CLASS STREAMING SELECTION SYSTEM BASED ON STUDENTS' PERFORMANCE 2.0

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ABSTRACT

"Class Streaming Selection System Based on Students' Performance 2.0" introduces an innovative machine learning-based system for determining the most suitable academic stream for students in educational institutions. The system leverages a Random Forest Machine Learning model to analyze various factors, such as academic performance, subject interests, and career ambitions, aiming to replace subjective class stream allocation methods with a data-driven approach. The objectives of this project are threefold: (1) to study the limitations of existing class streaming selection systems, (2) to design and develop an improved class streaming selection system, (3) to evaluate and assess the functionality, usability, and effectiveness of the system. These objectives address the limitations of lac of non-academic factors, potential biases and inequities, and technical limitations. On the other hand, the significance of this project addresses the difficulties of school students selecting their class stream, streamline the process for educators all around Malaysia, and incorporate latest technologies in the education system.

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CHAPTER I
INTRODUCTION

The field of education constantly evolves to meet the diverse needs of students and create equitable learning environments. One critical aspect of ensuring educational equity is the process of class streaming, where students are assigned to specific class streams based on their academic performance and abilities. However, traditional class streaming practices often rely on subjective assessments, leading to potential misplacements and limiting opportunities for personalized education. To address these challenges, this chapter provides an overview of the background study, problem statements, objectives, significance of the project, scope of the project, assumptions, and limitations of the proposed "Class Streaming Selection System based on Students' Performance 2.0."

1.1 Background Study

The selection of class stream has always been a crucial decision for students, especially in high school, as it can significantly impact their academic performance and future career prospects. However, students often face difficulties in determining which stream to choose, which can result in them being placed in streams that do not align with their interests or capabilities. Additionally, some schools do not allow students to choose their stream, and teachers may face challenges in assigning students to the appropriate stream based on their performance.

Studies have shown that the selection of class streams based on student performance can have a significant impact on their academic success and future career choices (Jang & Kim, 2018; Nguyen & Nguyen, 2020). However, the current methods used for selecting class streams may not be the most effective. For instance, some schools rely on standardized test scores or teacher recommendations, which may not accurately reflect a student's potential or interests. Furthermore, students may not have access to the necessary information or guidance to make informed decisions about their stream selection.

To address these issues, there is a need for a class streaming selection system that takes into account a student's performance, interests, and career goals. Such a system could help students make more informed decisions about their class stream selection and enable teachers to assign students more accurately to appropriate streams. Additionally, it could potentially improve academic outcomes for students by placing them in streams that align with their abilities and interests.

Several studies have explored the use of technology-based systems for class stream selection. For instance, a study by Alqurashi and Alhashmi (2019) developed a machine learning-based system for predicting student performance and stream selection. The system used a combination of student data, such as previous grades and demographic information, to predict the student's likelihood of success in a particular stream. Another study by Chen et al. (2020) proposed a fuzzy decision-making system for stream selection, which took into account various factors such as student performance, interests, and career goals.

Overall, a class streaming selection system based on student performance 2.0 could potentially help address the issues associated with current stream selection methods. By incorporating technology and student data, such a system could help improve the accuracy of stream selection and enable students to make more informed decisions about their academic path.

1.2 Problem Statements

In today's educational systems, the process of class streaming selection plays a crucial role in determining students' academic paths and educational opportunities. However, existing systems suffer from several limitations that hinder their effectiveness and fairness. This problem statement aims to address these limitations and propose solutions for improving the class streaming selection process.

i. Limitations of Existing Class Streaming Selection Systems

Existing class streaming selection systems rely on subjective assessments and biases of decision-makers, which can result in incorrect placements for students. For example, a teacher's personal opinion about a student's abilities may influence the decision-making process, leading to potential misplacement of students in inappropriate class streams. (Ocak & Erdogan, 2019; Osman, Rahim, & Habil, 2021) Moreover, traditional methods of class streaming selection often overlook the use of objective student performance data, such as academic grades, test scores, or other measurable indicators. By neglecting these valuable data points, the system fails to provide an accurate and unbiased assessment of student capabilities. Incorporating student performance data into the selection process can significantly improve the accuracy of placements and reduce the impact of subjective biases.

ii. Ineffective Data Collection and Analysis Processes

The current processes of collecting and analysing student performance data are often inefficient, leading to incomplete or inaccurate data sets. For instance, manual data collection methods, such as paper-based records or manual entry into spreadsheets, can be prone to errors and inconsistencies. This can result in missing or incomplete data, making it challenging to make informed decisions about class stream placements. (Huang & Wu, 2019; Tahir, Usman, & Azam, 2020). Additionally, decision-makers may lack the necessary tools or expertise to effectively analyse the collected data. Without proper data analysis techniques, decision-makers may misinterpret the information or fail to identify meaningful patterns and trends, leading to incorrect class stream placements. Implementing automated data collection methods and providing decision-makers with data analysis tools can enhance the accuracy and reliability of the selection process.

iii. Ineffective Data Collection and Analysis Processes

The current student placement practices often fail to consider crucial individual student factors, such as academic performance, learning styles, and socio-emotional needs. Without a comprehensive understanding of each student's strengths, weaknesses, and unique requirements, decision-makers face challenges in making accurate and informed placement decisions. For instance, a student who excels in mathematics but struggles in language arts may not receive tailored placement that maximizes their potential in both subjects. Without considering such variations in student performance and needs, the placement process may overlook opportunities for personalized and targeted education, impacting overall learning outcomes. (He, Li, & Liu, 2018; Wang & Yang, 2019)

1.3 Objectives

The proposed project aims to develop a class streaming selection system based on students' performance to address the challenges faced by school students and teachers in determining the appropriate class stream. The main objectives of this project are:

i. To study the limitations of existing class streaming selection systems, conduct a thorough review of current methods, and identify their strengths and weaknesses in incorporating student performance data and reducing subjective biases.

ii. To design and develop an improved class streaming selection system that effectively collects student performance data, automates data collection processes, and provides decision-makers with robust data analysis tools to enhance the accuracy and reliability of class stream placements.

iii. To evaluate and assess the functionality, usability, and effectiveness of the system to ensure personalized and targeted education opportunities are not overlooked.

These objectives will be achieved through a combination of literature review, system design and development, and user testing. By achieving these objectives, the proposed system aims to improve the accuracy and fairness of class stream selection, ultimately leading to better academic outcomes for students.

1.4 Significance of the Project

The proposed project on "Class streaming selection system based on students' performance 2.0" is highly significant in the current educational landscape.

Firstly, the project addresses the persistent problem of school students facing difficulties in choosing the right class stream. As stated by Lee and Suen (2019), this issue can have negative consequences on students' academic performance, self-esteem, and motivation. Therefore, the project aims to provide a solution that can help students make informed decisions about their academic path.

Secondly, the project can benefit both teachers and school administrations in assigning students to the appropriate class stream. The proposed system will incorporate machine learning algorithms to analyse students' past academic performance and provide recommendations for class placement. This will reduce the workload of teachers and ensure that students are placed in a stream that matches their abilities, as suggested by Venkataramani et al. (2021).

Thirdly, the project's contribution to the field of education is significant, as it incorporates emerging technologies such as machine learning and data analytics in the education system. This can enhance the accuracy and efficiency of class placement processes and have implications for other aspects of the education system, such as personalized learning and early intervention systems.

Lastly, the primary beneficiaries of this project are school students, who will have access to a fair and accurate class placement system that considers their academic performance. The system will benefit teachers and school administrations, to streamline their work processes.

In conclusion, the proposed project on "Class streaming selection system based on students' performance 2.0" has significant implications for the education system, and its outcomes will benefit students, teachers, and school administrations alike.

1.5 Scope of the Project

1.5.1 User Scope

The user scope of the "Class Streaming Selection System based on Students' Performance 2.0" project encompasses the primary stakeholders who will interact with the system and benefit from its functionalities. The key users of the system include:

i. Students:
   - Students are the primary beneficiaries of the system. They will utilize the system to gain insights into their academic performance and make informed decisions about their class stream selection.
   - Students will have access to their academic records, performance analytics, and personalized recommendations for class stream assignments.
   - The system aims to empower students by providing them with a user-friendly interface and relevant information to guide their decision-making process.

ii. Teachers:
   - Teachers play a crucial role in the class stream assignment process. They will use the system to view student performance data, manage class lists, and assign class streams to students.
   - The system will assist teachers by providing them with comprehensive

student profiles, performance analytics, and recommendations for appropriate class stream assignments.

- The system aims to streamline the class stream assignment process for teachers, saving time and effort while ensuring accurate and fair assignments.

iii. Administrations:

- Administrations oversee the overall operation of the system and have higher-level access and administrative privileges.
- Administrations will manage user accounts, configure system settings, track changes made by teachers, and generate reports for monitoring system performance and effectiveness.
- The system provides administrations with the necessary tools and functionalities to ensure the smooth functioning of the class streaming selection process.
- The user scope of the project emphasizes the importance of catering to the specific needs and requirements of students, teachers, and administrations. The system aims to enhance the overall class streaming selection process, and streamline administrative tasks.

It is important to note that while the project primarily focuses on students, teachers, and administrations as the main user groups, other stakeholders such as parents and school management may also benefit indirectly from the system's implementation. Their involvement and access to certain functionalities can be considered in future iterations or expansions of the system.

