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Aplikasi Computer Based Test (CBT) Berbasis Website Menggunakan Metode RAD Pada SMA Negeri 21 Medan

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ABSTRACT

A Computer-Based Test (CBT) can be utilized as a method that leverages technology in the field of education, packaged in a manner that is both effective and efficient. At SMA Negeri 21 Medan, the examination process is still conducted manually using a Paper-Based Test (PBT). The academic staff and students at SMA Negeri 21 Medan still use paper for everything from writing the exam questions to administering the exams, leading to inefficiencies in cost, time, and errors in the grading process that can disadvantage the students. This research aims to design and develop a computer-based test (CBT) application, beginning with data collection methods (literature review, interviews, and observations) and using the Rapid Application Development (RAD) system development methodology. The system design was created using UML, with use case diagrams, activity diagrams, sequence diagrams, and class diagrams. The resulting system can assist teachers and other academic staff in the online examination process, where the scores will be automatically generated once the exam is completed, thereby saving time from manually grading each exam. The application also includes a QR code containing student data to assist academic staff in checking whether students have paid their tuition and exam fees. The application system testing was conducted using the black box testing method to determine the functionality of the application according to the requirements.

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INTRODUCTION

Information, communication, and electronic technology are currently developing rapidly, touching various fields, including education, which has seen improvements in convenience and quality(Aulia Riski et al., 2022). The implementation of exams, previously conducted manually, is now shifting to computer-based testing (CBT), which narrows the constraints of space and time. This shift enables exams to be conducted more accurately with the support of CBT systems.

Computer-Based Test (CBT) is an exam taken on a computer, eliminating the need for paper, pens, or pencils to answer questions (Alyona, 2020). In general, a Computer-Based Test is an assement or learning evaluation conducted using computers (editor, 2022). With the CBT system, cheating during exams can be minimized since the exam's location and system can be well-controlled.

Since the exam system currently applied at SMA Negeri 21 Medan is still coventional, it is necessary to develop a CBT system to assist in transitioning the exam process from a conventional method to a computerized one. Implementing a CBT system can help SMA Negeri 21 Medan manage exam questions more efficiently, reducing the cost of printing exam papers, making the exam process more structured and timely, minimizing the use stationery and exam papers, and supporting the examination process with real-time result information (Yogie, 2024).

The Rapid Application Development (RAD) method is a model develop from the system Development Life Cycle (SDLC) that aims to accelerate the development process by using short development cycles, emphasizing intensive collaboration beetwen developers and stakeholders in

building the required application (Gabriel et al., 2023). In the context of CBT, the RAD model allows developers to quickly produce a system prototype, enabling users to test core functionalities such as test creation and processing, as well as test administration and assessment.

The development stages of a Computer-Based Test (CBT) system follow several steps, starting from initial needs identification, initial prototype development, rapid construction, feedback gathering, testing, and finally, system implementation and maintenance (Harira Irawan & Prihadi, 2023).

LITERATURE REVIEW

Software or application is a subclass of computer software that is directly utilized by users to perform or accomplish spesifi tasks. An application can also be defined as a ready-to-use-program that can execute commands from its users, providing more accurate results aligned with the application's intended purpose (Siregar et al., 2021).

A computer-based test is an assessment conducted using a computer, encompassing evaluation and testing methods implemented electronically. This method involves the administration and management of tests, where the results are recorded, graded, or both (Fauzi, 2022).

XAMPP is free software that supports multiple operating systems and is a compilation of several programs. Its function is as a standalone server (localhost), consisting of the apache HTTP server, MySQL database, and interpreters for languages written in PHP and Perl. The name XAMPP is an acronym for X (representing any operating system), Apache, MySQL, PHP, and Perl (Kaparang et al., 2019).

HTML is a basic programming language used in website development. It consists of elements such as the head, body, and within them, tags and attributes. Although it is often referred to as a programming language, HTML cannot truly be classified as one because it lacks essential features of programming languages, such as logic. HTML only provides output and, therefore, is more accurately described as the foundation or structure of a website. The actual programming is handled by languages like JavaScript, PHP, and others (Shiddiq, n.d.).

Website is a collection of information or pages that can be accessed via the internet. Anyone, anywhere, and at anytime can use it as long as they are connected online to the internet. Technically, a website is a collection of pages that are grouped under a spesific domain or subdomain. The websites are located within the World Wide Web (WWW) of the internet (Aulia Riski et al., 2022).

MySQL is a SQL-based database management system (DBMS) that is multithreaded and multi-user. MySQL is a relational database management system (RDBMS) distributed under the GPL (General Public License), allowing anyone to use it freely. MySQL is a system useful for managing collections of structured data (databases), including the processes of creating and managing databases (Aulia Riski et al., 2022).

Hypertext Preprocessor PHP is considered a relatively simple programming language for executing commands. It can be integrated with HTML, making it easier to develop web-based applications. PHP can also be used to create and update databases. Developed under the General Public License (GNU), PHP was initially created by Andi Gutmans to track the number of visitors to his website (Tumbal & Effendi, 2019).

