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# Website-Based Academic Information System Design Using Extreme Programming Method

# (Observation Study: State Junior High School 3 Watukumpul)

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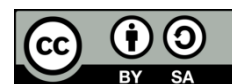[2]annisaa@ittelkom-pwt.ac.id
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## Abstract

*SMP Negeri 3 Watukumpul is a junior high school located in Bongas Village, Watukumpul District, Pemalang Regency, Central Java. This school has implemented website-based technology as a medium for conveying information, but the website is no longer usable. The data obtained from the interview results indicate the need for an academic information system website as a medium for disseminating information and managing academic data digitally. Based on the existing problems, researchers will re-create a website-based Academic Information System for SMP Negeri 3 Watukumpul as a medium for delivering information and managing academic data. This research uses the Extreme Programming method, which is one of the development methodologies of Agile Software Development Methodologies. The Extreme Programming method has several stages: Planning, Design, Coding, and Testing. The system uses black box testing on student, admin, and teacher accounts. Blackbox testing on student accounts includes login, register, profile, news, wall magazine, course material, grades, contacts, and logout menus. Blackbox testing on teacher accounts consists of login menus, course materials, grades, and grade page details. Black box testing on admin accounts consists of login menus, school profiles, teachers and employees, news, wall magazines, extracurriculars, and lesson schedules. In testing this system, researchers use black box testing to test its functionality. The black box test from the student's account got a result of 100%, the black box test result from the teacher's account got 100%, and the black box test from the admin account was 98.57%. Thus, the average black box test result from the three users was 99.52%. With the existence of this school website, it is hoped that information dissemination activities and academic data management activities will become more effective and efficient.*

**Keywords: Agile, Extreme Programming, Academic Information System**

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## I.    INTRODUCTION

The development of information systems in the current era of globalization is critical. An institution or company heavily relies on computers as a medium to aid in data processing and data input. By leveraging the existing computer technology, we can streamline data processing, making it more efficient in terms of time and cost [1]. Not to mention educational institutions that have also utilized this technology as a means to convey information and promotions. Schools require a medium to share information with internal parties within the school as well as the general public [2].

A website is one of the results of technological advancements that are widely used today as a means to support specific needs [3]. The utilization of websites has now expanded into various fields, including the

field of education. This is evidenced by the fact that almost all levels of schools, up to universities, use websites to deliver information and for other purposes.[4]. School websites are now widely used in the world of education and have received a very positive response from various parties, including educators, students, and the general public [5]. SMP Negeri 3 Watukumpul is one of the junior high schools located in Bongas Village, Watukumpul District, Pemalang Regency, Central Java. This school has implemented website-based technology as a medium to convey information about the school to educators, students, and the general public.

There are several previous studies related to school information systems based on websites, one of which is the Development of School Academic Information System (SIAS) Based on Website [3], and the Design of Academic Information Systems in Junior High School Based on the Web [6]. In those studies, the waterfall method was used in their development process. The difference in the research I conducted lies in using the Extreme Programming method. The advantages of the Extreme Programming method are that it is targeted at small to medium-sized teams, it has a short development time, and it is highly responsive to changes. Therefore, if there are any changes, there is no need to start over from the beginning [7]. Based on the issues described above, the author developed an Academic Information System for SMP Negeri 3 Watukumpul based on a website as a means of conveying information and managing academic data, making the activities of information delivery and academic data management more effective and efficient.

The purpose of this research is to develop an Academic Information System for SMP Negeri 3 Watukumpul, leveraging the benefits of the Extreme Programming method. By creating a web-based system, the project aims to enhance the effectiveness and efficiency of information dissemination and academic data management within the school. This system will serve as a vital tool for streamlining academic processes, ultimately contributing to improved educational outcomes.

## II.  RESEARCH METHOD

### A.  HTML (HyperText Markup Language)

HTML (HyperText Markup Language) is a script that can display our data and work through the internet network. In HTML, we can create a script that can control various elements such as titles, tables, lines, images, and others with predefined commands [8].

