ACADEMIC INFORMATION SYSTEM AT MUHAMMADIYAH HIGH SCHOOL KUDUS USING MOVING AVERAGE TO DETERMINE MASTERY STANDARD

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ABSTRACT

The utilization of information technology has been widely applied in various fields, including the education sector. However, at Muhammadiyah High School Kudus, administrative tasks such as student data management, class scheduling, attendance tracking, and report card generation still rely on Microsoft Word and Microsoft Excel, leading to inefficiencies and a high risk of human error. This study aims to develop a web-based Academic Information System to streamline administrative processes and improve data accuracy by integrating the Moving Average method to determine the Minimum Mastery Standard (SKBM) based on historical student performance data. The system is developed using the Waterfall method, with PHP as the programming language and MySQL as the database for efficient data management. Blackbox testing is conducted to evaluate system functionality, ensuring its reliability and accuracy. The results indicate that the proposed system significantly enhances administrative efficiency, reduces errors in academic data processing, and provides a more accurate SKBM determination. This research contributes to educational institutions by offering a systematic approach to academic performance evaluation, ultimately supporting better decision-making in student assessments and learning outcomes.

Key Words : *Academic Information System, Moving Average, SKBM, Web-Based System, Waterfall Model.*

1. INTRODUCTION

The rapid advancement of information technology has significantly enhanced data accessibility and management, making information processing more efficient and accurate. These technological developments have been widely implemented in various sectors, including education [1], [2].

Schools, as institutions responsible for organizing learning activities, require well-structured administrative management to support the teaching and learning process [3], [4].

Effective administration not only involves financial data management but also covers student records, teacher data, report card generation, and academic performance evaluation [5], [6].

At Muhammadiyah High School Kudus, administrative tasks such as student data management, class scheduling, attendance tracking, and report card processing are still manually conducted using Microsoft Word and Microsoft Excel. This manual approach leads to inefficiencies, including time-consuming processes, prone-to-error data entry, and disconnected information management, making it difficult to evaluate student performance comprehensively [7], [8].

One crucial aspect of academic evaluation is determining the Minimum Mastery Standard for each subject, which serves as a benchmark for assessing student learning outcomes. However, the current minimum mastery criteria determination lacks an automated and systematic approach, affecting the accuracy and consistency of evaluation results.

To address these issues, this study proposes the development of a Web-Based Academic Information System utilizing the Moving Average method to automate the minimum mastery criteria determination process. The Moving Average method is widely used in time-series forecasting and is expected to provide an accurate prediction of minimum competency standards based on historical academic data [9], [10].

The system is developed using the Waterfall model, employing PHP as the programming language and MySQL as the database management system.

This research aims to enhance the efficiency of academic data management, improve the accuracy of minimum mastery criteria calculation, and support better decision-making in student performance evaluation [11], [12], [13].

By integrating the Moving Average forecasting method, the system is expected to optimize minimum mastery criteria determination, ensuring a more data-driven, consistent, and objective assessment process for each subject and semester [14].

The expected outcomes of this study include the development of a reliable academic information system, improved data accessibility and accuracy, and enhanced efficiency in administrative processes. This system is anticipated to benefit teachers, school administrators, and students by providing faster and more precise academic evaluations, ultimately improving the overall educational quality at Muhammadiyah High School Kudus.

2. LITERATURE REVIEW

2.1. Definition Informartion System

An information system integrates various technological components to facilitate seamless communication and efficient information management within an organization, ensuring data-driven decision-making and operational effectiveness [15], [16], [17].

An information system functions as a critical component within an organization, integrating transaction processing, operational support, and strategic decision-making while delivering essential reports to both internal and external stakeholders[18], [19], [20].

2.2. Definition Academics

Academics encompass an educational framework where individuals pursue structured learning to attain academic degrees within a specified timeframe, ensuring knowledge development and professional competence [21], [22].

2.3. Definition Moving Average Method

The Moving Average method is a smoothing technique used in time series analysis to reduce or eliminate randomness in historical data[23], [24].