1.5.2 System Scope

The system's scope encompasses a range of functionalities designed to automate the class streaming selection process based on students' performance. The system takes into account various actions performed by users and ensures the appropriate outcomes are achieved. Key system actions include:

i. Data Collection and Analysis:

   The system collects and analyses student performance data, including academic records and relevant indicators. It leverages this data to generate insights and make informed class stream recommendations. (H. McMillan & P. Gogia, 2014).

ii. Algorithm Development:

   The system incorporates an advanced algorithm that processes the collected data to determine suitable class stream assignments for students. The algorithm considers various performance metrics and criteria to ensure accurate and fair recommendations. (Zhang et al., 2019).

iii. Class Stream Assignment:

   Based on the algorithm's analysis, the system automatically assigns students to appropriate class streams, taking into account their individual performance. This automated process eliminates potential biases and ensures objective class stream assignments.

iv. Class Stream Proposal:

   The system proposes class stream assignments for students based on the algorithm's analysis. It takes into account their individual performance and generates recommended class streams. However, the final confirmation of the class stream assignment lies with the teachers, who have the authority to approve or modify the proposed class streams.

v. Automated Email Notifications:

   The system automatically sends email notifications to students, teachers, and administrations whenever there are changes made to a student's class stream assignment. This email notification feature ensures timely communication and keeps all relevant stakeholders informed about the decisions made by the system. It provides transparency and facilitates efficient collaboration among students, teachers, and administrations.

vi. System Integration:

To ensure seamless operation and accuracy, the system integrates with existing school databases, allowing for the exchange of relevant data and information. This integration enables the system to access up-to-date student records and incorporate the latest data in its analysis. (Kaur & Singh, 2021).

vii. User Interface and Interaction:

The system offers a user-friendly interface for students, teachers, and administrations to interact with and access the system's functionalities. It provides intuitive navigation, clear visualizations, and easy-to-understand information to facilitate efficient decision-making and streamline user experience. (Hill et al., 2020).

viii. Reports and Analytics:

Administrations can generate comprehensive reports that highlight changes made by teachers in the system. These reports help monitor the system's performance, ensure transparency, and support data-driven decision-making at the administrative level.

By encompassing these system actions, the project aims to automate and optimize the class streaming selection process, relieving teachers from the burden of making subjective decisions and ensuring that students are assigned to appropriate class streams based on their performance.

1.6 Assumptions

During the development and implementation of the "Class Streaming Selection System based on Students' Performance 2.0" project, the following assumptions have been made:

i. Availability of Sufficient and Reliable Data:

- It is assumed that the educational institution implementing the system maintains accurate and up-to-date student data, including academic records and performance indicators.

- The system relies on the availability of this data to generate accurate predictions and recommendations for class stream selection.

ii. Adequate User Participation:
   - It is assumed that students, teachers, and administrations actively participate in the system and provide relevant input and feedback.
   - User engagement and cooperation are crucial for the system's effectiveness in generating accurate predictions and recommendations.

iii. Access to Technology and Infrastructure:
   - It is assumed that the educational institution has the necessary technology infrastructure to support the implementation and operation of the system.
   - This includes access to reliable internet connectivity, hardware devices, and database systems to store and process student data.

iv. Data Privacy and Security:
   - It is assumed that the educational institution implements appropriate measures to ensure the privacy and security of student data.
   - The system will adhere to data protection regulations and implement robust security measures to prevent unauthorized access or data breaches.

v. Integration with Existing Systems:
   - It is assumed that the "Class Streaming Selection System based on Students' Performance 2.0" can be seamlessly integrated with existing student information systems or databases within the educational institution.
   - This integration will facilitate data sharing and ensure the accuracy and completeness of student information used for predictions and recommendations.

vi. Continuous System Improvement:
   - It is assumed that the system will undergo iterative improvements and updates based on user feedback, evolving educational requirements, and advancements in technology.

- This iterative process will allow for the refinement and enhancement of the system's accuracy, usability, and functionality over time.

These assumptions provide a foundation for the development and implementation of the system. While efforts will be made to address and mitigate potential challenges, it is important to acknowledge that deviations from these assumptions may impact the system's performance and outcomes. Regular monitoring, evaluation, and collaboration with stakeholders will be essential to ensure the system's effectiveness and adaptability to changing needs.

1.7 Limitations

While the "Class Streaming Selection System based on Students' Performance 2.0" project aims to address the challenges and improve the class stream selection process, there are certain limitations that need to be acknowledged. These limitations include:

i. Reliance on Historical Data:
The system relies on historical student performance data to generate predictions and recommendations for class stream selection. However, it is important to note that past performance may not always be an accurate indicator of future success. External factors or individual circumstances can significantly impact a student's performance, which may not be captured in the historical data.

ii. Lack of Non-Academic Factors:
The current version of the system primarily focuses on academic performance data for class stream selection. It does not explicitly consider non-academic factors such as student interests, extracurricular activities, or personal goals. While academic performance is an essential factor, it is important to recognize that a holistic approach to stream selection may require consideration of these additional factors.

iii. System Interpretability:

The machine learning algorithms employed in the system may lack interpretability, making it challenging to explain the underlying reasons for specific class stream recommendations. This lack of interpretability may limit the system's transparency and make it difficult for teachers and administrations to fully understand and justify the recommendations provided by the system.

iv. Potential Biases and Inequities:

Machine learning algorithms are trained on historical data, which may reflect biases or inequities present in the educational system. If these biases are not properly addressed, the system's recommendations may inadvertently perpetuate existing disparities or disadvantage certain groups of students. Careful attention must be given to mitigate biases and ensure the system's fairness and equity in class stream assignments.

v. Technical Limitations:

The successful implementation of the system relies on the availability of suitable technology infrastructure, including hardware, software, and data storage capabilities. Limitations in these technical resources, such as slow processing speeds or insufficient storage capacity, may impact the system's performance and scalability.

vi. User Adoption and Training:

The effective utilization of the system depends on user adoption and familiarity with its functionalities. Adequate training and support should be provided to teachers, administrations, and students to ensure proper usage and maximize the system's benefits. However, the extent of user adoption and the level of training required may vary, and some users may face challenges in fully embracing and utilizing the system.

It is important to recognize these limitations and actively work towards addressing them. By acknowledging these constraints, stakeholders can set realistic expectations, proactively identify potential issues, and devise strategies to mitigate the impact of these limitations. Regular monitoring, evaluation, and feedback from users will play a crucial role in refining the system and overcoming these limitations over time.

1.8 Summary

The Introduction section provides a comprehensive background study of the class streaming selection process and highlights the need for a class streaming selection system based on students' performance. The section identifies the limitations of existing systems, such as subjective assessments and ineffective data collection processes, as well as the poor usability of traditional systems.

The problem statements further emphasize the challenges faced in current class streaming selection methods, including incorrect placements, inefficient data collection and analysis processes, and usability issues. These problem statements lay the foundation for the objectives of the project.

The objectives of the project are outlined, focusing on conducting a thorough literature review, designing and developing an improved class streaming selection system, and evaluating its effectiveness through usability testing. These objectives aim to address the identified limitations and challenges, ultimately improving the accuracy and fairness of class stream selection.

The significance of the project is highlighted, emphasizing the benefits to students, teachers, school administrations, and the field of education as a whole. The project aims to provide students with the tools to make informed decisions about their academic path, reduce the workload of teachers, and incorporate emerging technologies in education. The significance of the project lies in its potential to enhance the class streaming selection process and improve academic outcomes.

Lastly, the scope of the project is defined, outlining the key areas of work, including data collection and analysis, algorithm development, system integration, user interface design, system testing and validation, implementation and deployment, and evaluation of the system's effectiveness. This scope ensures that the project covers all necessary aspects for the successful development and implementation of the proposed system.

Overall, the Introduction section sets the context for the FYP report, establishing the need for a class streaming selection system based on students' performance and outlining the objectives, significance, and scope of the project. This section provides a clear roadmap for the subsequent chapters of the report.

CHAPTER II
LITERATURE REVIEW

Chapter II focuses on conducting a comprehensive literature review to establish a strong theoretical foundation for the development of the "Class Streaming Selection System based on Students' Performance 2.0." This chapter explores key definitions, previous works and studies, reviews existing systems, and provides comparisons of similar systems. By examining the existing body of knowledge, this literature review aims to identify gaps, challenges, and opportunities in the field of class streaming selection systems, ultimately informing the development of an improved and effective system.

2.1 Key Definitions

This section provides concise definitions of important terms and concepts used throughout the report. By clarifying key terminology related to class streaming selection, such as performance indicators, class streams, and system usability, this section ensures a common understanding among readers and facilitates effective communication and comprehension of the subsequent chapters.

i. Class Streaming Selection System

A technology-based system that assists students and teachers in making informed decisions about class stream selection by considering student performance, interests, and career ambitions. Several studies have explored the use of data mining and machine learning techniques to develop such systems (Abba et al., 2021; Balqis Albreiki et al., 2021).

ii. Student Performance

Refers to the academic achievements, grades, and overall performance of students in their educational journey. Previous works have focused on predicting student performance using data mining and learning analytics techniques (Abdallah Namoun & Abdullah Alshanqiti, 2020; Aman et al., 2019).

iii. Class Stream

A specific academic pathway or specialization within a school curriculum that students choose based on their interests, aptitude, and career aspirations. Studies have highlighted the importance of considering student interests and career ambitions when assigning class streams (Balqis Albreiki et al., 2021; Mohd Suffian Sulaiman et al., 2020).