HTML is an abbreviation for Hypertext Markup Language, which is a web standard language managed by the W3C (World Wide Web Consortium) in the form of tags that make up every element of the website. HTML acts as a website page structure organizer that places every element of the desired website layout [9].

### B.  CSS (Cascading Style Sheets)

CSS (Cascading Style Sheets) is a set of rules to control the components on a website, such as heading styles, borders, navbars, body text, footers, images, sidebars, and other styles, to make them more organized and consistent, resulting in a neat and tidy website appearance [3].

### C.  MySQL

MySQL is one of the DBMS (Database Management System), which is a program for creating and managing databases. The advantages of MySQL are its ease of use and being free since it is licensed under the GNU General Public License (GPL) [10].

MySQL is one of the most widely used types of databases to create dynamic web-based applications. MySQL is a type of RDBMS (Relational Database Management System). MySQL supports the PHP programming language. MySQL also has a simple query or SQL (Structured Query Language) language and uses the same escape character as PHP. MySQL is an implementation of a relational database management system (RDBMS) that is distributed for free under the GPL (General Public License) license. Any user can freely use MySQL, but the limitation is that the software may not be made into a derivative product of a commercial nature [11].

*D. Laravel*

Laravel is one of the frameworks that utilizes the PHP programming language to assist developers in building web-based applications. Developers widely adopt Laravel due to several advantages it offers, such as using the CLI (Command Line Interface) Artisan, utilizing Composer, and providing a concise yet structured and easily understandable code-writing approach [12].

Laravel is one of the web frameworks based on PHP and developed open-source. Laravel was developed by Taylor Otwell and is used to develop web-based applications that apply a pattern, namely MVC. The MVC structure implemented by Laravel is somewhat different from MVC in general. Laravel has a routing feature that is used to connect between the request user and a controller that receives it so that the controller cannot immediately receive a specific request [13].

*E. Agile Software Development Method*

Software companies and teams commonly use agile methods to improve productivity, speed up delivery, and increase flexibility, as well as customer satisfaction. However, transitioning to Agile can be challenging. Several frameworks and models have been proposed to ease the transition process. The challenge is maintaining agility after the transition. This issue has not been widely researched and is a cause for concern. This study aims to explore the transition to agility and provide a solution for Agile consolidation in newly Agile software teams using the grounded theory approach [14].

*F. Extreme Programming*

Extreme programming is one of the methodologies used in Agile software development methodologies. Extreme Programming is a software development methodology that is highly responsive to changes. The every step can be seen in Fig.1.
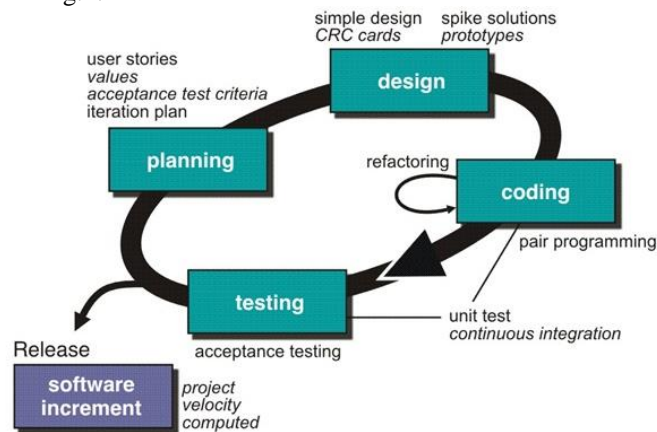


Fig. 1.        Extreme Programming Method Model [15]

Fig. 2.        ### Extreme Programming (XP) Software Development Process

Extreme Programming (XP) is an agile software development methodology that emphasizes customer satisfaction, continuous feedback, and incremental changes. It involves several essential steps, each focusing on different aspects of the software development lifecycle. The planning phase is the initial stage in system development, where various planning activities take place, such as identifying issues, analyzing requirements, and determining the system development schedule. Issues are identified by defining the problem the system aims to solve and engaging stakeholders to gather insights on challenges and expectations. Requirements are analyzed by collecting and prioritizing user stories to capture the needs from the end-user's perspective and define acceptance criteria for completion. The development schedule is determined by planning the work in small, manageable iterations and scheduling release dates for different system versions, ensuring frequent delivery of functional increments.