Visual Studio Code is a lightweight yet powerful source code editor that runs on the desktop. It can be used for various programming languages such as JavaScript, HTML, CSS, PHP, Python, C++, and many more. Visual Studio Code works on various operating systems, including Windows, macOS, and Linux. Additionally, Visual Studio Code offers the Live Share feature, which allows multiple developers to work on the same project simultaneously from different locations (Puspita, 2023).

Bootstrap is an intuitive and powerful front-end framework for faster and easier web application development. Bootstrap uses HTML, CSS, and JavaScript. The Bootstrap framework provides a range of features to help software developers create applications that are compatible with various mobile devices. Some of the key features of the Bootstrap framework include web browser compatibility, support for responsive web design, flexible CSS, and ready-to-use JavaScript components (Nanda Syarif et al., 2023).

CodeIgniter is an open-source framework for PHP designed to simplify and accelerate web application development. CodeIgniter is known for its excellent, comprehensive, and easy-to-

understand documentation, making it a developer-friendly framework, especially for those new to PHP frameworks or web development. The CodeIgniter framework follows the Model-View-Controller (MVC) architecture pattern (Gabriel et al., 2023).

UML (Unified Modeling Language) is a visual language for modeling and communicating about a system using diagrams and supporting texts. Some of the models included in UML are use case diagrams, class diagrams, activity diagrams, sequence diagrams, and others (Siagian et al., 2023).

Development System Method carried out in this study uses the Rapid Application Development (RAD) method. The RAD method is a model developed from the System Development Life Cycle (SDLC). RAD can be defined as a system development method with a prototyping approach, designed to produce high-quality systems in a relatively short time and at a lower cost (Sikumbang et al., 2020).

RESEARCH METHOD

Research Stages, To assist in the preparation of this research and application development, clear stages are necessary. These stages represent steps taken in accordance with the application's development process. The researcher proposes the following steps:

1. Initial Needs Identification, This stage is the initial phase conducted in this research to develop the CBT application. It involves direct meetings between the researcher and prospective users of the application. This stage aims to identify the specific needs that will be utilized by the actors or users of the CBT application.
2. System Design, This stage also involves interaction between the researcher and system actors (users) to determine the design of the system to be developed. The system design includes user interface design, database design, and application logic design. Once the system is designed, an initial application prototype is quickly developed to provide an early overview of how the application will function and to undergo initial testing.
3. Application Development Process, In this stage, the researcher develops the CBT (Computer Based Test) application based on the feedback provided by each actor (user) of the application. The development is carried out to improve the application according to the design and feature inputs from each actor (user) of the CBT application, ensuring that the design and features meet the needs of the actors (users). Components and functions are coded, tested, and integrated to create a suitable and complete application.
4. Implementation, Once the application is considered to meet the needs of the actors (users), training is conducted to help users adapt to the developed system. After the implementation stage is completed, the CBT (Computer Based Test) application can be fully operational and maintained according to the needs.

Data Collection, In this study, the author uses several data collection methods as follows:

1. Literature Review, It is a technique used to gather more information related to the theoretical needs and practical data of users regarding the application development requirements from various references such as journals, e-books, articles, theses, and educational videos.
2. Interview, This activity is conducted directly with the parties (users) who will later use the application or system, in order to identify the needs that will be implemented into the application to ensure it aligns with the goals of the application to be developed.
3. Observation, This activity involves direct observation conducted to collect data on the implementation process and the use of the CBT application at the location where the application is being used.

System Design Planning

Use Case Diagram, The Use Case Diagram for the Computer Based Test system in this study can be seen in the following image :

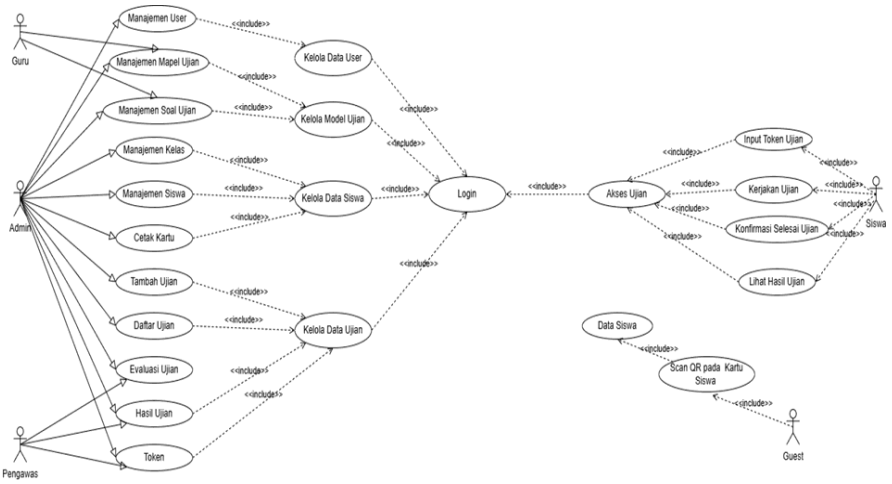

Figure 1. Use Case Diagram

RESULTS AND DISCUSSION

Results, The result of this research aims to develop a web-based Computer Based Test (CBT) application at SMA Negeri 21 Medan. This CBT application is developed using several supporting software such as XAMPP, HTML (HyperText Markup Language), MySQL, PHP (Hypertext Preprocessor), Visual Studio Code, Bootstrap Framework, and CodeIgniter Framework.

