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APPLICATION DEVELOPMENT WEBSITE-BASED ELECTRONIC VOTING (E-VOTING) USING THE RAPID APPLICATION DEVELOPMENT (RAD) METHOD IN THE ELECTION OF THE OSIS CHAIRMAN AT SMPN 191 JAKARTA

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ABSTRACT.
Voting is one way to elect leaders democratically. Indonesia is a country where leaders are chosen through general elections. Therefore, the most fundamental place to teach democracy is in schools. Every year, the election of the OSIS (Intra-School Student Organization) president at SMPN 191 Jakarta is conducted through a majority vote system. So far, the election has been conducted conventionally, using paper ballots by punching holes, writing names, or marking pictures of candidates. This traditional voting process has several drawbacks, including vote manipulation by adding extra ballots, potential damage to ballots making them unreadable, being environmentally unfriendly due to excessive paper usage, and inefficiency in manual vote counting. To address these issues, a web-based electronic voting (e-voting) system application is needed. In this research, the application development method used is Rapid Application Development (RAD), while data collection was conducted through observation, interviews, and literature studies. The e-voting application was developed using the PHP programming language and MySQL as the database server. The user interface (UI) was tested using the System Usability Scale (SUS) and achieved a score of 78, categorized as acceptable. The expected outcome of this research is a system capable of conducting OSIS president elections quickly, accurately, reliably, cost-effectively, and in an environmentally friendly manner.

Keywords: e-voting, OSIS president election, web

1. Introduction.

Voting is an important process in a democracy. It allows citizens to choose their leaders and representatives who will work for the people. In some countries voting is done manually, which is very inefficient in terms of time and cost [1]. One important factor in determining the success or failure of elections is democracy education. High political awareness enables people to participate in elections. Therefore, democracy education must be fostered from an early age, where the voting age is at least 17 years old. Data states that first-time voters vote in sizable numbers during general elections in Indonesia [2].

One way to help young voters understand democracy and elections is at school. The organization formed to help students is the existence of an intra-school student organization (OSIS), in this organization an organizational structure is formed where the highest person is the OSIS coach, then the chairman and deputy, and finally the members. The preparation of the organizational structure that will lead the student council is by conducting general elections that will be elected by all students in the school. This indirectly teaches all

students about democracy and how the election process is carried out. Student Council also plays an important role in carrying out school activities and completing programs that have been planned in the future.

At the junior high school (SMP) level, democracy learning has begun with the formation of an organization called OSIS (Intra-School Student Organization). This student council annually conducts elections for the student council chairman, this aims for students to be able to vote and learn to understand the basic concepts of democracy. Therefore, it will greatly impact the formation of students' understanding and attitude of participation towards the principles of democracy from an early age. With the advancement of technology now, it is required in all fields to keep up with the times. SMPN 191 Jakarta in its election process still relies on a manual system. This will cause problems including errors in the voting process, which can cause ballots to be invalid and reduce the validity of the election results, large costs and time consuming, large use of paper used to print ballots and campaign posters in all classes, and finally the slow process of delivering candidate information and vote results in the election. Therefore, it is necessary to consider updating the election system to make it more efficient and in line with the demands of the times. In addition, the manual election process does not provide a transparent and accountable system for electing student council leaders [3].

Web-based e-voting will be one of the answers to solve the problems when using a manual system. E-voting is an election system that uses electronic technology, such as computers and the internet, to facilitate the election process [4]. The advantages of e-voting include faster vote counting and a more efficient election process [5]. E-voting can increase transparency and reduce errors through the use of audit trails, and e-voting is considered more accurate. This is one of the main advantages of e-voting compared to manual voting [6]. An audit trail is digital documentation that records every transaction or activity that occurs in the system and database [7]. This function is critical to maintaining voting accuracy, enabling verification, as well as ensuring every vote is counted correctly, thus increasing voter confidence in the election process.