The design phase involves creating models for the project, including system design, architecture design, and database design. System design provides a high-level overview, outlining significant components and their interactions through component diagrams. Architecture design ensures scalability, performance, and

security considerations are incorporated. Database design includes schema design, normalization to reduce redundancy, and developing the necessary tables, relationships, and constraints.

In the coding phase, the previously designed models are implemented into user interfaces and database structures using appropriate programming languages. Front-end development converts design mockups into functional interfaces, ensuring they are user-friendly, intuitive, and responsive. Database implementation involves creating tables, indices, and relationships based on the schema and integrating the database with the application. Code development entails writing the actual application logic and integrating interfaces and database structures while utilizing pair programming techniques to improve code quality and facilitate knowledge sharing.

The final stage is system testing, which is conducted to determine whether the developed system functions according to the requirements and to identify any errors. Functionality testing includes writing and running unit tests for individual components and integration tests to ensure different system parts work together. System testing involves acceptance tests to verify the system meets defined criteria, and performance testing evaluates the system under various conditions. Errors are tracked and managed using bug-tracking tools, with debugging to identify root causes and fix them. Continuous feedback is gathered from customers and end-users, which is used to improve future iterations and ensure the system evolves to meet user needs.

Overall, the XP process emphasizes a collaborative and iterative approach to software development, focusing on planning, design, coding, and testing to ensure the system is developed incrementally with continuous feedback, leading to high-quality software that meets user requirements. [15].

## III. RESULTS AND DISCUSSION

### A. Planning

The planning process for the academic information system involves a comprehensive analysis of the specific requirements identified for the school. This ensures that the system will effectively support the various roles within the school community, including students, teachers, and administrators. The analysis has outlined several key features and functionalities that the system must provide as the following:

1. The school profile page offers a detailed profile of the school, accessible to students, teachers, and admins. This helps all users understand the school's mission, history, facilities, and other relevant information.
2. The news page displays current news and updates related to the school. This keeps the community informed about events, achievements, and important announcements.
3. The wall magazine page features articles, stories, and creative content contributed by the school community. This encourages engagement and showcases contributions from students and teachers.
4. The extracurricular page provides information on various extracurricular activities available at the school. This helps students and parents learn about and participate in these opportunities.
5. The academic page displays course materials and grades. It allows teachers to add course materials and student grades, centralizing academic resources and performance data for easy access and management.
6. The contact page lists contact information for the school. This facilitates communication between the school and its community members.
7. Administrative capabilities allow admins to manage data related to the school profile, news, wall magazine, extracurricular activities, and contacts. Admins can add, edit, and delete information, ensuring that the information is accurate and up-to-date and maintaining the integrity of the system.
8. For students, teachers, and admins, the system provides viewing capabilities across various pages. The school profile page enables users to understand the comprehensive background and operational ethos of the school. The news page keeps users updated with the latest developments and news. The wall magazine page engages users with creative and informative content created by the school community. The extracurricular page informs users about the various non-academic activities that they can participate in. The academic page provides access to learning materials and allows students to track their academic performance. The contact page provides necessary contact details for communication purposes.

9. For teachers, the system offers course material management. Teachers can upload and update course materials for students. It also provides grade management, enabling teachers to input and manage student grades, ensuring that academic records are current and accurate.