The development of this application is expected to assist teachers and students at SMA Negeri 21 Medan in conducting exams more effectively and efficiently. The CBT application is designed and built as a web-based platform and uses the Blackbox testing method for system evaluation.

Discussions, The following is a discussion of the implementation related to the pages of the CBT (Computer Based Test) application that has been developed. The implementation is as follows:

1. Operator Login Interface

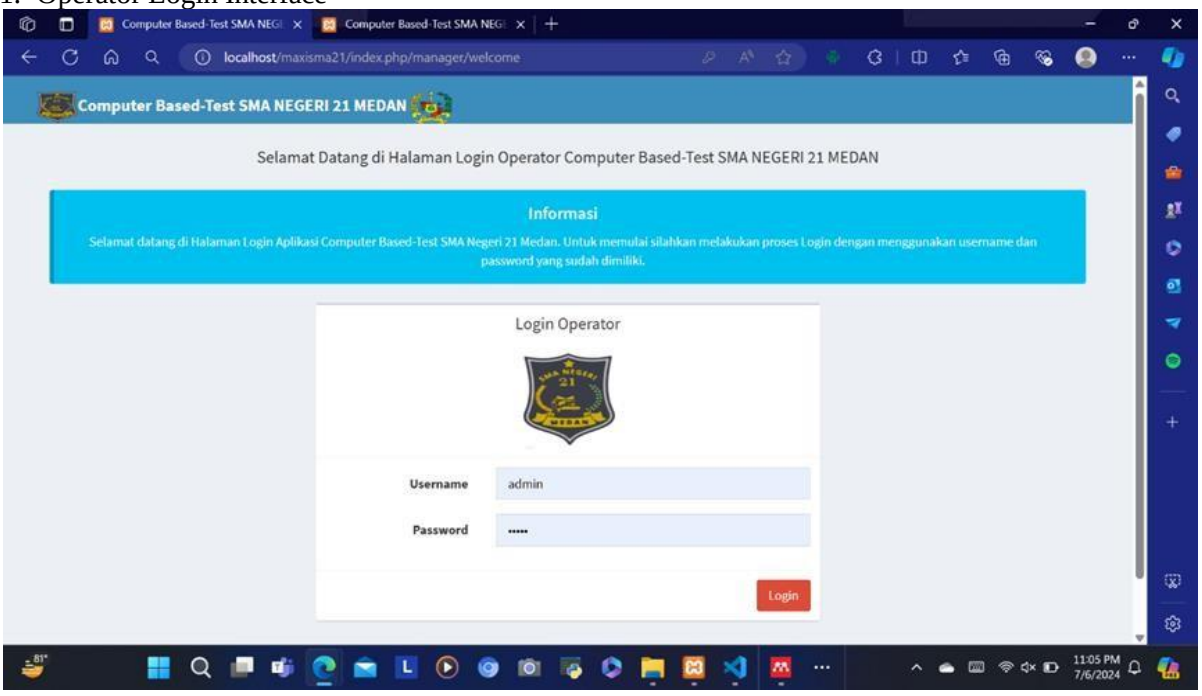

Figure 2. Tampilan Halaman Login Operator

The operator login interface is the initial page for operators (Admin, Teachers, and Supervisors) to log in by entering their registered username and password. Once logged in, they can access various menus, each tailored to the specific tasks and roles associated with their account.