By averaging past values, this method helps predict future periods, making it a widely used technique in forecasting [25].

One of the main challenges in Moving Average forecasting is determining the value of t (the averaging period) [26].

A larger t value results in a smoother forecast but may fail to follow the actual data pattern accurately. This method is most effective for time series data without significant trends, as previous data points are not reused once the averaging process moves forward [27].

The steps in applying the Moving Average method include collecting observed data, computing the average, and obtaining the predicted value for the next period [28].

The forecasting formula for Moving Average is:

$$\mathbf{F_{t+1}} = \frac{\mathbf{Y_t + Y_{t+1} + Y_{t+2} + \cdots + Y_{t-n+1}}}{\mathbf{n}} \quad (1)$$

Where:

F_{t+1} = Forecast for period t+1

Y_t = Data at period t

n = Number of periods in the averaging calculation

Key Characteristics of the Moving Average Method

a. Historical data is required over a specific period to generate forecasts for future periods.
b. Forecasting results become smoother when applied to longer time series data, reducing fluctuations in predictions.

Case Study: Academic Information System for Report Card Analysis at SMA Muhammadiyah Kudus This research applies the Moving Average method in a web-based Academic Information System to determine the Minimum Mastery Standard at SMA Muhammadiyah Kudus. By leveraging time-series data, the system aims to automate minimum mastery criteria calculations, improving the accuracy and efficiency of academic performance evaluation.
Subject: Indonesian Language
Period: Grade Xi-I Social Science - Semester 1
Method Objective: Determination Of Minimum Mastery Criteria For Indonesian Language In Semester II

Table 1. Grade xi-i social science - semester i

No	Student name	UH 1	UH 2	UH 3	UH 4	Mid	Final	Average	Standard average
1	ABDULLAH	70	85	60	70	75	79	74	80
2	AGUNG	90	80	95	89	85	89	88	
3	NABILA	86	74	86	45	80	89	77	

Subject: Indonesian Language
Period: Grade Xi-II Social Science - Semester 1
Method Objective: Determination Of Minimum Mastery Criteria For Indonesian Language In Semester II

Table 2. Grade xi-i social science - semester ii

No	Student name	UH 1	UH 2	UH 3	UH 4	Mid	Final	Average	Standard average
1	AZIZAH	80	80	70	80	95	95	84	84
2	BAMBANG	95	85	80	75	80	83	83	
3	YUSRON	90	77	86	80	90	87	85	

Application of the Moving Average Method to Determine the Minimum Mastery Standard in the Second Semester.

Table 3. Moving average method

NO	CLASS/DEPARTMENT	SCORE
1	XI IPS I	80
2	XI IPS II	84
	Average	82

3. RESEARCH METHODOLOGY

To obtain accurate, relevant, valid, and reliable data, the researcher employed various data collection techniques, including:

3.1. Primary Data Sources

3.1.1. Interviews

In the development and implementation of information systems, identifying system requirements is crucial for analyzing the existing situation and

identifying actual problems. Interviews with business stakeholders are an effective means of gathering data, particularly in addressing real-world challenges during system application.

a. Literature Study
   This data collection method involves reviewing books and previous research related to the research topic to deepen understanding and provide context for the study
b. Observations
   Observation is a data collection technique where the researcher directly observes activities in a specific business operation. This method is employed to understand and analyze real-world processes as they occur in the field.

3.2. Secondary Data Sources

Secondary data is obtained indirectly from research subjects, often through existing literature or other resources. Secondary data sources include:

a. Documentary Study
   Documentary study involves gathering data from various literature and online resources that provide relevant information to the research.
b. Library Research
   This technique involves collecting information from books that are aligned with the research topic, providing additional insights into the issues being examined.

3.3. System Development Methodology

The methodology employed in this study is the Waterfall model, a straightforward and classical approach characterized by a linear flow[29].