10. For admins, the system offers robust data management capabilities. Admins can add, edit, and delete information related to the school profile, news, wall magazine, extracurricular activities, and contact data. This ensures comprehensive and up-to-date information.

This needs analysis highlights a robust academic information system that ensures all users—students, teachers, and admins—can effectively engage with and manage the various facets of school life. The system's design prioritizes accessibility, functionality, and ease of use, ensuring that the school community is well-informed and that academic and extracurricular activities are well-supported. By providing detailed viewing and administrative capabilities, the system aims to enhance the overall educational experience and operational efficiency of the school.

## B. Design

Researchers will design the website based on the plans that were made before. Fig. 2 displays the wireframe display on the profile menu page. This page will display information about the profile of the SMP Negeri



Fig. 3. Menu Profile

## C. System Implementation

This part is telling about the results of system implementation. This includes the Login Page, Profile Page, Extracurricular Page, Schedule Page, Course Page, and Scores Page.

Fig. 3 displays the login page for users who already have an account. Just like the previous registration page, this page features input fields for email and password to match the data of users who have been registered in the system.
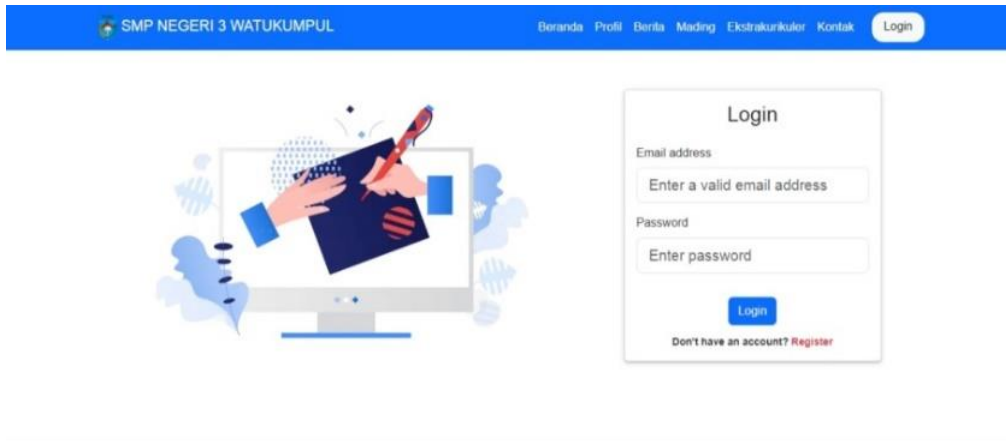
Fig. 4.    Login Page

In Fig. 4, the profile menu page, which contains school profile information, includes biodata, vision, mission, organizational structure, and teachers and school staff.
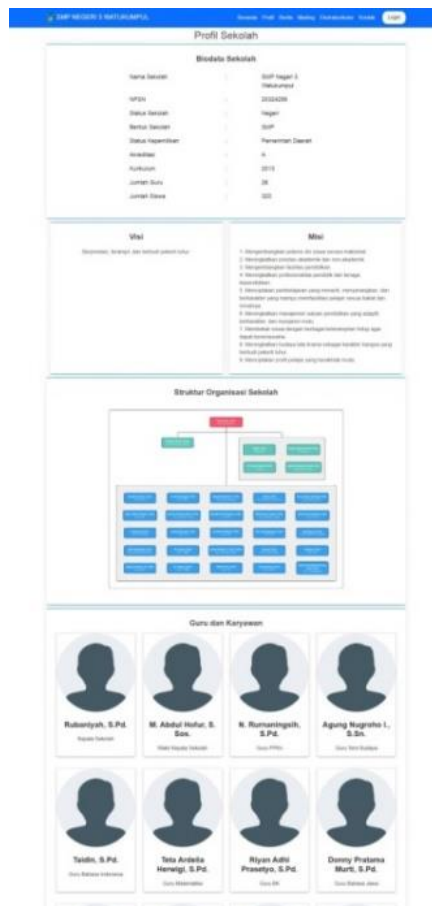