2. Admin Dashboard Interface

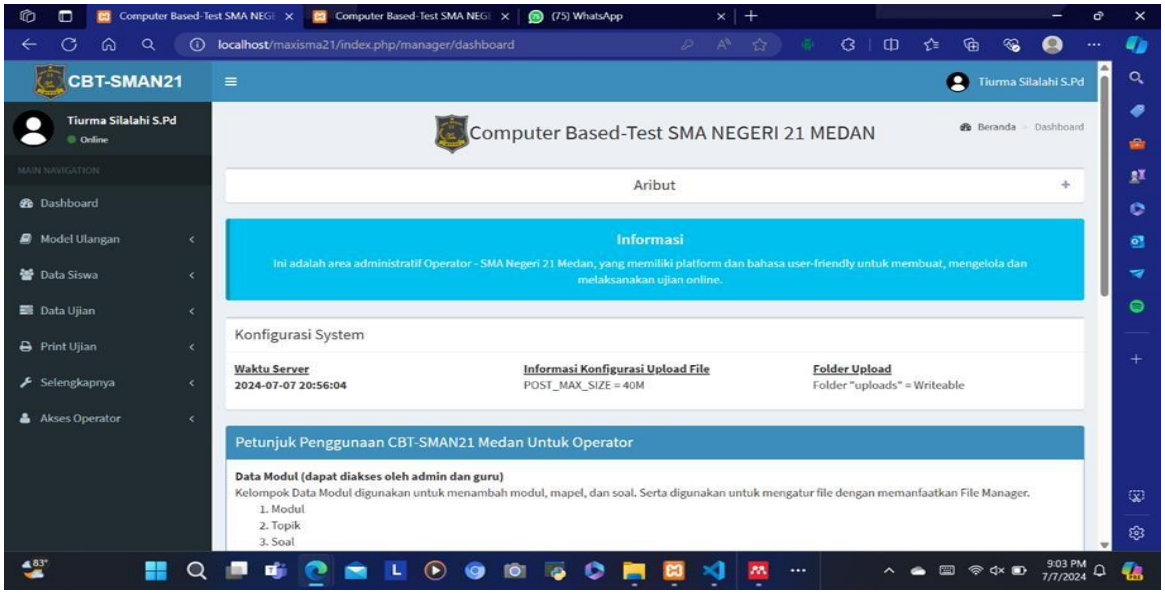

Figure 3. Tampilan Dashboard Admin

The admin dashboard interface is the initial view for the admin after logging into the CBT (Computer Based Test) application. This dashboard displays information about the access rights of each operator (admin, teacher, and supervisor) as well as several menus that the admin can access to manage the CBT application.

3. The Model Exam Menu Page Interface

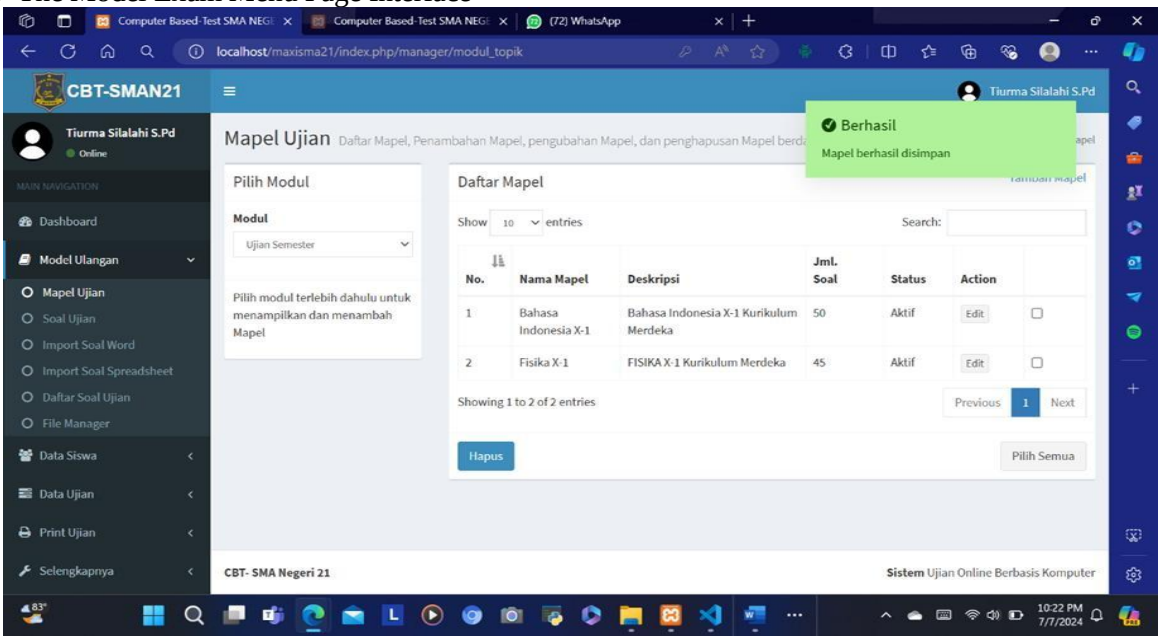

Figure 4. Tampilan Menu Mapel Ujian

The Exam Subjects interface is a sub-menu within the model exam menu, where the admin can input, edit, and delete subject data available at SMA Negeri 21 Medan.