Each phases output serves as the input for the subsequent phase, ensuring a structured and sequential development process [30].

The stages in the Waterfall methodology include the following, as illustrated in Figur 1:

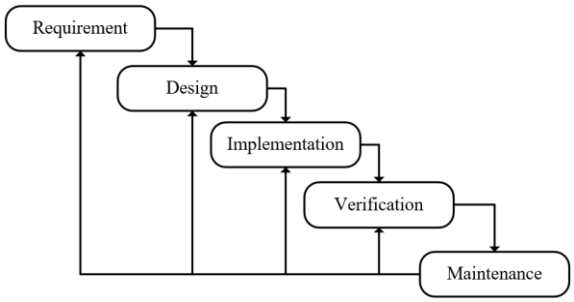

Figure 1. Waterfall model

a. Requirement
   In this phase, the researcher identifies all existing problems and outlines the hardware, software, and user requirements [31].
   Additionally, the necessary data and information to support system development are defined.
b. Design
   Once the requirements have been gathered, the next step is to design the system based on problem identification. This phase involves translating the identified issues into a functional system and building the corresponding application [32].
c. Implementation
   At this stage, the developed application undergoes testing, where it is implemented in the research environment [33].
   After implementation, supervision and evaluation of the results are carried out to assess the effectiveness of the application.
d. Verification
   Here, the application is considered ready for deployment. It is integrated with all relevant system aspects, ensuring full functionality and readiness for real-world application [34].
e. Maintenance
   In this final phase, the system is used by the intended users. Ongoing maintenance is carried out, including troubleshooting and system upgrades, to address errors or improve service quality as needed [35].

3.4. Use Case Diagram

The System Use Case diagram is used to explain the activities performed by both actors and the system in order to achieve specific objectives. To analyze the system model that will be developed, the first step is to assess the general system requirements. Figure 2 illustrates the flow of the use case diagram:

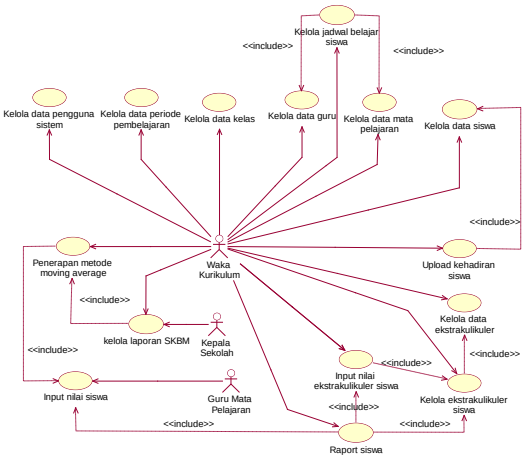

Figure 2. Use case diagram

3.5. Class Diagram

The class diagram plays a vital role in illustrating the diverse classes within the system or software under development. It offers a detailed representation of the system's architecture and the interconnections between its components. Figure 3 below displays the Class Diagram, highlighting the system's design phase and revealing the interactions among classes essential for system management.

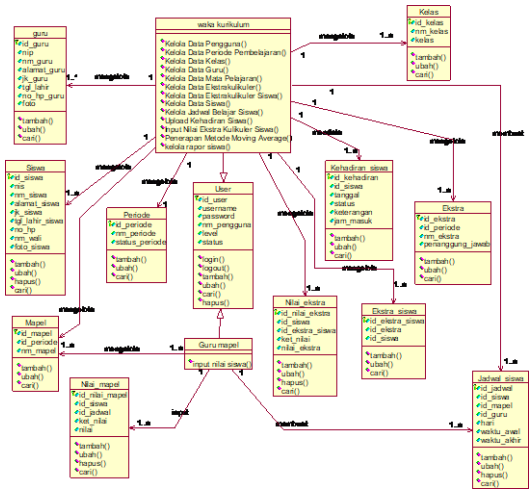

Figure 3. Class diagram

3.6. Entitiy Relationship Diagram

The Entity Relationship Diagram (ERD) is a crucial tool for designing a database, as it visually represents the relationships and attributes of entities or objects within the system. The primary goal of creating an ERD is to identify the entities involved in the database and define how they relate to one another. Figure 4 illustrates the step-by-step procedure used in developing the ERD, aiming to create an efficient and well-structured database management system.