A number of studies have been conducted on e-voting systems, including Pratama & Pertiwi[8] designing an e-voting application for high school student council chairman to replace the manual system. This application allows students to vote even if they are unable to attend, increases participation, and provides faster and more accurate results. Other studies use animations and graphics that make it interesting and also vote counting is done in real time. In addition, the system can send confirmation emails to voters who have voted [9]. There are still gaps in previous research, especially in the delivery of information about student council chair candidates to help students understand their vision, mission, and work program. Most research on e-voting focuses more on technical aspects, such as security and ease of use of the system. Therefore, the purpose of this research is to develop an electronic voting system that can be accessed via the internet for the election of student council chairman at SMPN 191 Jakarta. The expected result of this research is an electronic voting system that is secure, transparent, and accountable, and can provide a more efficient and effective way to elect student council leaders [1].

2. **Methodology.**

This research was conducted at SMPN 191 Jakarta, this school is a public junior high school whose address is at Jl. Duta Raya No. 2, West Jakarta City. Currently, SMP Negeri 191 Jakarta implements the 2013 SMP learning curriculum guide.

2.1 Data Collection

In the implementation of the research, data collection was carried out including:

a. Literature study, which is conducting learning through data and previous research related to the research that is owned, can be through books, journals and scientific articles [10].
b. Observation, Data collection through observation at SMPN 191 Jakarta was carried out by making a direct visit to the school location to directly observe the atmosphere and activities in the environment.
c. Interviews, This process involves meeting directly with the interviewees, which in this case includes the student council supervising teacher and the student council chairperson of SMPN 191 Jakarta. Prior to conducting the interviews, questions were carefully prepared to ensure relevance to the research objectives. This approach is expected to provide rich and in-depth data in support of the research analysis.

2.2 Problem Analysis

The problem analysis uses a fishbone diagram, to systematically identify and categorize the various possible causes of a problem. This diagram makes it easier to understand the process that occurs by dividing it into several categories, such as workflow, individual roles, material aspects, machine performance, operational procedures, and policy implementation [11].

Analysis of the fishbone diagram problem in this study, namely the selection results are not accurate, then there are major categories that are the main causes, including human factors, methods, materials, machines, environment, and management. With this approach, researchers can systematically identify the root of the problem and formulate effective solutions.

2.3 Software Development Methods

Rapid Application Development (RAD) is the software development method used. RAD is a software development process model that focuses on a rapidly adapted version of the Waterfall method and a short development life cycle, especially for short lead times [12]. Here are the steps:

1. Requirements planning, where the needs and functionality of the application are identified and evaluated. At this stage the researcher collects everything obtained from the interview starting from the complaints and desires of prospective users on the application to be made.
2. User design, by creating a prototype of the app. A mockup is created first by determining the buttons, colors, and typography. All work is done using figma software.
3. Construction, where application coding is done in accordance with the design that has been made. This stage involves the implementation of concepts and ideas that have been designed previously.
4. Cutover, involves testing and implementing the created system into a production environment. In this stage, the reliability and performance of the system is tested to ensure that the application can function optimally in the actual environment.

2.4 System Usability Scale

A very trustworthy method for assessing the usability of a product is the System Usability Scale (SUS). Ten questions make up this tool, and each question offers respondents five possible answers. Respondents can indicate how much they agree or

disagree with various aspects of the usability of the product under review by using these answer choices, which range from "strongly agree" to "strongly disagree." John Brooke created this tool originally in 1986, and it has since grown in popularity and recognition. SUS allows developers and researchers to assess a wide variety of goods and services, including software, websites, and web applications, as well as hardware, such as PCs and cell phones. SUS is a top choice due to its flexible options [13]. The following is the SUS question table which contains 10 questions [14].

TABLE 1. System Usability Scale Questions

No	*Question*
1.	*I think that I would like to use this product frequently.*
2.	*I found the product unnecessarily complex.*
3.	*I thought the product was easy to use.*
4.	*I think that I would need the support of a technical person to be able to use this product.*
5.	*I found the various functions in the product were well integrated.*
6.	*I thought there was too much inconsistency in this product.*
7.	*I imagine that most people would learn to use this product very quickly.*
8.	*I found the product very awkward to use.*
9.	*I felt very confident using the product.*
10.	*I needed to learn a lot of things before I could get going with this product.*

In filling out the questionnaire, respondents will fill it in by choosing a scale of 1-5, where 1 for "strongly disagree", 2 for "disagree", 3 for "undecided", 4 for "agree", and 5 for "strongly agree".