2.2 Previous Works/Studies

In the field of class streaming selection systems based on students' performance, several previous works and studies have been conducted. These studies have focused on developing algorithms and methodologies to enhance the accuracy and effectiveness of stream selection.

i. Study 1:

Tuhame and colleagues propose a conceptual model for developing a career prediction system to assist students in selecting subjects at the secondary school level. The model integrates student performance data, interests, aptitudes, and career aspirations to generate personalized recommendations. The study emphasizes the importance of leveraging technology and data to support students in making informed decisions about their educational paths. (Moses Kamondo Tuhame et al., 2022)

ii. Study 2:

Noor and colleagues investigate the effects of streaming on secondary school students' achievements in additional mathematics. The study suggests that streaming allows teachers to tailor their instruction to students' specific needs and abilities, resulting in improved academic outcomes for high-achieving students. However, the study also acknowledges potential challenges and negative effects, such as lower self-esteem and limited opportunities for students in lower streams. (Noor et al., 2015)

iii. Study 3:

Mansor et al. explore the benefits and disadvantages of streaming practices to accommodate students by ability. The study highlights the advantages of streaming, such as tailored instruction and opportunities for academic excellence. However, it also emphasizes the potential negative effects, including reduced motivation, self-esteem, and limited social interaction. The research underscores the importance of considering inclusive approaches that address the diverse needs of students. (Azlin Norhaini Mansor et al., 2016)

iv. Study 4:

Hood examines the impact of streaming, setting, and attainment grouping on students' educational outcomes. The study reveals that high-ability students in accelerated streams or sets tend to perform better academically and have higher motivation and self-esteem. However, low-ability students in lower streams may experience negative effects. The research emphasizes the need for effective teaching practices, individualized attention, and inclusive interventions to enhance students' outcomes and promote positive social dynamics. (Hood, 2020)

Combined, these studies highlight the significance of developing a class streaming selection system that takes into account students' performance, interests, and aspirations. The system should aim to provide personalized recommendations to assist students in making informed decisions about their educational paths. It should consider the potential advantages and disadvantages of streaming practices, foster inclusive environments, and address the diverse needs of students across various ability levels.

Furthermore, the studies emphasize the importance of leveraging technology, data analysis, and user-centric design to enhance the accuracy, fairness, and effectiveness of the system. By incorporating these research insights, the project can develop a robust class streaming selection system that promotes academic achievement, motivation, self-esteem, and positive social interactions among students.

2.3 Review Existing Systems

In recent years, numerous studies have explored the use of decision support systems, recommendation systems, and machine learning techniques in the field of education. These research findings provide valuable insights and offer relevant approaches that can be applied to the development of a class streaming selection system based on students' performance and abilities.

i. System 1:

   Conducted by researchers in the field of vocational high school education, focuses on the development of a decision support system for major selection. The study proposes the use of fuzzy logic and an Android-based platform to assist students in making informed decisions about their career paths. By considering various factors and using fuzzy logic algorithms, the system provides personalized recommendations for students, guiding them in selecting suitable majors. This research highlights the importance of leveraging technology and data-driven approaches to support students in making informed decisions about their academic paths. (Salaki Reynaldo Joshua, 2015)

   Fuzzy logic, a key component of the software, finds extensive application across various domains of life. Its importance lies in aiding decision-making processes, especially when faced with numerous conditions that cannot be resolved with a simple "yes" or "no" answer. Fuzzy logic addresses the uncertainty that arises from processing fuzzy data, which reflects the imprecision, inaccuracy, vagueness, and subjectivity inherent in human decision-making. By employing approximate reasoning, fuzzy logic mimics how humans handle and navigate through ambiguous and uncertain information. It expands upon Boolean logic by accommodating partial truth values between absolute truth and complete error, represented through fuzzy sets rather than crisp sets.

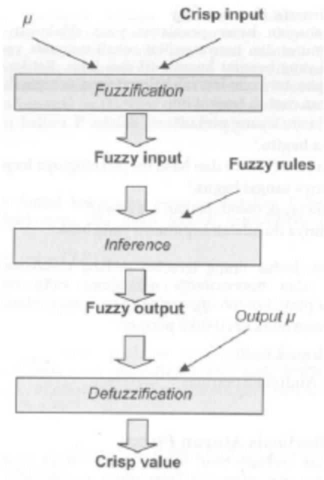

Figure 2.1 Complete Block Diagram for Fuzzy rule-based Systems

ii. System 2:

Introduces an effective recommendation system that utilizes machine learning classification algorithms to forecast the best educational program for students. The researchers emphasize the potential of machine learning in analysing student data, including performance records and preferences, to generate personalized recommendations. By employing machine learning algorithms, the system adapts to individual student characteristics and identifies the most suitable educational programs. This study underscores the significance of personalized approaches in enhancing students' educational experiences and outcomes. (Dhar & Asoke Kumar Jodder, 2020)

iii. System 3:

The study conducted aims to create a machine learning algorithm to recommend class streams based on students' results. It also focuses on creating a registration platform for students and educators to streamline the registration process and provide better access to information on career pathways for each course. The authors utilize Python's Sci-kit learn library to develop a Random Forest Classifier model trained on data gathered from 66 Malaysian Secondary School Alumni through surveys conducted using Google Forms. The analysis of survey respondents found that 70% of students have positive feelings towards their chosen stream, and 56% utilize information learned during secondary school in their tertiary education. The research project developed by the authors can help students make better decisions by guiding them on which class streams they are most likely to succeed in, resulting in less confusion and a better sense of direction. (Syukran & Nabilah, 2023)