Fig. 5.    Profile Page

In Fig. 5, the main page of the extracurricular menu is displayed. Similar to the previous menus, the main page of the extracurricular menu is created using a grid component.
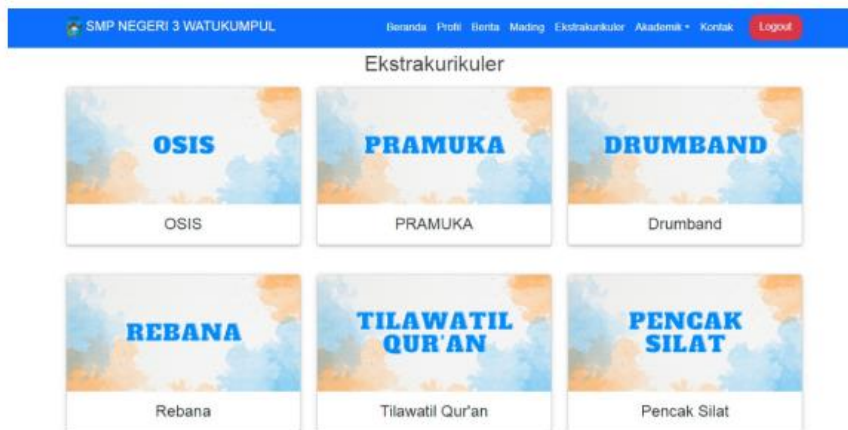
Fig. 6.      Extracurricular Page

In Fig. 6, the main page of the class schedule is displayed in the academic menu under the sub-menu class schedule.



Fig. 7.      Schedule Page

In Fig. 7, the main page of the study materials is displayed in the academic menu under the sub-menu course. The detailed page of the study materials is equipped with a search feature, and users with the role of a student can download the study materials files.



Fig. 8.      Course Page

In Fig. 8, the grade page is displayed in the academic menu under the sub-menu scores. The main page of this submenu includes a search feature and a details button that will redirect to the student's grade detail page. The grade detail page will show data such as the student's name, gender, NISN (National Student Identification Number), and semester, and a table presenting the student's grades for each subject available.
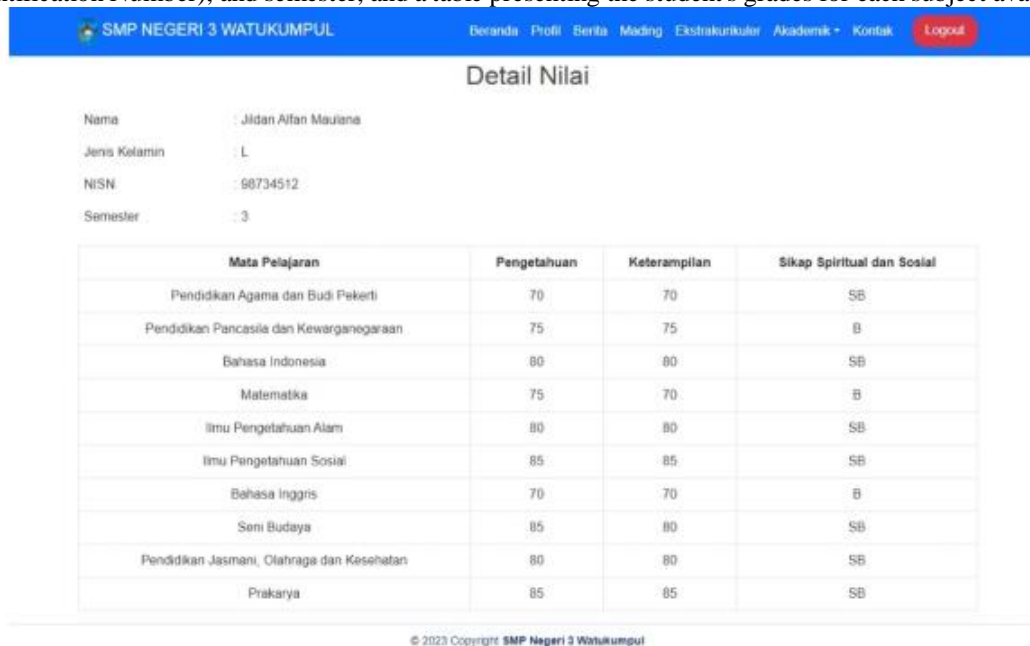