3 Results and Discussion.

Based on the results of interviews that have been conducted, on related parties at SMPN 191 Jakarta, problems have been obtained in the process of selecting the student council chairman manually which is time consuming and costly and inefficient. These problems will be used as the basis for proposals for designing information systems in the form of a Web-based Student Council Chair Election E-voting Application at SMPN 191 Jakarta. After knowing this, UML design is then carried out, to assist in the design and understanding of the construction and operation of the system [15]. For example, by designing actor interactions with the system, namely by designing use case diagrams provided in figure 1. Use case diagram explanation, as follows:

1. View candidate information: Students can use this system to view the vision & mission, work program and self-introduction video.
2. Voting: Students can use this system to vote for their preferred candidate.
3. Viewing provisional voting results: Students can use this system to view the provisional voting results.
4. Adding voters: Admins can use this system to add new voters.
5. Adding candidate: Admins can use this system to add a new candidate.
6. Adding candidate information: Admins can use this system to add new candidate information.
7. Adding class: Admins can use this system to add new classes.
8. Viewing voting results: Admins can use this system to view the final voting

results.

9. Printing voting results: Admin can use this system to print the final voting result as an image (PNG).

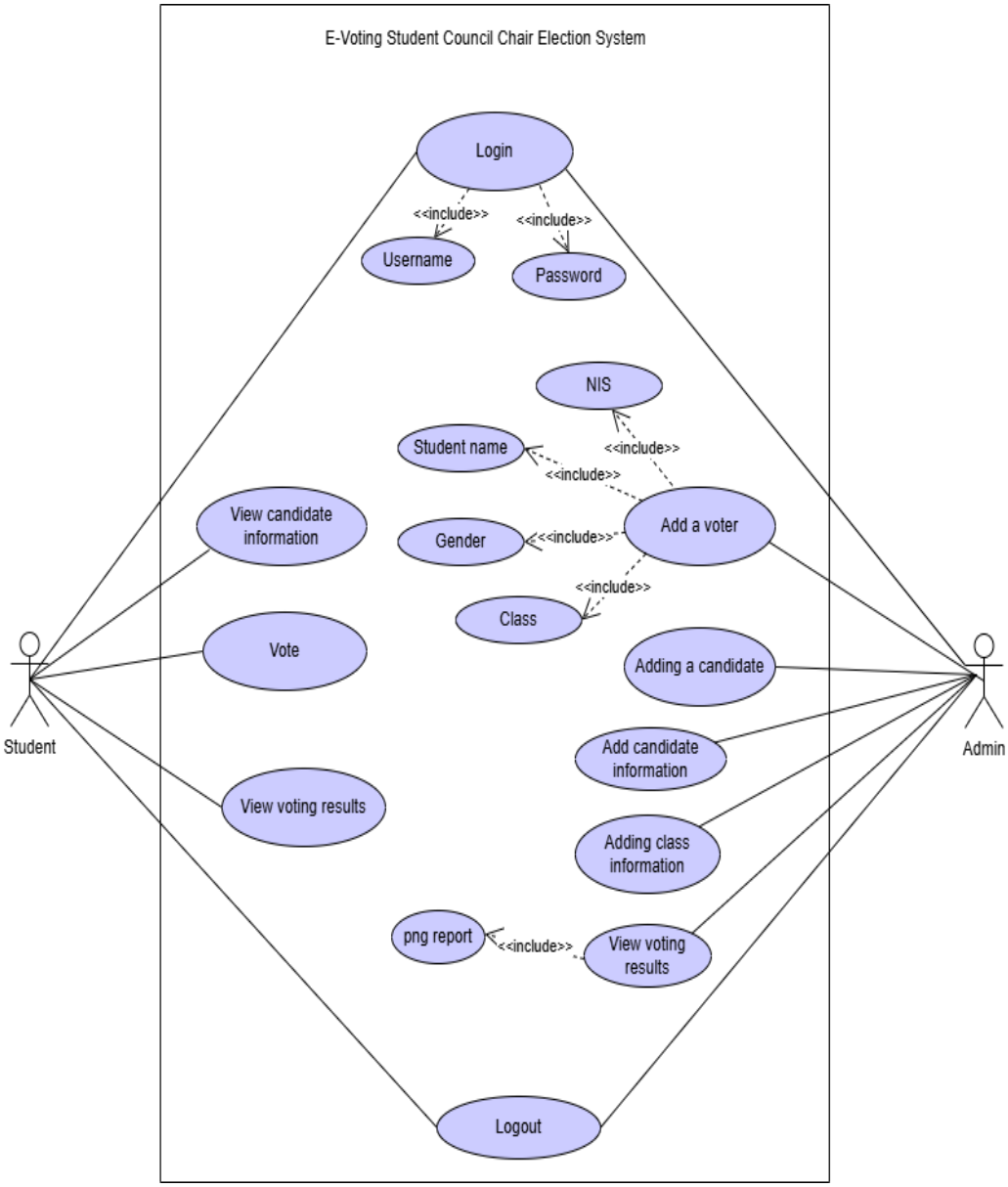

Figure 1. Use Case Diagram

The existence of the previous diagram design can make it easier to design the user interface, the entire design is made using figma. The following is the appearance of the student council chair election e-voting application.

Figure 2. Login page

The login page, students will fill in the NIS and password that has been given by the admin before.

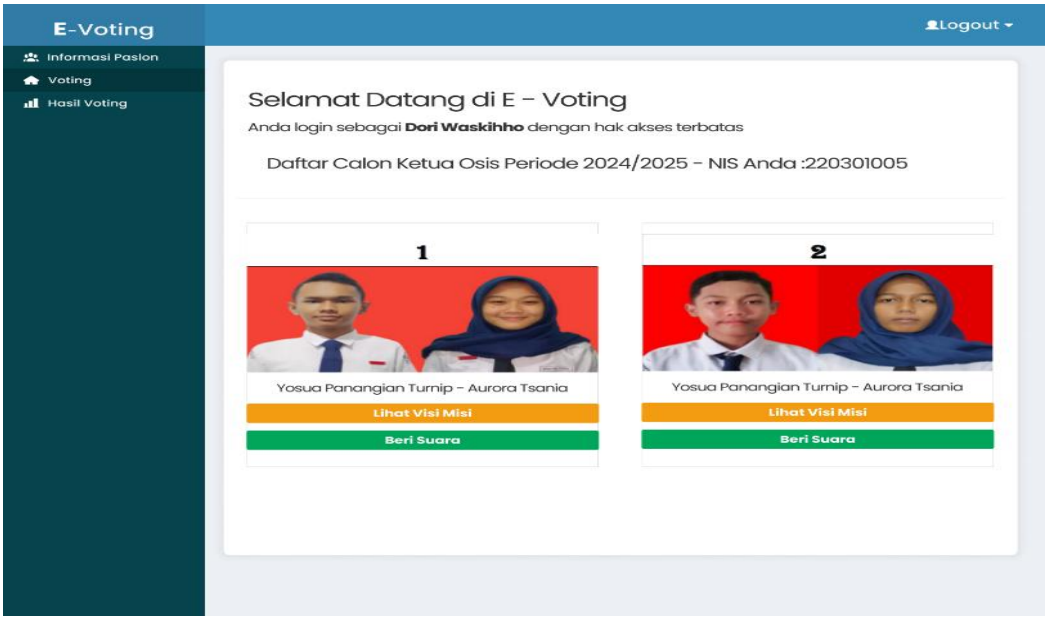

Figure 3. Voting Menu Page

This page will display an image of the list of candidates to be selected. There are two buttons on each candidate, namely the “View vision-mission” and “Vote” buttons. Students who are sure they will vote can immediately press the green “Vote” button.