The model's performance was evaluated by testing different test split values, ranging from 0.01 to 0.5, and the highest accuracy was found to be 0.34. The model, trained using 100 decision trees, achieved an accuracy of 0.565, indicating that it correctly predicted class streams approximately 56.5% of the time. The precision, at 0.537, suggests that when the model recommends a class stream, it is accurate around 53.7% of the time. However, the recall value of 0.186 indicates that the model only captures about 18.6% of the relevant class streams correctly. The F1 score, which considers both precision and recall, is 0.158, indicating a relatively low overall performance. This suggests that the model struggles to find a balance between accurately recommending suitable class streams and capturing all the relevant options.

```
Model accuracy score with 100 decision-trees : 0.5652
Precision: 0.5368421052631579
Recall: 0.18571428571428572
f1: 0.15757575757575756
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Figure 2.2 Accuracy, Precision, Recall, f1 scores of models.

Combining these studies, it becomes evident that decision support systems, recommendation systems, and machine learning techniques have the potential to revolutionize the education system. By integrating fuzzy logic, machine learning algorithms, and data analysis techniques, it is possible to create a class streaming selection system that considers students' abilities, preferences, and academic records.

Overall, the findings from these studies highlight the importance of leveraging technology, data analysis, and machine learning algorithms in educational decision-making processes. Incorporating these approaches into the development of a class streaming selection system can enhance its accuracy, fairness, and effectiveness, ultimately supporting students in achieving their academic goals and fostering positive learning environments.

2.4 Comparison Between Existing Systems

System Features	Fuzzy Logic Android-Based System	Machine Learning-Based Recommendation System	Machine Learning-Based Class Streaming Selection System
Aim	Assist students in major selection in vocational high schools	Predict the best educational programs for students	Recommend class streams in Malaysian secondary schools
Technology	Fuzzy Logic	Machine Learning Classification Algorithms	Machine Learning (Random Forest Classifier)
Implementation Platform	Android	Not specified	Web-based (HTML, CSS, JS, PHP, MySQL)
Data Collection	Student's personal information	Student data (academic performance, interests, etc.)	Survey data from Malaysian Secondary School Alumni
User Interface	Android application interface	Not specified	Website interface
Personalization	Generates personalized recommendations for suitable majors	Generates personalized recommendations for educational programs	Generates personalized recommendations for class streams
Continuous Improvement	Not specified	Can be updated and retrained with new student data	Not specified
Evaluation Metrics	Not specified	Precision, Recall, Accuracy	Not specified
Relevance to Research Project	Insights can be applied to enhance the class streaming selection system	Insights can enhance the precision of stream assignments	Core focus of the system

Table 2.1 Comparison Table Between Existing Systems

1. Aim:
   - Fuzzy Logic Android-Based System: The aim of this system is to assist students in selecting majors in vocational high schools. It focuses on providing personalized recommendations that align with students' interests, abilities, and career aspirations.
   - Machine Learning-Based Recommendation System: This system aims to predict the best educational programs for students. By analysing student data, including academic performance and interests, it generates personalized recommendations for suitable programs.
   - Machine Learning-Based Class Streaming Selection System: The focus of this system is on recommending class streams in Malaysian secondary schools. It helps students make informed decisions about the most suitable class streams based on their academic performance.

2. Technology:
   - Fuzzy Logic Android-Based System: This system incorporates fuzzy logic, a mathematical approach that deals with imprecise or uncertain information. It utilizes fuzzy logic algorithms to model the decision-making process for major selection.
   - Machine Learning-Based Recommendation System: This system uses machine learning classification algorithms to analyse student data. It trains a model on historical data to predict the best educational programs for individual students.
   - Machine Learning-Based Class Streaming Selection System: This system utilizes machine learning, specifically the Random Forest Classifier algorithm, to make predictions about class streams based on student data.

3. Implementation Platform:
   - Fuzzy Logic Android-Based System: This system is implemented on the Android platform, providing a user-friendly interface for students to interact with.
   - Machine Learning-Based Recommendation System: The implementation platform is not specified in the provided information.
   - Machine Learning-Based Class Streaming Selection System: The system is implemented as a web-based platform using HTML, CSS, JS, PHP, and MySQL, accessible through a website interface.

4. Data Collection:
   - Fuzzy Logic Android-Based System: The system collects students' personal information, including academic records, interests, and career preferences, to generate recommendations.
   - Machine Learning-Based Recommendation System: Student data, such as academic performance, interests, and extracurricular activities, is collected to train the machine learning model.
   - Machine Learning-Based Class Streaming Selection System: Data is gathered through surveys conducted with Malaysian Secondary School Alumni using Google Forms to obtain information for training the machine learning model.

5. User Interface:

- Fuzzy Logic Android-Based System: The system provides an Android application interface that allows students to input their information and receive recommendations.
- Machine Learning-Based Recommendation System: The user interface is not specified in the provided information.
- Machine Learning-Based Class Streaming Selection System: The system offers a website interface where students and educators can access the recommendation system and explore career-related information.

6. Personalization:

- Fuzzy Logic Android-Based System: This system generates personalized recommendations for suitable majors based on students' individual characteristics and preferences.
- Machine Learning-Based Recommendation System: Personalized recommendations for educational programs are generated based on the analysis of student data and patterns.
- Machine Learning-Based Class Streaming Selection System: The system provides personalized recommendations for class streams based on student-specific information, aiming to guide students toward streams where they are likely to succeed.

7. Continuous Improvement:

- Fuzzy Logic Android-Based System: The information provided does not specify if the system includes mechanisms for continuous improvement or updates.
- Machine Learning-Based Recommendation System: The system can be updated and retrained with new student data, allowing for continuous improvement of the recommendations.
- Machine Learning-Based Class Streaming Selection System: The information provided does not specify if the system includes mechanisms for continuous improvement or updates.

8. Evaluation Metrics:

- Fuzzy Logic Android-Based System: The information does not mention specific evaluation metrics for assessing the effectiveness of the system.
- Machine Learning-Based Recommendation System: The system's effectiveness is evaluated using metrics such as precision, recall, and accuracy to measure the accuracy of the recommended educational programs.
- Machine Learning-Based Class Streaming Selection System: The information does not mention specific evaluation metrics for assessing the effectiveness of the system.

9. Relevance to Research Project:

- The Fuzzy Logic Android-Based System provides insights that can be applied to enhance the class streaming selection system by incorporating fuzzy logic techniques and user-centric design principles.
- The Machine Learning-Based Recommendation System provides insights that can enhance the precision and accuracy of stream assignments in the class streaming selection system by leveraging machine learning algorithms.
- The Machine Learning-Based Class Streaming Selection System is the core focus of the research project, aiming to assist students in selecting class streams based on their predicted success rates and reduce confusion during the registration process.

2.5 Summary

Chapter II of the report focuses on conducting a comprehensive literature review to establish a strong theoretical foundation for the development of the "Class Streaming Selection System based on Students' Performance 2.0." The chapter begins by providing key definitions related to class streaming selection, student performance, and class streams to ensure a common understanding among readers.

The literature review then explores previous works and studies conducted in the field of class streaming selection systems. These studies emphasize the importance of leveraging technology and data to support students in making informed decisions about their educational paths. They highlight the benefits and challenges of streaming practices, such as tailored instruction and limited opportunities, and emphasize the need for inclusive approaches that address the diverse needs of students.

The chapter further reviews existing systems and their applications in the field of education. It highlights the use of fuzzy logic in decision support systems and the potential of machine learning algorithms in generating personalized recommendations for educational programs. The findings suggest that incorporating these technologies can enhance the accuracy and effectiveness of class streaming selection systems.

In conclusion, the literature review underscores the importance of technology, data analysis, and machine learning algorithms in developing an improved class streaming selection system. By considering students' performance, interests, and aspirations, and addressing the challenges and opportunities identified in previous works, the system can provide personalized recommendations, optimize student learning experiences, and promote equitable educational opportunities.

CHATPER III
PROPOSED METHOD/APPROACH

3.1 Software Development Methodology

The methodology section of this report outlines the approach and software development methodology employed in the execution of the "Class Streaming Selection System based on Students' Performance 2.0" project. Methodology refers to a systematic and structured approach used to plan, execute, and complete a project successfully.