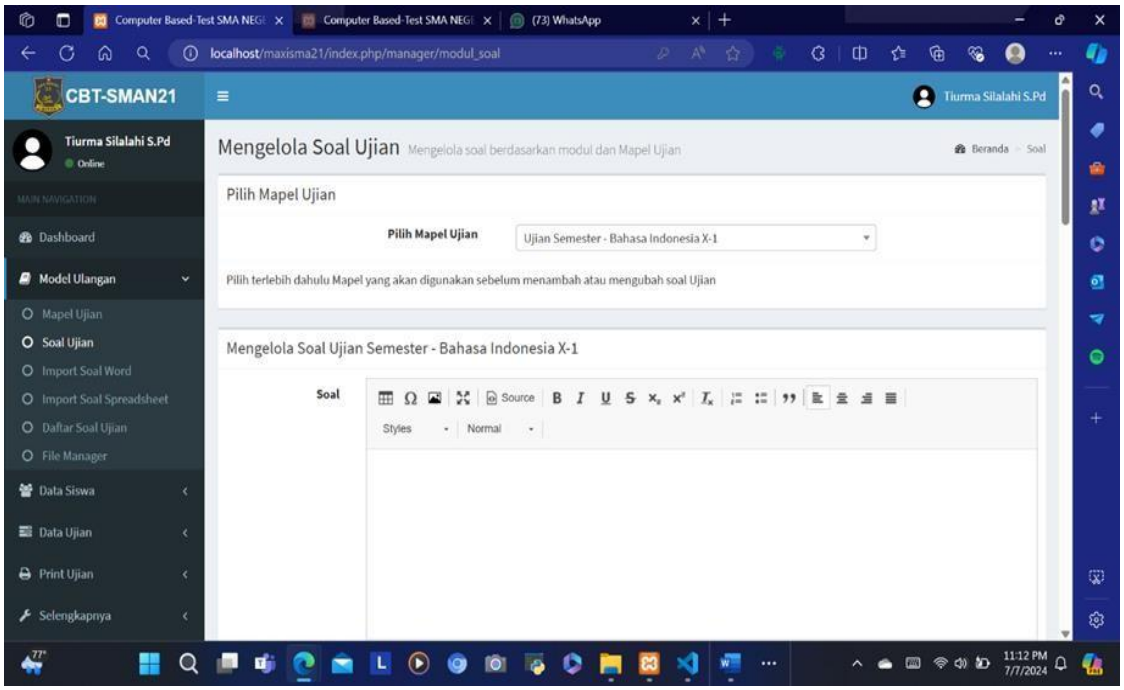

Figure 5. Tampilan Menu Soal Ujian

The Exam Questions menu is also a sub-menu within the model exam menu. This menu allows the admin to input, edit, and delete exam question data based on the subjects that have already been entered.

4. Student Data Menu Page Interface

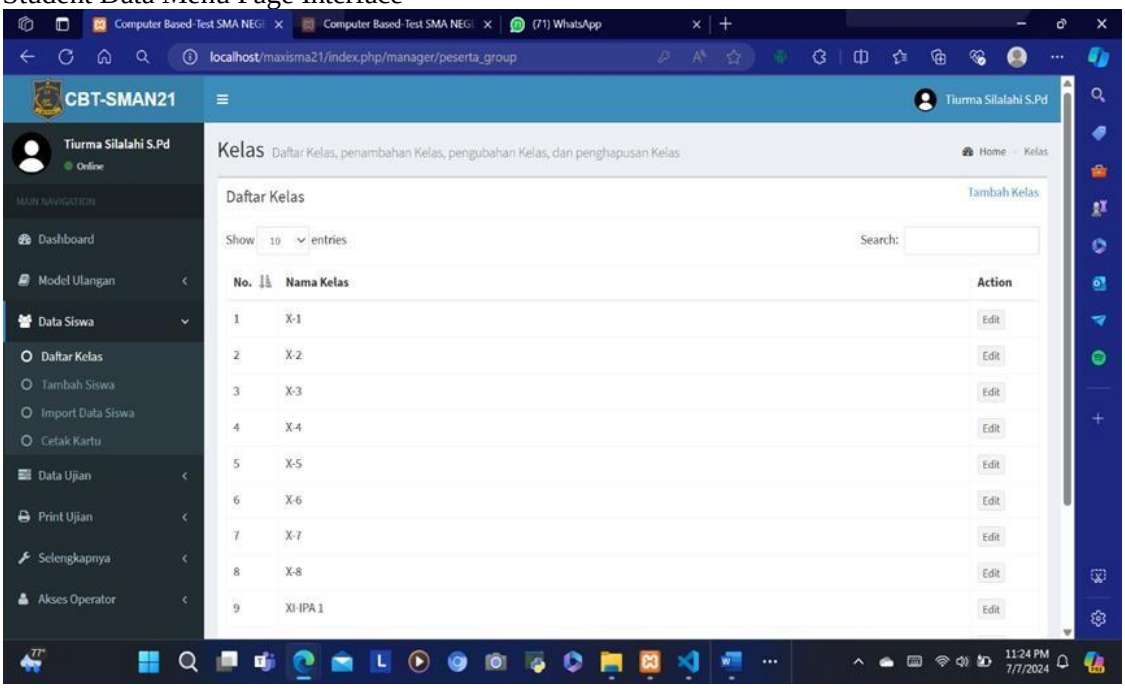

Figure 6. Tampilan Menu Daftar Kelas

The Class List menu is a sub-menu within the Student Data page, where this menu allows the admin to input, edit, and delete class list data for SMA Negeri 21 Medan.