Fig. 9.    Scores Page

## D.  Testing

The blackbox testing conducted by the author with SMP Negeri 3 Watukumpul, represented by the school operator, resulted in all functionalities of the website working as expected. Therefore, this blackbox testing is declared successful and valid. The system uses black box testing on student, admin, and teacher accounts. Blackbox testing on student accounts includes login, register, profile, news, wall magazine, course material, grades, contacts, and logout menus. Blackbox testing on teacher accounts consists of login menus, course materials, grades, and grade page details. The blackbox testing on admin accounts consists of login menus, school profiles, teachers and employees, news, wall magazine, extracurriculars, and lesson schedules. The recapitulation from the blackbox testing can be seen in Table I.

TABLE I.        BLACK BOX TEST RESULTS

| Account | Number of Successful Scenario | Number of Fail Scenarios |
|---------|-------------------------------|--------------------------|
| Admin | 69 | 1 |
| Teacher | 19 | 0 |
| Student | 27 | 0 |

The black box testing results for the academic information system are summarized in Table I, detailing the number of successful and failed scenarios for different user roles: Admin, Teacher, and Student. The Admin role was tested across 70 scenarios, with 69 passing successfully and only 1 failing. This indicates high reliability for admin functionalities, although the single failure suggests a specific issue that needs addressing to ensure complete robustness.

For the Teacher role, all 19 tested scenarios passed successfully, demonstrating that the system's features designed for teachers are functioning correctly without any detected issues. This result reflects thorough validation and suggests that the system meets the requirements set for teacher interactions, such as adding course materials and student grades.

Similarly, the Student role testing showed a perfect score with 27 successful scenarios and no failures. This indicates that the features accessible to students, like viewing course materials, grades, and school information, are working as intended.

Overall, the black box test results demonstrate that the academic information system is largely reliable and meets the expected functional requirements for all user roles, with a minor issue identified in the Admin functionalities that requires further investigation and resolution.

As can be seen in Table I, black box testing on the admin account consists of a login menu, school profile, teachers and employees, news, wall magazines, extracurriculars, and lesson schedules. The edit school profile menu is invalid. Thus, the Blackbox test from the admin account is 98.57%. The blackbox test on the teacher's account consists of a login menu, course materials, grades, and grade page details. Blackbox testing on student accounts is the login menu, register, profile, news, wall magazines, subject matter, grades, contacts, and logout. Blackbox testing of student accounts gets 100% results. Thus, the average black box test result from the three users was 99.52%.

## IV.    CONCLUSION

Based on the results of this research, by applying the Extreme Programming method in the system design and using Black Box testing in the system testing, it can be concluded that this website can be implemented for various types of users, such as students, teachers, and administrators. Users with teacher and admin status can perform CRUD (Create, Read, Update, and Delete) functions because the website is dynamic. The testing stages in this research were conducted through Black Box Testing, where this testing produced successful input and output processes, and the features functioned well according to the provided scenario flow from the perspective of students, teachers, and admins. Further research development can be added to the value graph and ranking of each class. So that teachers and students can see the difference between students and not only their data. The black box test from the student's account got a result of 100%, the black box test result from the teacher's account got 100%, and the black box test from the admin account was 98.57%. Thus, the average black box test result from the three users was 99.52%.

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