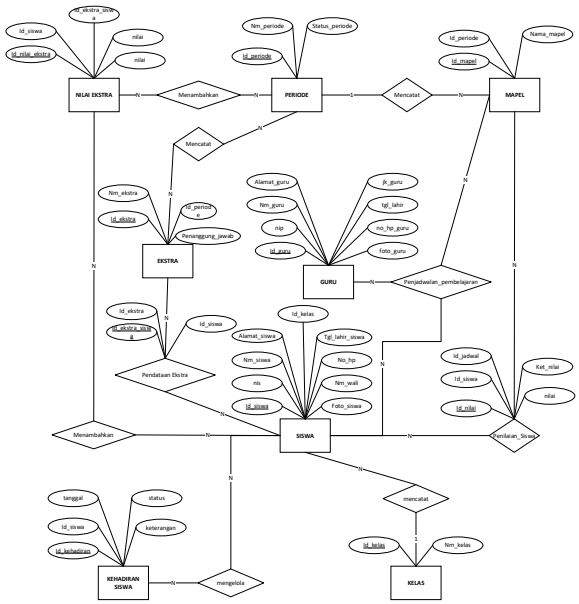

Figure 4. Entity relationship diagram

3.7. Table Relation

The relationships between tables in the database designed for the Academic Information System of Report Cards at Muhammadiyah High School Kudus, utilizing the Moving Average Method to determine the Minimum Mastery Standard for a web-based system, are illustrated in the following diagram. As illustrated in Figure 5, the diagram provides a clear representation of how these tables interact, ensuring seamless data integration and efficient management.

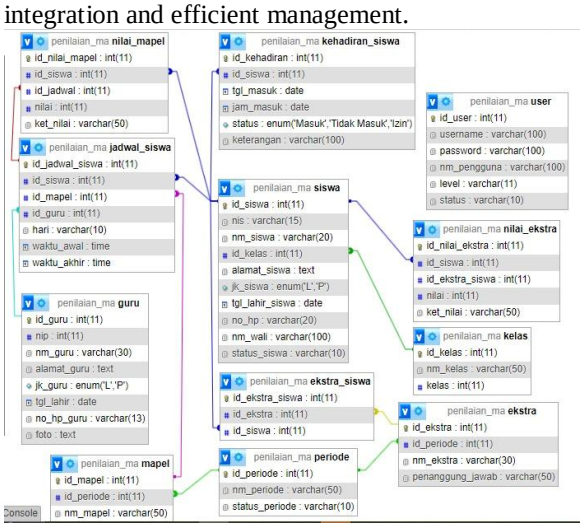

Figure 5. Table relations

4. RESULT AND DISCUSSION

4.1. Implementation of The System

Implementation is a crucial phase in deploying and testing the design of the Academic Information System for Report Cards at Muhammadiyah High School Kudus, utilizing the Moving Average Method to determine the Minimum Mastery Standard for a web-based system. This stage marks the transition from system design to the actual coding process, where the design is translated into lines of code that the computer can execute.

4.2. Main Page

The Main Page represents the initial screen users encounter upon entering the system. On this page, users can log in using their registered credentials. The following image, Figure 6, displays the layout of the main page.

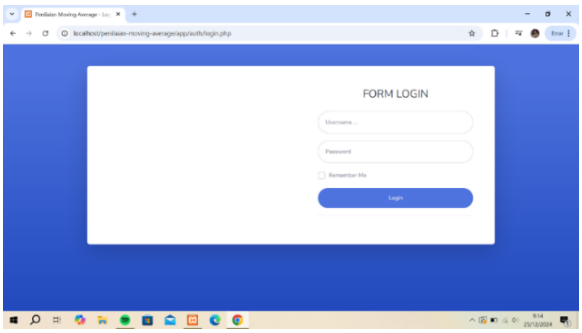

Figure 6. Main page

4.3. Dashboard Page Layout

The dashboard page serves to provide a concise overview of the existing data. The layout of the dashboard page is illustrated in Figure 7 below.