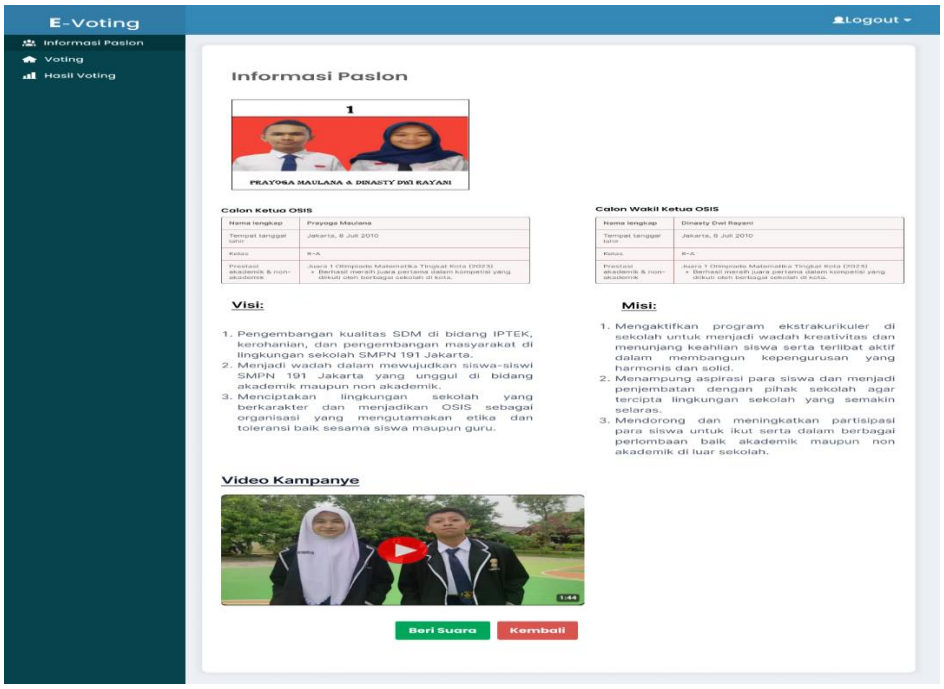

Figure 4. Candidate Information Menu Page

This menu page will display a list of each candidate to see more information on each candidate.

The user interface design that has been designed is then tested, using the system usability scale (SUS) method.

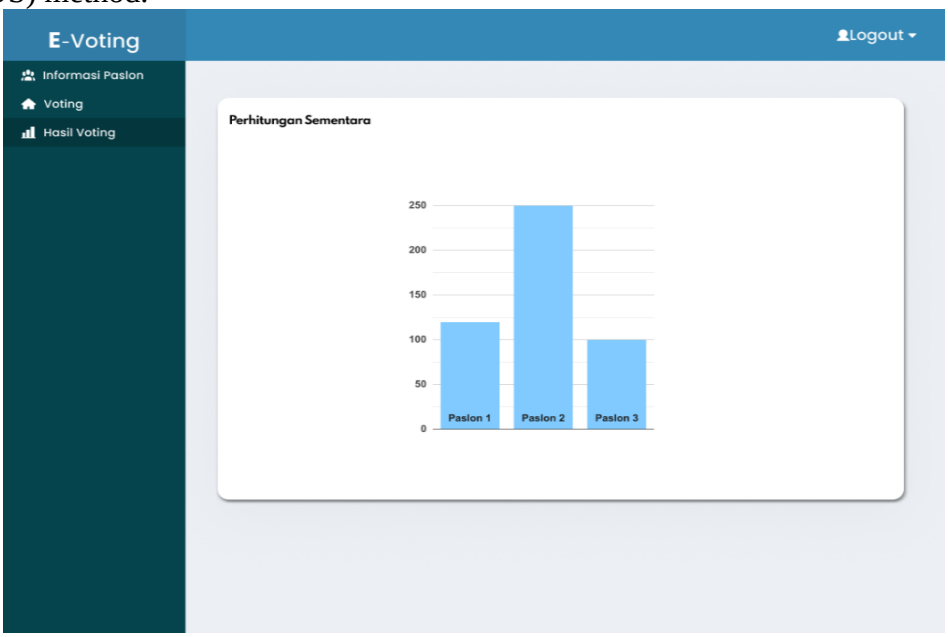

Figure 5.Voting Result Menu Page

On the voting results menu, after students have cast their votes, they can then see the graph of the results of each candidate.

