P(H1|E) = \frac{0.8 * 0.2580}{0.7901} = 0.2612$

$P(H2|E) = \frac{0.6 * 0.1935}{0.7901} = 0.1469$

$P(H3|E) = \frac{0.9 * 0.2903}{0.7901} = 0.2903$

$P(H4|E) = \frac{0.8 * 0.2580}{0.7901} = 0.2612$

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After getting all the P grades (Hi | E), then add all the Bayes values with the following formula :

$$\sum_{k=a}^{n} Bayes = P(E|H1) * P(H1|E1) + \cdots + P(E|Hi) * P(Hi \mid Ei)$$

ADINDA FARRA DILLA

= (0.2612*0.8) + (0.1469*0.6) + (0.2903*0.9) + (0.2612*0.8)

= 0.2089+0.0881+0,2612+0,2089

= 0,7671

So, the results of data analysis for Adinda Farra Dilla were obtained from the theorama value obtained into the alternative extracurricular futsal.

System Implementation

The implementation in this system includes, among others, login display, homepage display, extracurricular data display, extracurricular criteria data display, student data display, user data display and SPK process display. The application system is built using the native PHP programming language.

Login Display

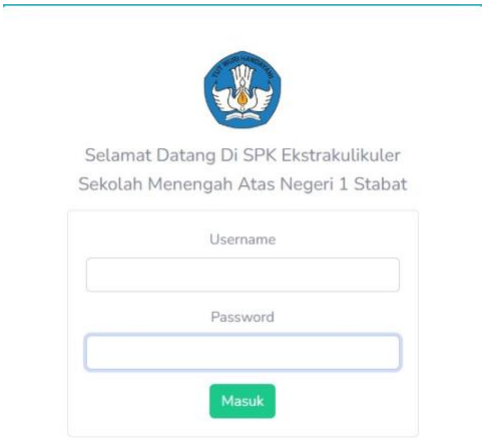

Figure 3. Login Page

The login view is the first view when the user wants to access the system. This display has a security system in the form of usernames and passwords that have been recorded or previously stored in the database.

Home View

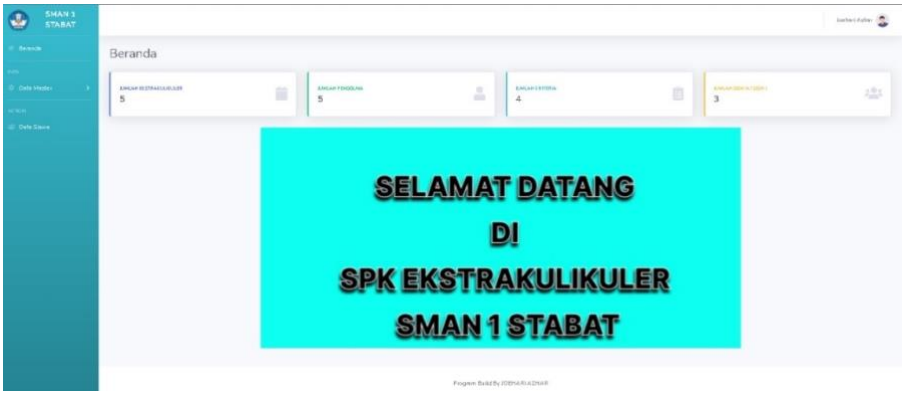

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Figure 4. Home Page

The home menu display is the first display when we access the system page after logging in.

Display of extracurricular data

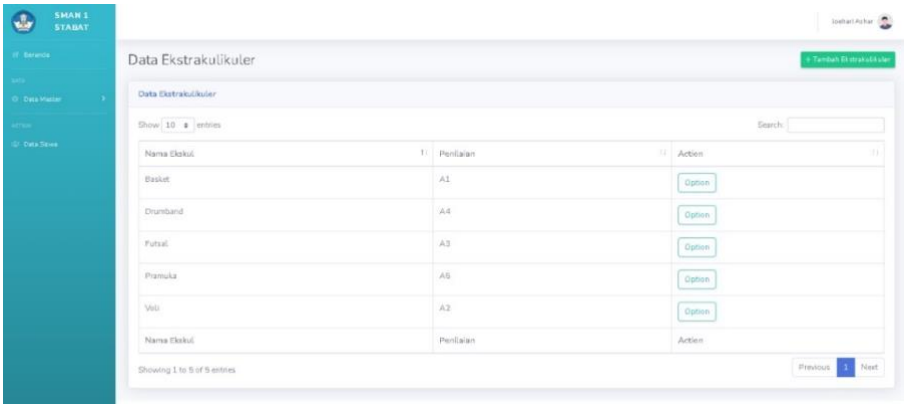

Figure 1. Extracurricular Data Pages

The extracurricular data display contains extracurricular data which is an alternative data from the SPK system.