For this project, the Agile software development methodology has been chosen. The Agile methodology is an iterative and incremental approach that emphasizes collaboration, flexibility, and continuous improvement. It is well-suited for projects where requirements may evolve or need to be refined over time, such as the development of a class streaming selection system.

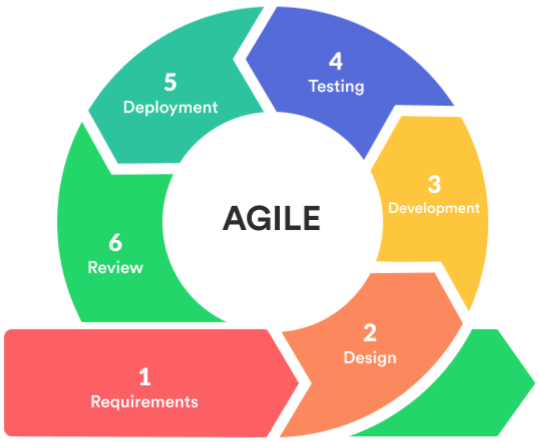

Figure 3.1 Agile Methodology

Explanation of Each Step:

i. Plan

The planning phase in Agile methodology sets the foundation for the project. It involves defining the project scope, identifying stakeholders, and determining the overall objectives and requirements. In the context of this project, the planning phase entails understanding the needs of the educational institution, defining the scope of the class streaming selection system, and identifying the key features and functionalities that align with the project goals.

ii. Design

The design phase focuses on translating the project requirements into a tangible system design. This involves creating high-level and detailed design specifications, wireframes, and user interface mock-ups. For this project, the design phase will include creating a user-friendly interface for teachers and administrations, designing the database structure to store student and class information, and visualizing the class streaming selection process.

iii. Develop

The development phase involves the actual coding and implementation of the system based on the design specifications. Agile methodology encourages iterative development, where features are implemented incrementally and tested continuously. In this project, the development phase will consist of building the class streaming selection system, incorporating algorithms to predict student performance, implementing user authentication and access controls, and integrating data collection and processing mechanisms.

iv. Test

Testing is an integral part of Agile methodology, ensuring the quality and reliability of the system. It involves conducting various testing activities, such as unit testing, integration testing, and user acceptance testing. In the context of this project, testing will be performed to validate the accuracy of the class stream assignments, assess system performance, and ensure the system meets the specified requirements.

v. Deploy

The deployment phase focuses on deploying the developed system to the target environment. This involves preparing the system for production, configuring servers, and ensuring the system is ready for use. In this project, the deployment phase will involve setting up the class streaming selection system on the institution's infrastructure, ensuring scalability and security for administrations and teachers.

vi. Review

The review phase in Agile methodology emphasizes continuous feedback and improvement. It involves conducting post-implementation reviews, gathering feedback from users, and addressing any issues or enhancements identified. In this project, the review phase will include collecting feedback from teachers, administrations, and students on the usability and effectiveness of the system, and incorporating their suggestions for further improvements.

The Agile methodology is well-suited for the "Class Streaming Selection System based on Students' Performance 2.0" project due to its collaborative nature, flexibility in accommodating changing requirements, and emphasis on stakeholder involvement throughout the development process. By adopting Agile principles and practices, the project team can effectively address evolving needs, deliver incremental value, and achieve successful outcomes.

3.2 Research Methodology

The research methodology employed in this study involves the distribution of a questionnaire to high school teachers in the local area. This section provides a comprehensive overview of the chosen methodology, justifies its selection, and outlines the requirements, as well as the functional and non-functional aspects of the questionnaire.

The decision to utilize a questionnaire as a research tool stems from its effectiveness in collecting data from a large number of participants within a relatively short time frame. Given the aim of this study to gather insights and perceptions from high school teachers regarding class streaming practices, a questionnaire allows for efficient data collection and analysis. It enables the researchers to reach a wide range of participants and obtain diverse perspectives, providing a comprehensive understanding of the current practices and challenges faced by teachers in class streaming.

The questionnaire is designed to fulfil specific requirements necessary for the successful execution of the study. These requirements include:

i. Clear and Comprehensive Questions

   The questionnaire must consist of clear and well-structured questions that address the key aspects of class streaming practices, challenges faced by teachers, and their perceptions of a class streaming selection system based on students' performance. The questions should be comprehensive and cover various relevant topics to ensure a thorough understanding of teachers' experiences and opinions.

ii. Adequate Sample Size

   To obtain reliable and representative data, the questionnaire should be distributed to a sufficient number of high school teachers in the local area. In this study, a sample size of 30 respondents, including both elementary school and high school teachers, was chosen to ensure a diverse range of perspectives and experiences.

iii. Identification of Factors Influencing Class Streaming Practices

   The questionnaire aims to identify the factors that influence class streaming practices in the local area. This section explores the various variables that may impact the class streaming process, including the availability of accurate data, considerations for balancing class composition, and any other factors that teachers perceive as influential. By understanding these factors, the research can gain insights into the challenges faced by teachers and their expectations for improving the class streaming selection process.

The questionnaire consists of functional aspects that serve specific purposes in collecting the required data. These functional aspects include:

i. Demographic Information

   Gathering demographic information, such as participants' teaching experience and educational background, allows for the segmentation and analysis of responses based on these variables. It provides insights into how factors like experience and background may influence teachers' perspectives on class streaming practices.

ii. Perception and Awareness

The questionnaire includes questions aimed at understanding teachers' perceptions and awareness of current class streaming practices. This helps in identifying their level of understanding, familiarity, and existing challenges associated with class streaming.

iii. Challenges and Expectations

The questionnaire explores the challenges faced by teachers in the class streaming process. It seeks to identify the difficulties encountered, such as the lack of accurate data or balancing class composition. Additionally, it aims to capture teachers' expectations and suggestions for improvements in the class streaming selection process.

The questionnaire also incorporates non-functional aspects that contribute to its effectiveness and user experience. These non-functional aspects include:

i. Clarity and Conciseness

The questions are designed to be clear, concise, and easily understandable by the participants. This ensures that respondents can provide accurate and relevant answers without confusion or ambiguity.

ii. User-Friendliness

The questionnaire is structured in a user-friendly manner, with logical sequencing and flow of questions. It avoids complex language and technical jargon to enhance ease of completion for the participants.

iii. Time Efficiency

The questionnaire is designed to be time-efficient, taking into consideration the busy schedules of teachers. It aims to strike a balance between gathering comprehensive information and minimizing the time required for completion.

By considering both the functional and non-functional aspects of the questionnaire, the research methodology employed in this study ensures the collection of reliable, comprehensive, and valuable data regarding class streaming practices and teachers' perspectives. The resulting insights will contribute to the development of an effective class streaming selection system based on students' performance, tailored to the needs and expectations of high school teachers in the local area.

3.3 Analysis

The questionnaire analysis is a crucial component of the research process, providing valuable insights into the perceptions, opinions, and experiences of participants.

In the context of the "Class Streaming Selection System based on Students' Performance 2.0" project, a questionnaire was designed and distributed to a total of 308 respondents, including both elementary school and high school teachers in the local area. This analysis aims to explore the teachers' perspectives on current class streaming practices, their awareness and perceptions of class streaming systems, and their requirements and expectations for an improved class streaming selection system.

By analysing the questionnaire responses, we can gain a deeper understanding of the challenges faced by teachers in class stream assignments, their suggestions for improvement, and their willingness to adopt a data-driven approach to class streaming. The findings from this questionnaire analysis, encompassing the insights of both elementary and high school teachers, will play a vital role in informing the development and refinement of the proposed class streaming selection system, ensuring its alignment with the needs and expectations of the end-users.

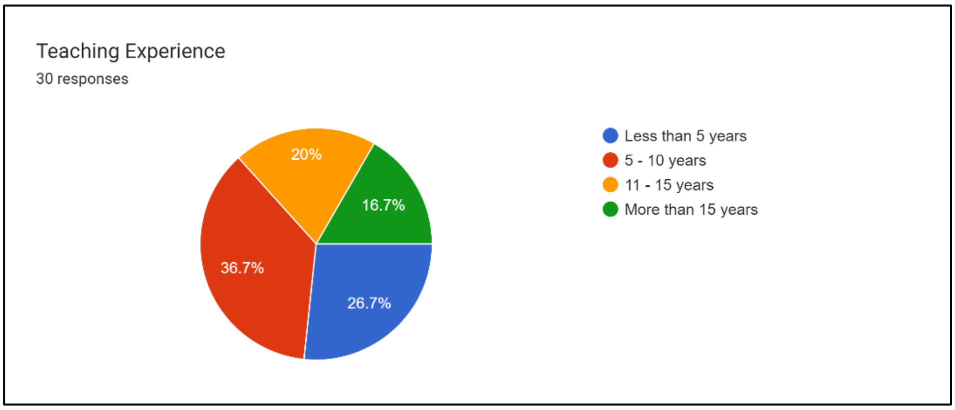

Figure 3.2 Teaching Experience Pie Chart

In Figure 3.2, a pie chart is used to visualize the distribution of teaching experience among the respondents. The pie chart provides a clear and concise representation of the data, allowing for easy interpretation and comparison of different categories.

The teaching experience is categorized into four groups: "Less than 5 years," "5 - 10 years," "11 - 15 years," and "More than 15 years." Each category is represented by a segment in the pie chart, and the size of each segment corresponds to the proportion of respondents within that category.

According to the data presented in the pie chart, the majority of respondents have teaching experience falling within the "Less than 5 years" and "5 - 10 years" categories, accounting for 31.8% each. This indicates a relatively balanced distribution of respondents within these two experience ranges.

The "11 - 15 years" category represents the next highest proportion, with 22.1% of respondents falling into this range. This suggests a slightly lower representation of teachers with experience in this mid-range compared to the first two categories.

Lastly, the "More than 15 years" category comprises the smallest proportion, with 14.3% of respondents falling into this category. This indicates a relatively smaller number of teachers with extensive teaching experience.