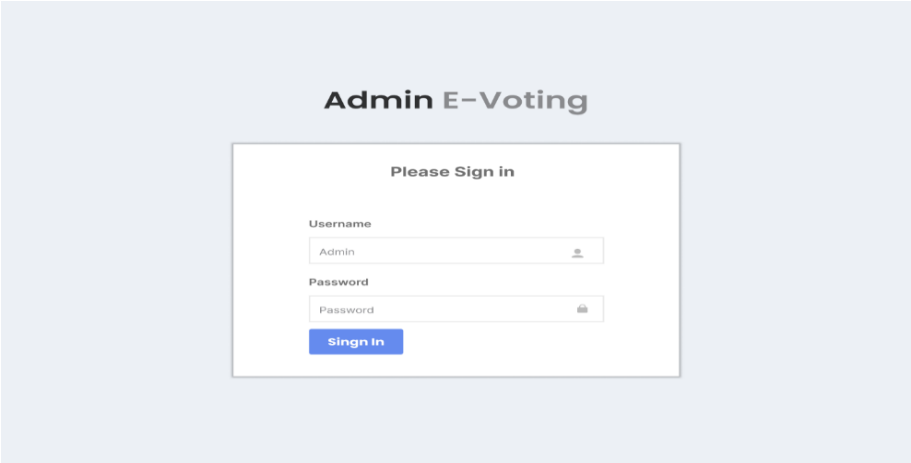

Figure 6. Admin Sign In Form

On the form the admin will fill in the username and password to be able to enter the next page.