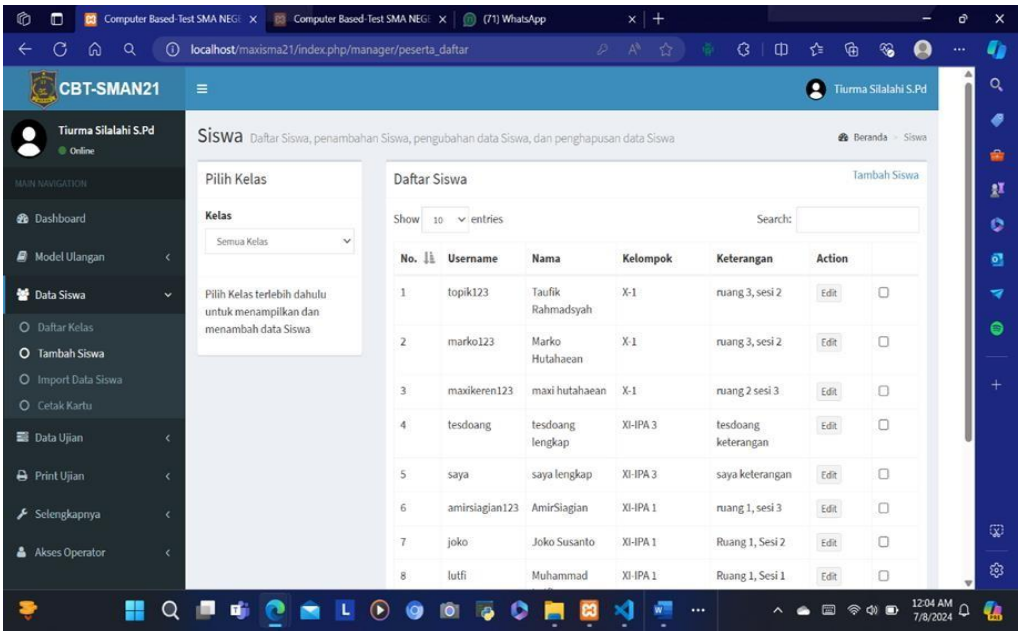

Figure 7. Tampilan Menu Tambah Siswa

The Add Student menu is also a sub-menu within the Student Data page. This menu is used to input, edit, and delete student data for SMA Negeri 21 Medan.

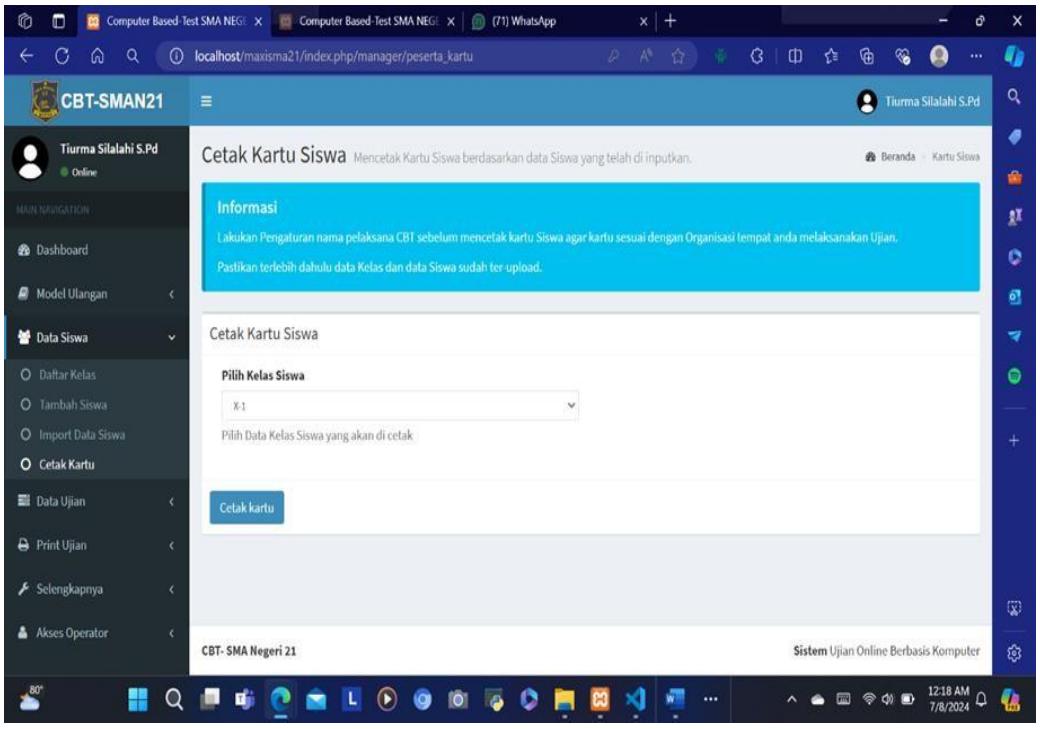

Figure 8. Tampilan Menu Cetak Kartu

The Print Card menu is a sub-menu within the Student Data page. This menu is used to view and print the student exam card data that has been previously entered.