Criteria Data Display

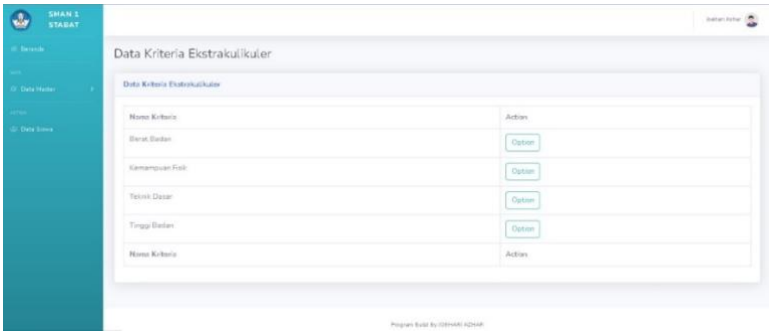

Figure 2. Criteria Data Page

This display contains criteria data as a factor in determining the SPK process. These data consist of weight, physical ability, basic techniques, height.

Student Data Display

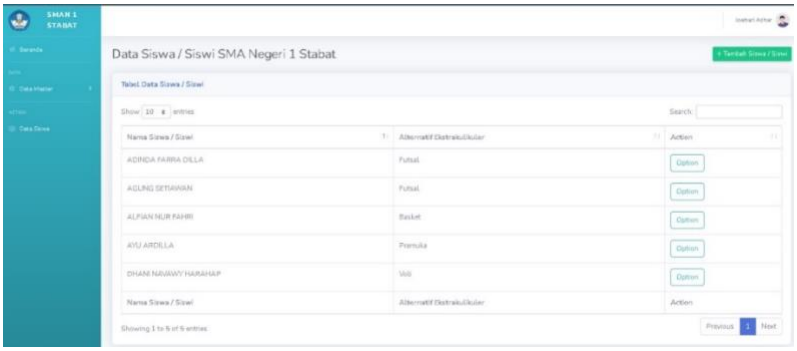

Figure 3. Student Data Pages

This display contains a list of students from SMA Negeri 1 Stabat whose data will be processed in the system for extracurricular specialization.

User Data View

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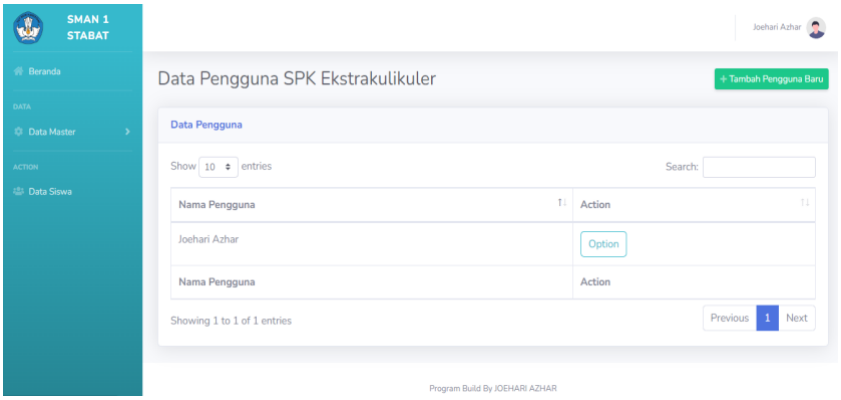

Figure 4. User Data Pages

This view contains a list of users who accessed the system. In this view, users can add, edit and delete users.

SPK Process Display

Figure 5. SPK Process Display in the System

This SPK process takes place on the student data page. This process has 4 criteria with each criterion having 4 weight values, namely low, moderate, good and very good. The results of the SPK process will be released immediately when all the criteria have been filled. This is marked by the issuance of total assessments and alternative results for extracurricular

Conclusion

Based on the results of the research and implementation that has been carried out, it can be concluded that the Naive Bayes method has proven to be effective in classifying extracurricular specialization data. This algorithm is able to handle various attributes that affect students' interests and provide accurate predictions based on existing data. The developed system shows a high level of accuracy in determining extracurricular specializations. Testing with test data shows that this system is able to provide recommendations that are relevant and in accordance with student preferences. With this system, the process of determining specialization becomes more objective and data-based.

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