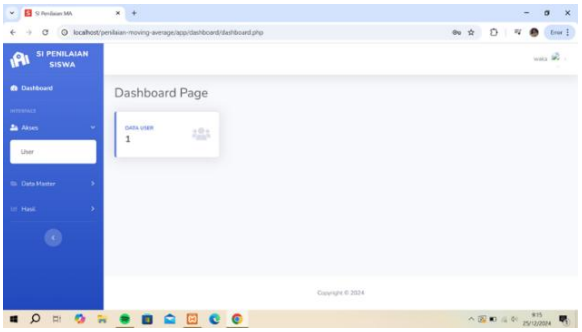

Figure 7. Dashboard page layout

4.4. Survey Class Page

The Class Page is designed for the curriculum coordinator to manage class data according to the required needs. The layout of the class page is shown in Figure 8 below.

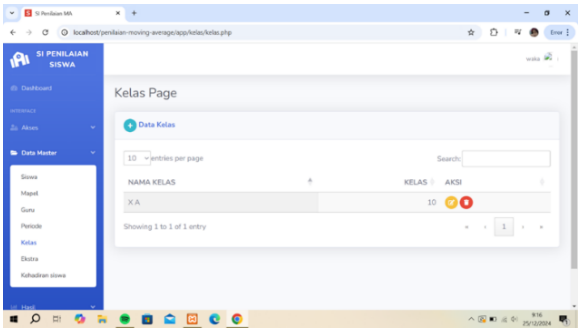

Figure 8. Class page

4.5. Subject Page

The subject page is designed to manage data for subjects across grades X to XII. The layout of the subject page is shown in Figure 9 below.

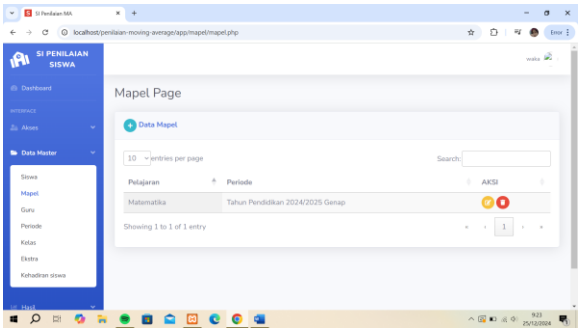

Figure 9. Subject page

4.6. Student Attendace Page

The student attendance page is designed to manage the attendance data of all students in the school. The layout of the student attendance page is shown in Figure 10 below.

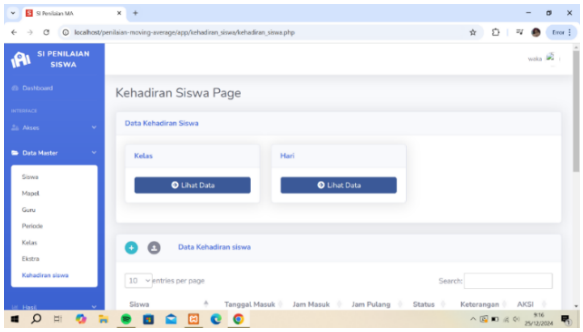

Figure 10. Student attendance page

4.7. Grade Page

The grade page is designed to display all student grades based on the completed semester. The layout of the grade page is shown in Figure 11 below.