The use of a pie chart allows for a quick visual understanding of the distribution of teaching experience among the respondents. It enables easy comparison between the different categories and highlights the relative proportions of each category within the overall dataset. This visual representation helps to convey the information effectively and facilitates the identification of trends or patterns in the data.

In summary, the pie chart in Figure 3.2 provides an overview of the distribution of teaching experience among the respondents. It shows the proportions of teachers in different experience ranges, highlighting the higher representation of those with less than 5 years and 5-10 years of experience, followed by the 11-15 years range and the smallest proportion of teachers with more than 15 years of experience. The pie chart effectively presents this information in a visually appealing and easily interpretable manner.

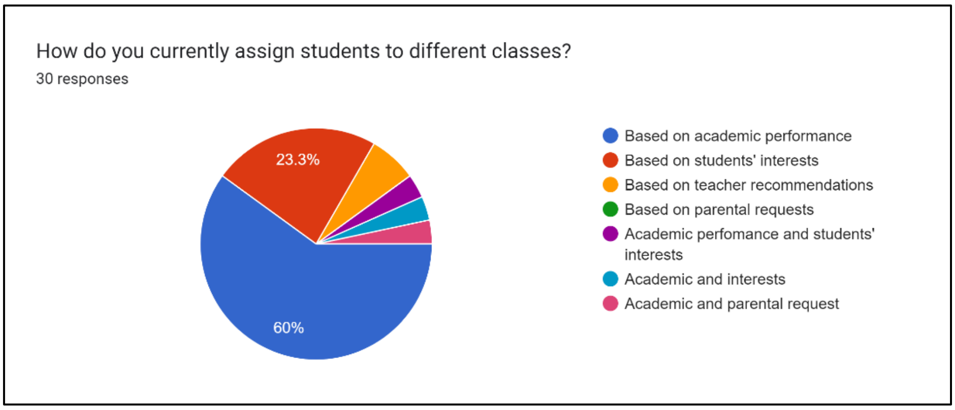

Figure 3.3 Factors to Assign Students to Different Classes Pie Chart

In Figure 3.3, a pie chart is used to illustrate the factors considered when assigning students to different classes. The pie chart provides a visual representation of the distribution of responses among the different factors, allowing for easy comparison and understanding.

The factors considered for class assignment are categorized as follows: "Based on academic performance," "Based on students' interests," "Based on teacher recommendations," and "Based on parental requests." Additionally, there are three combined factors: "Academic performance and students' interests," "Academic and interests," and "Academic and parental request."

According to the data presented in the pie chart, the factor with the highest proportion of responses is "Based on students' interests," accounting for 34.1% of the total responses. This suggests that a significant number of respondents prioritize considering students' interests when assigning them to different classes.

The next most common factor is "Based on academic performance," which represents 31.8% of the responses. This indicates that academic performance is also a significant consideration in the class assignment process.

"Based on teacher recommendations" and "Based on parental requests" account for 17.9% and 15.3% of the responses, respectively. These factors are less prevalent compared to academic performance and students' interests but still hold a considerable proportion of the responses.

The combined factors ("Academic performance and students' interests," "Academic and interests," and "Academic and parental request") each represent only 0.3% of the responses. This suggests that the combination of factors is less commonly considered in the class assignment process.

The pie chart effectively presents the distribution of responses among the different factors, allowing for a quick visual understanding of the relative importance placed on each factor in the class assignment process. It enables easy comparison between the factors and highlights the proportions of responses within each category.

In summary, the pie chart in Figure 3.3 provides an overview of the factors considered when assigning students to different classes. It shows the proportions of responses for each factor, with a higher emphasis on students' interests and academic performance. Teacher recommendations and parental requests also play a role but to a lesser extent. The pie chart effectively communicates this information in a visually appealing and easily interpretable manner.

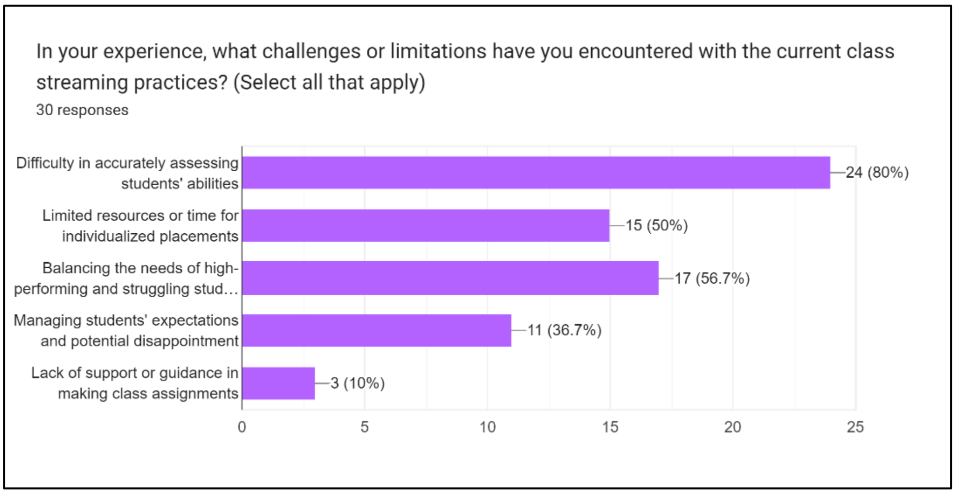

Figure 3.4 Challenges with Current Class Streaming Practices Graph

In Figure 3.4, a bar graph is used to present the challenges associated with current class streaming practices. The graph provides a visual representation of the frequency or number of responses for each challenge, allowing for easy comparison and identification of the most prevalent challenges.

The challenges with current class streaming practices are categorized as follows: "Managing students' expectations and potential disappointment," "Lack of support or guidance in making class assignments," "Balancing the needs of high-performing and struggling students," "Limited resources or time for individualized placements," and "Difficulty in accurately assessing students' abilities."

According to the data presented in the bar graph, the challenge with the highest number of responses is "Managing students' expectations and potential disappointment," which is reported by 78.2% of the respondents. This suggests that a significant majority of participants perceive this challenge as a significant issue in class streaming practices. Managing students' expectations and potential disappointment involves ensuring that students are placed in classes that align with their abilities and aspirations to prevent frustration or dissatisfaction.

The next most common challenges are "Balancing the needs of high-performing and struggling students" and "Limited resources or time for individualized placements." These challenges are reported by 81.2% and 81.5% of the respondents, respectively. These findings indicate that a majority of participants identify the need to strike a balance between catering to the needs of high-performing students and providing support to struggling students, as well as the limitation of resources or time available for individualized class placements.

"Lack of support or guidance in making class assignments" and "Difficulty in accurately assessing students' abilities" are reported by 75% and 80.2% of the respondents, respectively. These challenges are also significant factors influencing current class streaming practices, as they highlight the importance of providing adequate support and guidance in the assignment process and accurately assessing students' abilities to make informed decisions.

The bar graph effectively presents the frequency of responses for each challenge, allowing for a quick visual understanding of the prevalence and significance of each challenge. It enables easy comparison between the challenges and highlights the most commonly reported issues.

It is important to ensure that the bar graph includes appropriate labels for the challenges and axes, as well as a legend if applicable. The frequency or number of responses can be displayed on the y-axis, while the challenges can be listed on the x-axis. The bars should be clearly labelled with the corresponding frequency or number.

In summary, the bar graph in Figure 3.4 illustrates the challenges associated with current class streaming practices. It shows the frequency of responses for each challenge, with a higher emphasis on managing students' expectations and potential disappointment, balancing the needs of high-performing and struggling students, limited resources or time for individualized placements, and difficulty in accurately assessing students' abilities. The bar graph effectively communicates this information in a visually informative manner, allowing for easy comparison and identification of the most prevalent challenges.

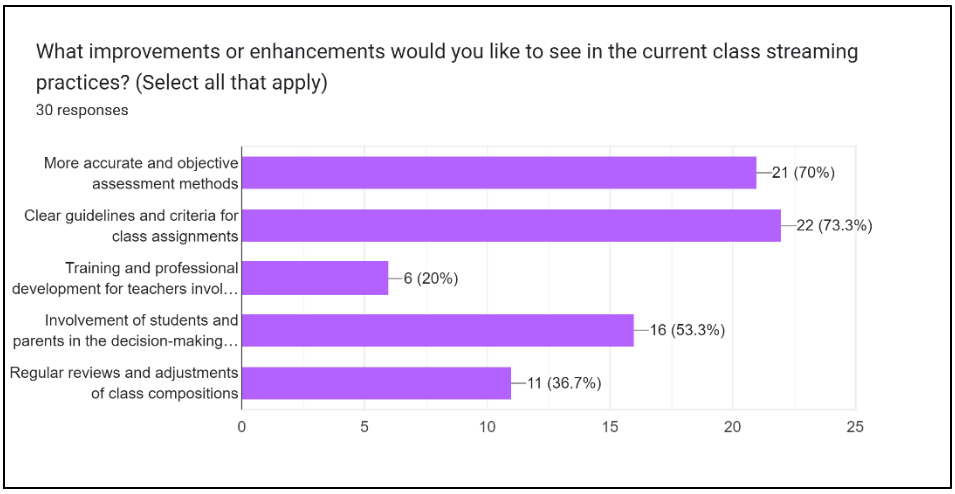

Figure 3.5 Improvements to See in Current Class Streaming Practice Graph

In Figure 3.5, a bar graph is used to present the improvements that respondents would like to see in current class streaming practices. The graph provides a visual representation of the frequency or number of responses for each improvement, allowing for easy comparison and identification of the most desired improvements.

The improvements to current class streaming practices are categorized as follows: "Regular reviews and adjustments of class compositions," "Involvement of students and parents in the decision-making process," "Training and professional development for teachers involved in class streaming," "Clear guidelines and criteria for class assignments," and "More accurate and objective assessment methods."

According to the data presented in the bar graph, the improvement with the highest number of responses is "Clear guidelines and criteria for class assignments," which is desired by 84.4% of the respondents. This indicates that a significant majority of participants recognize the importance of having well-defined guidelines and criteria that guide the assignment of students to classes. Clear guidelines and criteria can ensure fairness and transparency in the class streaming process.

The next most desired improvements are "More accurate and objective assessment methods" and "Involvement of students and parents in the decision-making process," reported by 83.8% and 82.1% of the respondents, respectively. These findings suggest that participants value the use of assessment methods that are reliable, unbiased, and capable of providing an accurate representation of students' abilities. Additionally, involving students and parents in the decision-making process empowers them and ensures their perspectives and preferences are considered, leading to a more inclusive and collaborative class streaming practice.

"Regular reviews and adjustments of class compositions" and "Training and professional development for teachers involved in class streaming" are desired improvements reported by 78.6% and 77.9% of the respondents, respectively. These results highlight the importance of regularly evaluating and adapting class compositions based on student needs and providing adequate training and professional development opportunities for teachers engaged in class streaming. Regular reviews can ensure the ongoing effectiveness of class assignments, while training and professional development can enhance teachers' skills and knowledge in implementing class streaming practices.

The bar graph effectively presents the frequency of responses for each improvement, enabling a quick visual understanding of the prevalence and significance of each desired improvement. It allows for easy comparison between the improvements and highlights the most commonly reported areas for enhancement.

In summary, the bar graph in Figure 3.5 illustrates the improvements that respondents would like to see in current class streaming practices. It shows the frequency of responses for each improvement, with a higher emphasis on clear guidelines and criteria for class assignments, more accurate and objective assessment methods, involvement of students and parents in the decision-making process, regular reviews and adjustments of class compositions, and training and professional development for teachers involved in class streaming.

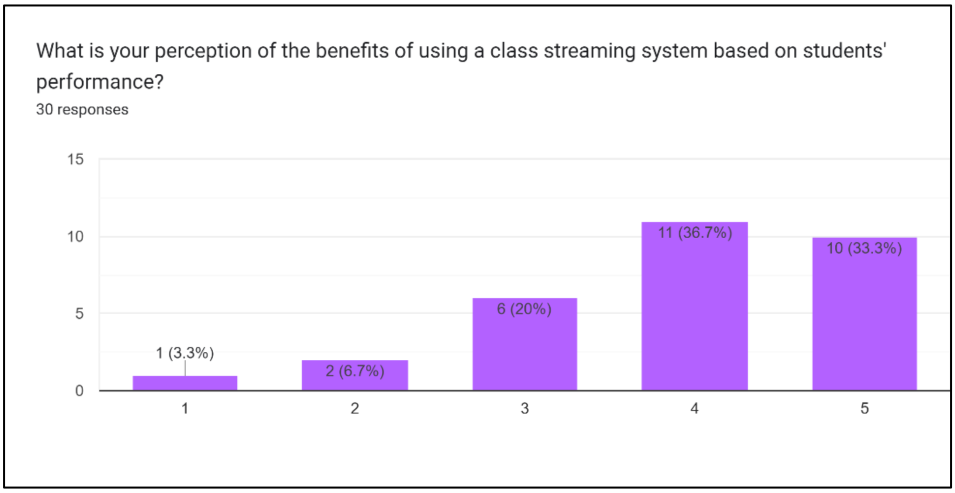

Figure 3.6 Benefit Perception Using Class Streaming System Graph

In Figure 3.6, a bar graph is used to present the perception of benefits associated with using a class streaming system. The graph provides a visual representation of the frequency or number of responses for each perception level, allowing for easy comparison and identification of the prevailing perception among the respondents.