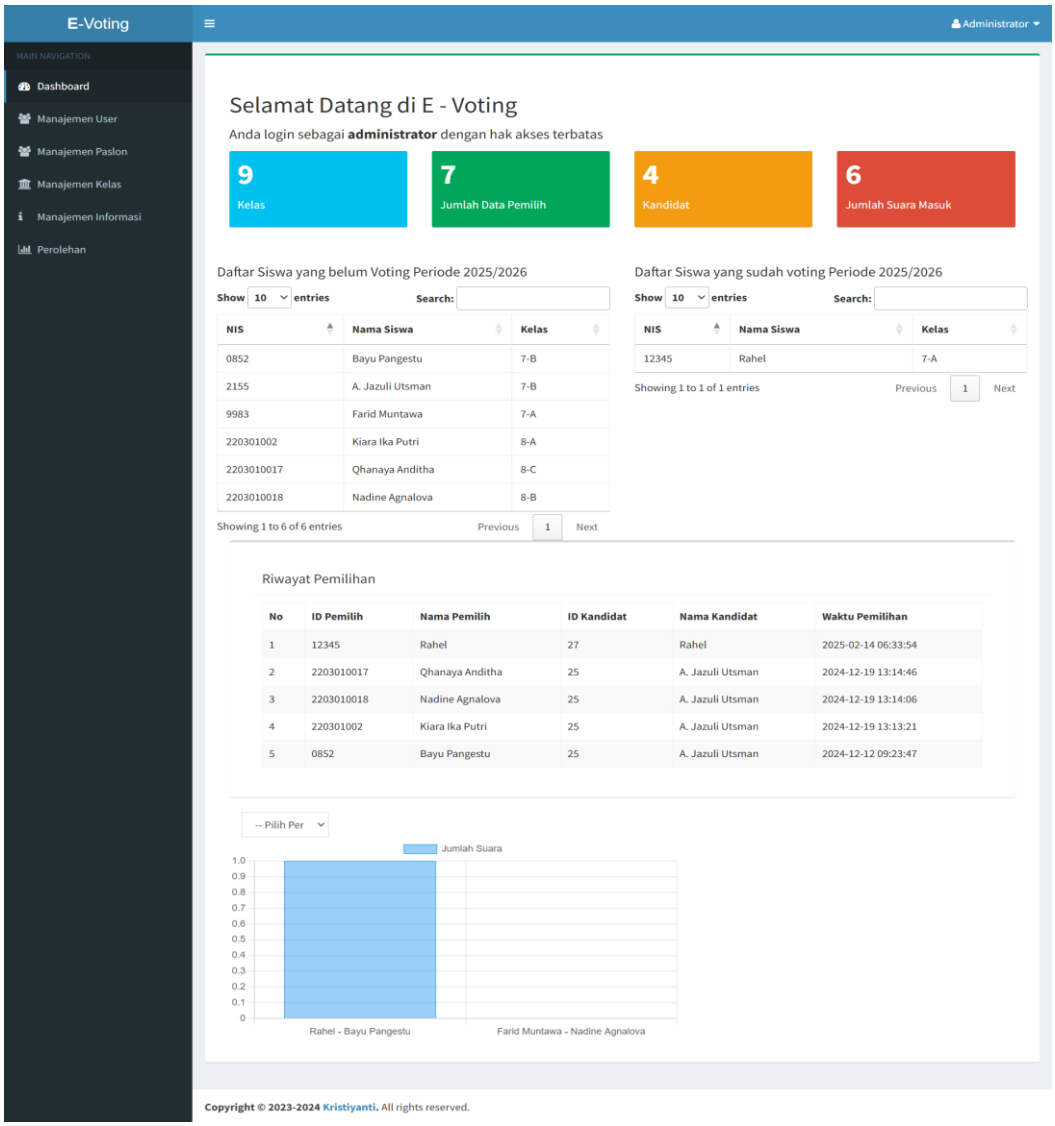

Figure 7. Dashboard menu

The dashboard page, where there is info on the number of classes, voters, candidates, incoming votes, then there is a table listing students who have not and have voted, and the last is the voting graph.

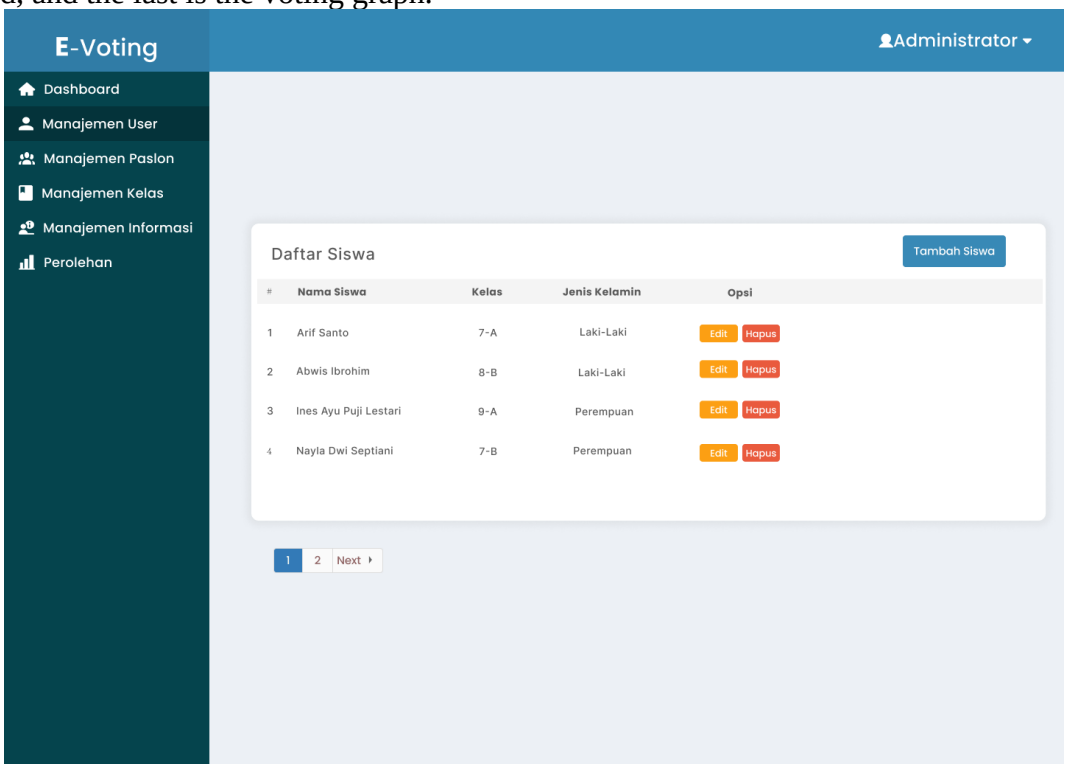

Figure 8. User Management Menu

On this page the admin will add students who can vote. This page also has actions that can be performed by the admin, namely editing student data and deleting from the list of students to vote.