5. Exam Data Menu Page Interface

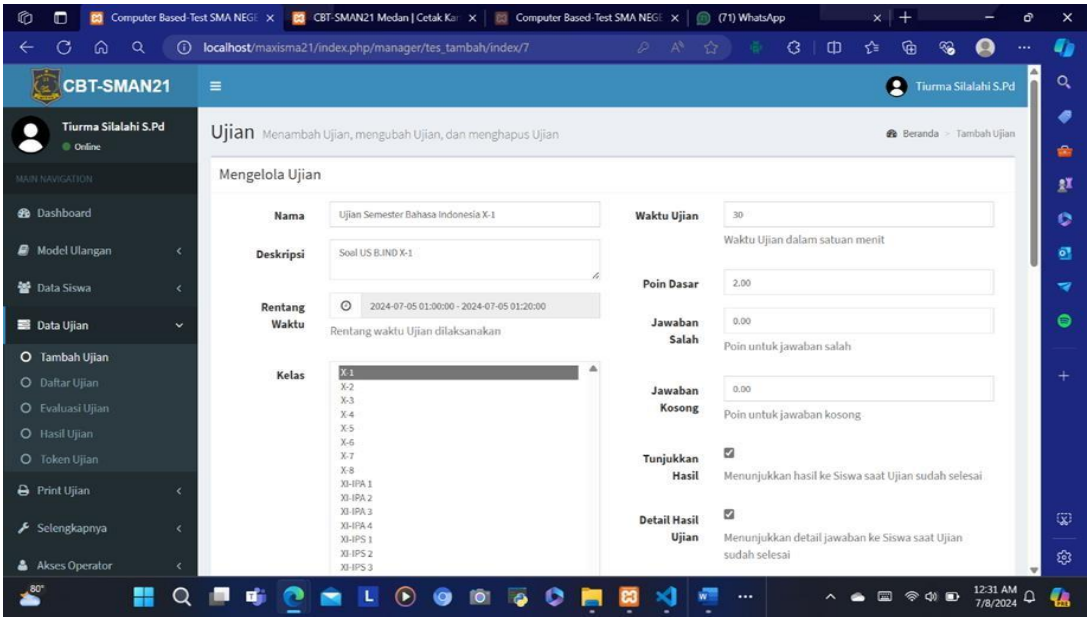

Figure 9. Tampilan Menu Tambah Ujian

The Add Exam menu is a sub-menu within the Exam Data section. This menu is used to create new exam data, allowing the configuration of the exam's implementation as needed.

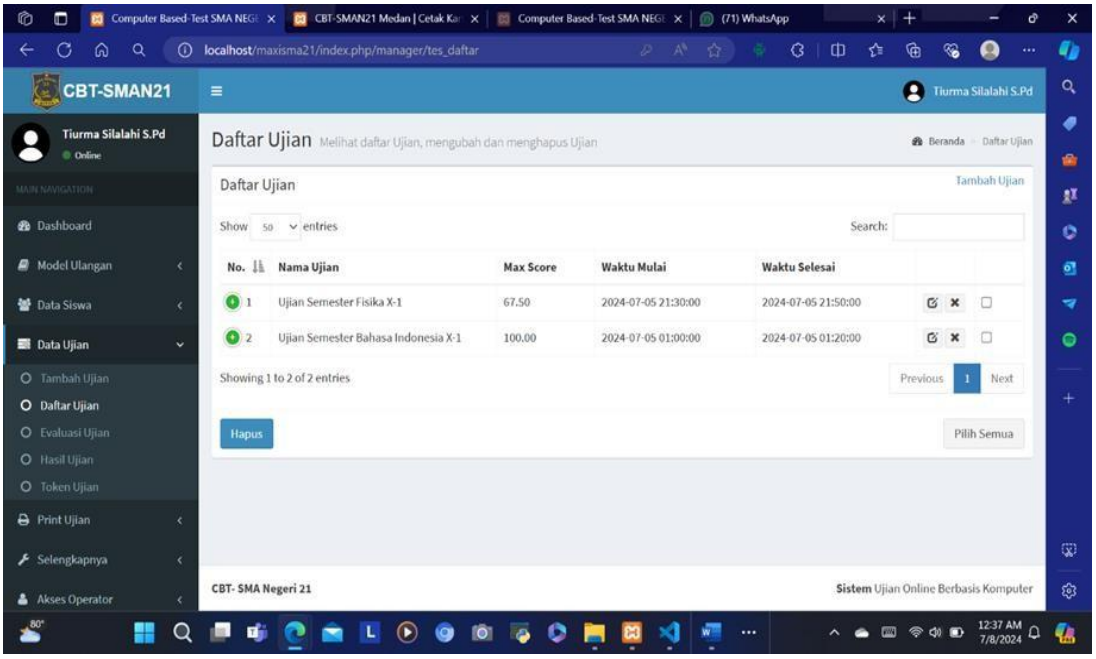

Figure 10. Tampilan Menu Daftar Ujian

The Exam List menu is also a sub-menu within the Exam Data page. This menu is used to add, edit, and delete exam data that has been created or is to be created.