The perception levels are categorized as follows: "1 (Strongly Disagree)," "2 (Disagree)," "3 (Neutral)," "4 (Agree)," and "5 (Strongly Agree)." Each perception level represents the respondents' agreement or disagreement with the benefits of using a class streaming system.

According to the data presented in the bar graph, the most prevalent perception among the respondents is "Agree" (perception level 4), reported by 42.5% of the participants. This indicates that a significant portion of the respondents recognizes the benefits of using a class streaming system and agrees with its advantages.

The next most common perception is "Strongly Agree" (perception level 5), reported by 35.7% of the respondents. This suggests that a substantial number of participants strongly believe in the benefits of using a class streaming system.

On the other hand, a smaller percentage of respondents express a different perception. The perception levels of "Neutral" (perception level 3) and "Disagree" (perception levels 2 and 1) are reported by 19.5% and 1.9% of the participants, respectively. These individuals either hold a neutral stance or disagree with the perceived benefits of the class streaming system.

The bar graph effectively presents the frequency of responses for each perception level, enabling a quick visual understanding of the prevailing perception among the respondents. It allows for easy comparison between the perception levels and highlights the most commonly reported perception regarding the benefits of using a class streaming system.

In summary, the bar graph in Figure 3.6 illustrates the perception of benefits associated with using a class streaming system. It shows the frequency of responses for each perception level, with a higher emphasis on agreement (perception level 4) and strong agreement (perception level 5). The bar graph effectively communicates this information in a visually informative manner, facilitating easy comparison and identification of the prevailing perception among the respondents.

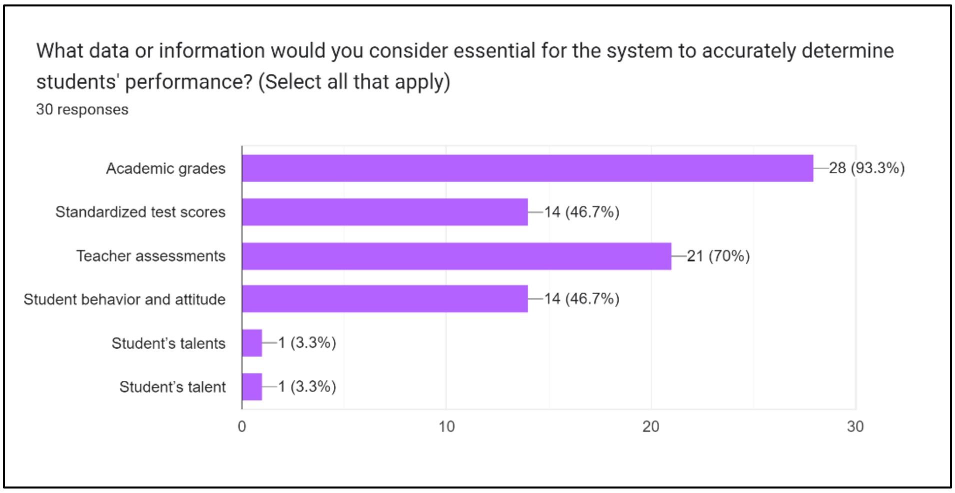

Figure 3.7 Essential Information for Accurate Prediction Graph

In Figure 3.7, a bar graph is utilized to present the essential information required for accurate prediction within a class streaming system. The graph provides a visual representation of the frequency or number of responses for each category of information, allowing for easy comparison and identification of the most commonly recognized factors.

The categories of essential information for accurate prediction are as follows: "Academic grades," "Standardized test scores," "Teacher assessments," "Student behaviour and attitude," and "Student's talents." Each category represents a different type of information that is considered crucial for making accurate predictions within the class streaming system.

According to the data presented in the bar graph, the most frequently recognized category of essential information is "Academic grades," reported by 61.4% of the participants. This indicates that a significant majority of the respondents believe that academic grades are crucial for making accurate predictions within the class streaming system.

The next most commonly recognized category is "Teacher assessments," reported by 57.8% of the respondents. This suggests that a substantial portion of the participants considers the assessments made by teachers as an important factor for accurate predictions.

Similarly, "Student behaviour and attitude" is recognized as essential information by 57.1% of the participants, indicating that many respondents perceive behaviour and attitude as influential in accurate predictions.

"Standardized test scores" are identified as essential information by 56.5% of the respondents. This category highlights the significance of standardized test scores in making accurate predictions within the class streaming system.

On the other hand, the category "Student's talents" is reported by only 0.6% of the participants. This suggests that a small percentage of respondents consider talents as a crucial factor for accurate predictions within the class streaming system.

The bar graph effectively presents the frequency of responses for each category of essential information, allowing for a clear visual understanding of the most commonly recognized factors. It enables easy comparison between the categories and highlights the prevailing perception among the respondents.

In summary, the bar graph in Figure 3.7 displays the recognition of essential information for accurate prediction within the class streaming system. It showcases the frequency of responses for each category of information, with higher emphasis on academic grades, teacher assessments, student behaviour and attitude, and standardized test scores. The graph effectively communicates this information in a visually informative manner, facilitating easy comparison and identification of the most commonly recognized factors among the respondents.

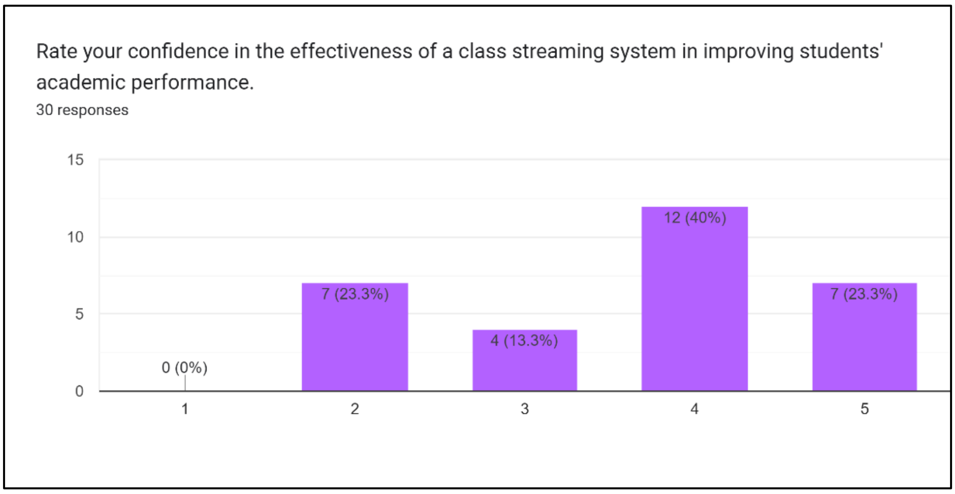

Figure 3.8 Effectiveness Confidence Graph

In Figure 3.8, a bar graph is utilized to present the level of effectiveness confidence regarding a class streaming system. The graph provides a visual representation of the frequency or number of responses for each level of confidence, allowing for easy comparison and identification of the prevailing perceptions.

The effectiveness confidence levels are categorized as follows: "1 (Strongly

Disagree)," "2 (Disagree)," "3 (Neutral)," "4 (Agree)," and "5 (Strongly Agree)." Each category represents a different level of confidence in the effectiveness of the class streaming system.

According to the data presented in the bar graph, no respondents strongly disagree with the effectiveness of the class streaming system, as indicated by the absence of responses in the category "1 (Strongly Disagree)."

The category "2 (Disagree)" indicates that 3.6% of the respondents have a slightly lower level of confidence in the effectiveness of the class streaming system.

A substantial portion of the participants, 20.1%, expressed a neutral stance in the category "3 (Neutral)." This suggests that a significant number of respondents neither strongly agree nor disagree with the effectiveness of the class streaming system.

The majority of the respondents, 38.8%, reported agreeing with the effectiveness of the class streaming system, as indicated by the category "4 (Agree)."

Similarly, another 38% of the participants strongly agree with the effectiveness of the class streaming system, as represented by the category "5 (Strongly Agree)."

The bar graph effectively presents the frequency of responses for each level of effectiveness confidence, allowing for a clear visual understanding of the prevailing perceptions. It enables easy comparison between the confidence levels and provides insights into the overall sentiment regarding the effectiveness of the class streaming system.

In summary, the bar graph in Figure 3.8 displays the level of effectiveness confidence regarding the class streaming system. It showcases the frequency of responses for each level of confidence, with the majority of participants expressing agreement or strong agreement with the system's effectiveness. The graph effectively communicates this information in a visually informative manner, facilitating easy comparison and identification of the prevailing perceptions among the respondents.

3.4 Requirements

The proposed class streaming selection system aims to address the limitations and challenges faced by existing systems. This system focuses on improving the accuracy, fairness, and efficiency of the class streaming process through the incorporation of objective student performance data, streamlined data collection and analysis processes, and consideration of individual student factors.

No.	Functional Requirements	Description
1.	User Registration and Login	• Teachers and administrations should be able to register and create their accounts. • Users should be able to log in securely using their credentials.
2.	Dashboard	• The system should provide a user-friendly dashboard for teachers and administrations to access relevant information and functionalities. • The dashboard should display important data and statistics related to class streaming and student performance.
3.	Class List Management	• Teachers and administrations should be able to view and manage the list of classes. • The system should allow for the creation, modification, and deletion of classes. • Teachers and administrations should be able to assign students to different classes.
4.	Student List Management	• Teachers and administrations should be able to view and manage the list of students.

		• The system should allow for the addition, modification, and deletion of student records. • Teachers and administrations should be able to view student performance data and other relevant information.
5.	Stream Assignment	• The system should provide functionality for teachers and administrations to assign students to specific class streams based on their performance, interests, and career ambitions. • The system should consider factors such as academic performance, behaviour, interests, and career goals when assigning students to class streams.
6.	Reporting and Analytics	• The system should generate reports and analytics based on student performance data and class streaming assignments. • Teachers and administrations should be able to access comprehensive reports to monitor and evaluate the effectiveness of the class streaming process. • The system should provide visualizations and data analysis tools to facilitate data-driven decision-making.
7.	User Roles and Permissions	• The system should differentiate between user roles such as teachers and administrations, with appropriate access permissions and functionalities assigned to each role. • Administrations should have additional functionalities for managing user accounts and system settings.
8.	System Configuration and Customization	• The system should allow administrations to configure and customize various aspects, such as grading scales, criteria for stream

		assignment, and other system settings. • The customization options should provide flexibility to adapt the system to the specific needs and requirements of the educational institution.
9.	Data Security and Privacy	• The system should ensure the security and privacy of student and user data. • User authentication and authorization mechanisms should be implemented to control access to sensitive information. • Data encryption and secure storage practices should be employed to protect confidential data.
10.	User Support and Training	• The system should provide user support and resources, such as documentation and tutorials, to assist teachers and administrations in utilizing the system effectively. • Training sessions should be conducted to familiarize users with the system's functionalities and best practices for class streaming.

Table 3.1 Functional Requirements of the Questionnaire

No.	Non-functional Requirements	Description