After designing the user interface, testing is carried out using the system usability scale (SUS) method, to get direct feedback from users which will help in improving the design.

TABLE 2. System Usability Scale Answers

Respondent	*Q1*	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*	*Q9*	*Q10*	*Total*
R1	*5*	*2*	*5*	*1*	*4*	*3*	*4*	*2*	*5*	*2*	*82.5*
R2	*4*	*2*	*5*	*3*	*4*	*2*	*4*	*2*	*4*	*2*	*75*
R3	*4*	*2*	*5*	*3*	*4*	*2*	*4*	*2*	*4*	*2*	*75*
R4	*5*	*2*	*4*	*2*	*4*	*2*	*4*	*2*	*4*	*2*	*77.5*
R5	*4*	*2*	*4*	*2*	*4*	*2*	*4*	*2*	*4*	*2*	*75*
R6	*4*	*2*	*4*	*2*	*5*	*3*	*3*	*2*	*4*	*2*	*72.5*
R7	*4*	*2*	*5*	*2*	*4*	*3*	*3*	*2*	*4*	*2*	*72.5*
R8	*4*	*2*	*4*	*2*	*5*	*2*	*3*	*2*	*4*	*2*	*75*
R9	*5*	*1*	*5*	*3*	*4*	*2*	*5*	*1*	*4*	*2*	*85*
R10	*5*	*2*	*4*	*2*	*4*	*2*	*5*	*2*	*4*	*2*	*80*
R11	*5*	*2*	*4*	*2*	*4*	*3*	*4*	*3*	*3*	*1*	*72.5*
R12	*3*	*2*	*4*	*2*	*5*	*2*	*4*	*2*	*3*	*2*	*72.5*
R13	*4*	*2*	*4*	*2*	*4*	*3*	*4*	*2*	*4*	*2*	*72.5*

Respondent	*Q1*	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*	*Q9*	*Q10*	*Total*
R14	*5*	*2*	*4*	*4*	*4*	*2*	*4*	*1*	*5*	*2*	*77.5*
R15	*4*	*2*	*4*	*2*	*4*	*2*	*4*	*2*	*4*	*1*	*77.5*
R16	*4*	*2*	*5*	*2*	*5*	*2*	*5*	*2*	*5*	*2*	*85*
R17	*5*	*2*	*4*	*2*	*4*	*2*	*3*	*2*	*5*	*2*	*77.5*
R18	*5*	*1*	*5*	*2*	*5*	*1*	*5*	*1*	*5*	*3*	*92.5*
R19	*4*	*1*	*5*	*4*	*5*	*1*	*4*	*1*	*5*	*3*	*82.5*
R20	*5*	*2*	*4*	*2*	*5*	*1*	*4*	*2*	*4*	*3*	*80*
Average score											*78*

Calculations on each question contained in the questionnaire that has been filled in by respondents. The first calculation is to calculate the score on odd questions using the formula x-1, where x is the value or scale given by the respondent, and 1 is the minimum score on the SUS scale. The second calculation is to calculate the score on even questions using the formula 5-x, where x is the value of the respondent and 5 is the maximum score on the SUS scale. This calculation is carried out on a number of respondents, in this case there are 20 respondents. After calculating the score, then add up all the scores on each respondent from questions 1-10, then multiply by 2.5. After that, the results of the multiplication from all respondents are divided by the number of respondents, namely 20. The end of this calculation results in a SUS value of 78 as stated in the table above.

On the SUS score, the value of 78 in the adjective ratings group gets “Good”, while on the grade scale it is included in the “C” rating, and in the acceptability ranges it gets “acceptable”. The recommended score to be considered acceptable is at least 70. So it can be said that the prototype that has been made is acceptable has been used by prospective users easily and in accordance with existing expectations.

4 Conclusions.

The results of research and application development show that, compared to conventional methods, a web-based electronic voting (e-voting) application was successfully designed and built. This application allows the election of student council chairman of SMPN 191 Jakarta to be easier. The results of user interface testing using the system usability scale (SUS) method are acceptable with a score of 78. The application can speed up the vote counting process, which used to take days and now only takes a few minutes.

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