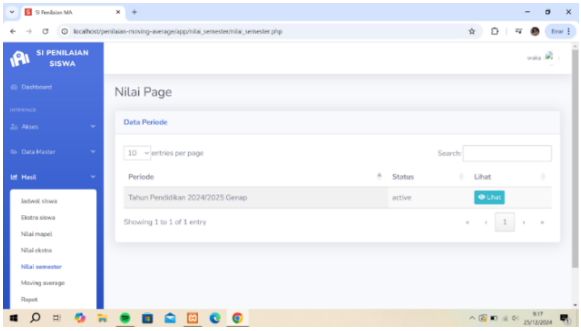

Figure 11. Grade page

4.8. Report Card Page

The report card page is designed to generate the report cards for students at the end of each semester. The layout of the report card page is shown in Figure 12 below.

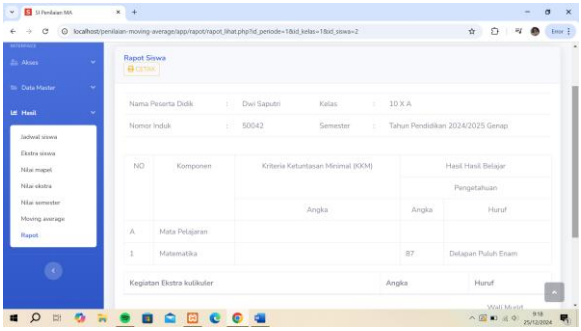

Figure 12. Report card page

The system was tested using blackbox testing, covering user data management, learning period management, subject management, and student learning schedule management. The results confirm that the system successfully processes valid inputs while identifying errors in incorrect or empty data entries. However, some test cases failed, indicating areas that require further improvements, such as handling invalid symbols, duplicate data, and incorrect time formats.

Table 4. Blacbox testing

No	Function Tested	Scenario	Expected Result	Result
User Data Management				
1	Correct Input	User enters valid data and submits	User data successfully added	Successful
2	Incorrect Input	User enters a name containing numbers	Warning message displayed	Failed (Error message did not appear)
3	Empty Fields	User submits without entering data	Warning message displayed	Failed (No warning displayed)
Learning Period Management				
1	Correct Input	User enters valid learning period data and submits	Learning period data successfully added	Successful
2	Incorrect Input	User enters symbols other than slash (/)	Warning message displayed	Failed (Accepted invalid symbols)
3	Empty Fields	User submits without entering data	Warning message displayed	Failed (No warning displayed)
Subject Management				
1	Correct Input	User enters valid subject data and submits	Subject data successfully added	Successful
2	Incorrect Input	User enters a duplicate subject name	Warning message displayed	Failed (Duplicate data accepted)
3	Incorrect Input	User enters a subject name containing numbers	Warning message displayed	Failed (No warning displayed)
4	Empty Fields	User submits without entering data	Warning message displayed	Failed (No warning displayed)
Student Learning Schedule Management				
1	Correct Input	User enters valid schedule data and submits	Schedule data successfully added	Successful
2	Incorrect Input	User enters an incorrect time format for start or end time	Warning message displayed	Failed (Invalid format accepted)
3	Empty Fields	User submits without entering data	Warning message displayed	Failed (No warning displayed)

5. CONCLUSION AND RECOMENDATION

This research successfully developed a Web-based Academic Information System for Report Cards at SMA Muhammadiyah Kudus, utilizing the Moving Average method to determine the Minimum Completion Standard. The system integrates three user levels—Curriculum Coordinator, Subject Teachers, and the School Principal—each assigned specific roles to ensure smooth and efficient operation. The Curriculum Coordinator manages essential master data, Subject Teachers input students' grades, and the School Principal accesses and prints Minimum Completion Standard reports at the end of each semester.

The findings highlight the practical application of the Moving Average method in education, improving the accuracy of academic assessments and streamlining data management for more efficient reporting and decision-making. This research contributes to the integration of technology into academic management, offering an automated approach to grading and performance evaluation. However, the system's effectiveness depends on accurate data input by users, which may impact reliability. Future research should explore advanced features such as real-time updates and automated alerts to enhance performance tracking and feedback mechanisms, further improving the system's overall effectiveness.

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