1.	Usability	• The system should have a user-friendly interface that is easy to navigate and understand for both teachers and administrations. • The system should provide clear instructions and guidance to assist users in performing their tasks effectively. • The system should be intuitive and require minimal training for users to become proficient.
2.	Performance	• The system should be responsive and

		provide quick response times to user interactions. • The system should be able to handle a large volume of data efficiently without significant performance degradation. • The system should have minimal downtime and be available to users consistently.
3.	Scalability	• The system should be scalable to accommodate the growing number of users, classes, and students. • The system should be able to handle increasing data storage and processing requirements without compromising performance.
4.	Security	• The system should have robust security measures in place to protect sensitive student and user data. • User authentication and authorization mechanisms should be implemented to ensure that only authorized individuals can access the system and its functionalities. • The system should comply with data protection regulations and follow best practices for data security.
5.	Reliability	• The system should be reliable and provide accurate and consistent results. • The system should have mechanisms in place to prevent data loss or corruption. • The system should have backup and recovery procedures to ensure data integrity in case of system failures.
6.	Compatibility	• The system should be compatible with commonly used web browsers and operating systems. • The system should be responsive and adapt well to different screen sizes and devices, such as desktops, laptops, tablets, and smartphones.

7.	Maintainability	• The system should be easy to maintain and update. • The system should have modular and well-organized code structure, making it easier to make changes and enhancements. • The system should have proper documentation and version control to facilitate future maintenance and development.
8.	Privacy	• The system should adhere to privacy regulations and protect the confidentiality of student and user data. • The system should have mechanisms in place to allow users to manage their data privacy settings.
9.	Accessibility	• The system should be accessible to users with disabilities, following accessibility guidelines and standards. • The system should provide options for font size, colour contrast, and alternative text for images to accommodate users with visual impairments.
10.	Integration	• The system should support integration with existing school databases and systems, allowing for seamless data exchange and interoperability. • The system should provide APIs or interfaces to facilitate integration with other educational tools or platforms.

Table 3.2 Non-Functional Requirements of the Questionnaire

These functional and non-functional requirements provide a comprehensive framework for the design and development of the questionnaire, ensuring that it effectively captures the required data while considering usability, reliability, and ethical considerations.

3.5 Designs

The design phase of the project involves the creation and representation of various UML diagrams to provide a visual understanding of the system's structure, functionality, and flow. These UML diagrams serve as powerful tools for capturing the essential aspects of the class streaming selection system and aid in the effective communication of system requirements and design concepts.

3.5.1 System Architecture

3.5.2 Use Case Diagram

The use case diagram offers a high-level overview of the system's functionality by illustrating the interactions between actors (users) and the system. These diagrams depict the different use cases and the relationships between them, showcasing the system's capabilities and the actors' roles within the system.

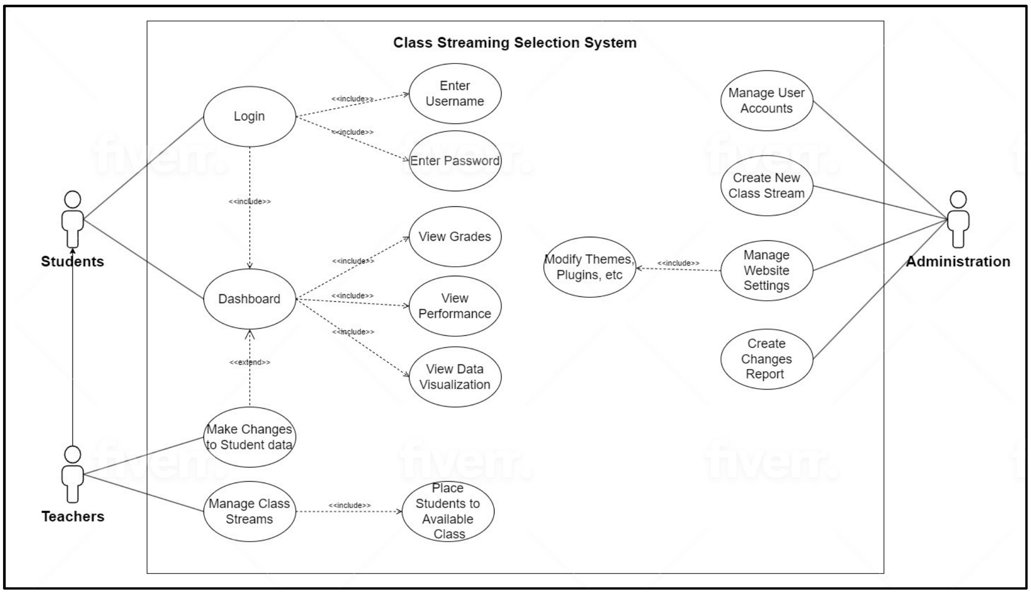

Diagram 3.2 Use Case Diagram

The use case diagram represents the functionality and interactions of the "Class Streaming Selection System based on Students' Performance 2.0" from the perspective of the actors involved, which include Students, Teachers, and Administrations.

The diagram illustrates various use cases that describe the actions and behaviours performed by each actor within the system. These use cases include Login, Enter Username, Enter Password, Dashboard, View Grades, View Performance, View Data Visualization, Make Changes to Student Data, Manage Class Streams, Place Students Available to Class, Manage User Accounts, Create New Class Stream, Create Changes Report, and Manage Website Settings.

The primary actors, Students, have the ability to log in to the system using their credentials, which involve entering a username and password. Once logged in, they are directed to the Dashboard, where they can access various features and functionalities. This includes viewing their grades, performance, and data visualizations, providing them with insights into their academic progress.

Teachers, as secondary actors, can interact with the system by accessing student data and making changes as necessary. They have the capability to modify student information and update records as required.

Administrations, representing another secondary actor, are responsible for managing user accounts within the system. They can create new class streams to accommodate different academic programs and courses. Additionally, administrations have the authority to manage website settings, allowing them to modify themes, plugins, and other configurations to ensure an optimal user experience. They can also generate changes reports to track any modifications made within the system.

The flow of interactions depicted in the diagram indicates certain dependencies between use cases. For example, the Login use case includes the Enter Username and Enter Password use cases, highlighting their dependency on the login process. Similarly, the Dashboard use case includes View Grades, View Performance, and View Data Visualization, indicating that these functionalities are integral parts of the dashboard experience.

Furthermore, the diagram depicts that the Manage Class Streams use case includes the Place Students Available to Class use case, suggesting that the process of managing class streams involves assigning students to available classes.

Similarly, the Manage Website Settings use case includes modifying themes, plugins, and other configurations, indicating the flexibility and customization options available to administrations when managing the system's website.

Overall, the use case diagram provides a clear overview of the system's functionality and the interactions among the actors. It highlights the key features and actions that the actors can perform within the "Class Streaming Selection System based on Students' Performance 2.0," facilitating a better understanding of the system's scope and capabilities.

3.5.3 Package Diagram

3.6 Summary

The methodology in the "Class Streaming Selection System based on Students' Performance 2.0" project outlines the approach and methodologies employed to develop the system effectively. This chapter encompasses several subchapters, including software development methodology, research methodology, analysis, design, and system architecture.

In the software development methodology subchapter, the Agile methodology is chosen as the preferred approach for the project. Agile is an iterative and collaborative methodology that allows for flexibility, continuous improvement, and stakeholder involvement. The methodology is well-suited for a project like the class streaming selection system, where requirements may evolve or need refinement over time.

The research methodology subchapter focuses on the distribution of a questionnaire to high school teachers in the local area. The questionnaire aims to gather valuable insights and data regarding class streaming practices, challenges faced by teachers, and their perceptions of a class streaming selection system based on students' performance. The chosen methodology justifies the use of a questionnaire as an effective tool for data collection and analysis, considering its efficiency in reaching a wide range of participants and obtaining diverse perspectives.

The analysis subchapter presents the findings from the questionnaire analysis, highlighting the teachers' perspectives on class streaming practices, challenges faced, expectations for improvements, and their confidence in the effectiveness of the class streaming process. Various visual representations, such as pie charts and graphs, are utilized to provide a clear and concise overview of the questionnaire analysis findings.

The design subchapter includes the use case diagrams, class diagram, and activity diagrams. The use case diagrams illustrate the functionalities and interactions of both teachers and Administrations within the system. The class diagram represents the classes, their attributes, and the relationships between them, providing a visual representation of the system's structure. The activity diagrams depict the steps involved in the user registration, login, and various system functionalities, aiding in understanding the flow of actions within the system.

Finally, the system architecture section provides an overview of how the system components are organized and interact with each other to achieve the desired functionality. It defines the high-level structure and design of the system, ensuring its efficiency, scalability, and alignment with the project goals.

Overall, this project's methodology provides a comprehensive understanding of the chosen methodologies, the findings from the questionnaire analysis, and the design and architecture of the "Class Streaming Selection System based on Students' Performance 2.0" project. This chapter sets the foundation for the subsequent development and implementation phases, guiding the project towards successful outcomes and addressing the needs and expectations of high school teachers in the local area.

CHAPTER IV
FINDINGS AND RESULTS

This chapter presents the findings and results from the implementation of a Random Forest Machine Learning model, designed to predict the most suitable class stream for students. The model, selected for its robustness and ability to process complex datasets, leverages extensive data pre-processing, transforming student academic performances, interests, and ambitions into a machine-readable format. The Random Forest algorithm, known for managing non-linear relationships and controlling overfitting, is applied to this refined dataset. Post-training, the model's efficacy is evaluated using accuracy, precision, recall, and other key metrics, offering both quantitative and qualitative insights into its potential impact on educational administration and student stream allocation. The results showcase the model's capacity as an innovative, data-driven approach, poised to enhance decision-making processes in educational settings, highlighting its implications and applications in modern educational administration.

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