6. User Settings Menu Interface

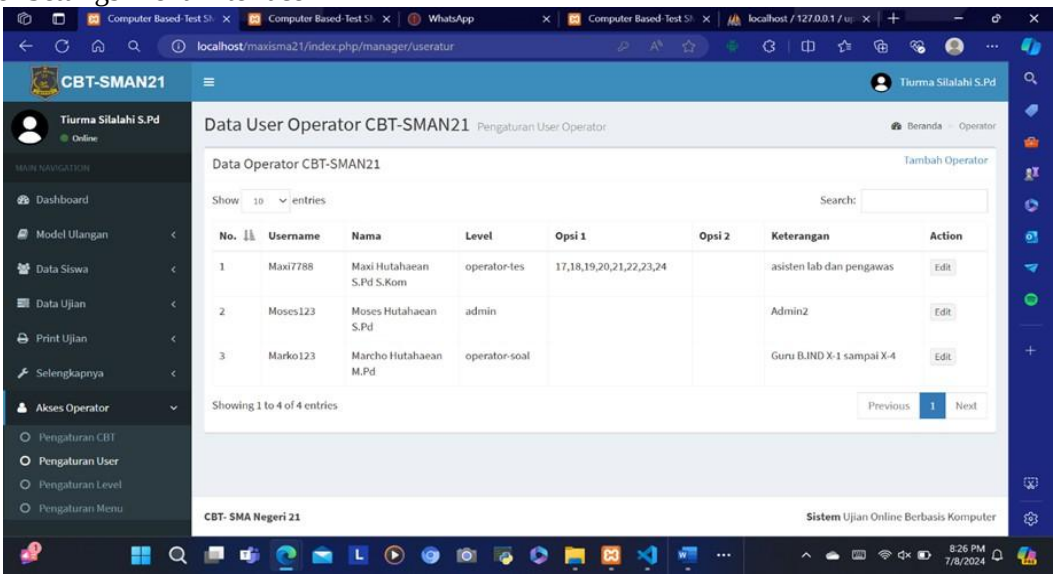

Figure 11. Tampilan Menu Pengaturan User

The User Settings menu is used to input user (operator) data into the CBT (Computer Based Test) application, which includes admin, teachers, and supervisors at SMA Negeri 21 Medan.

In the design of this Computer Based Test application, RAD (Rapid Application Development) and Black Box testing were used. The results of system implementation and testing involved the user interface display, the features available in the application, and the performance evaluation of the application. After the implementation and testing phase, feedback was collected from the users of the CBT (Computer Based Test) application.

Black Box testing is an approach used to test whether each function within the application operates correctly, although it is possible that some bugs may still occur or the system may not be 100% bug-free. The following processes were carried out during this testing phase:

1. Testing the functions of each feature to ensure they operate correctly, including both input and output. If any function does not work as expected, it will be identified and addressed
2. Identifying interface errors that may affect the user's experience with the application. These issues could include design flaws, navigation problems, or unclear elements that hinder usability
3. Identifying errors in data structure or database access. This includes issues such as incorrect data retrieval, data corruption, or failure to properly connect to the database, which may affect the functionality of the application

CONCLUSION

Conclusion, Based on the results of the research and testing that have been conducted and discussed, the following conclusions can be drawn. The CBT (Computer Based Test) application developed can assist teachers in managing online exams, from managing and inputting questions to viewing schedules and checking exam results in real-time. Students do not need to wait long for the grading process, as the results can be printed and viewed in real-time by both students and teachers. The questions displayed can be configured in various types, including multiple choice, essay, and a combination of both types. The application includes an automated timer feature for the exam. Once the preset exam time expires, the exam will automatically stop, and the results can be immediately viewed. The developed application has a QR code generation feature that contains the profile data of the students taking the exam. This feature helps supervisors and visitors easily verify the profile data of the exam participants.

Suggestion, Based on the results of the research on the web-based Computer Based Test (CBT) application at SMA Negeri 21 Medan, the following suggestions or recommendations are provided. It is hoped that in the next CBT update, the application can be developed into a mobile-based platform. It

is expected that in future research, this application can be developed with new features, such as a Real-Time Exam Monitoring feature. It is hoped that in future research, other methods such as Extreme Programming (XP), Prototype Model, Feature-Driven Development (FDD), and other methodologies will be used.

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