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DESIGNING OF E-VOTING APPLICATION FOR MOSQUE YOUTH LEADER ELECTION (CASE STUDY IN MASJID AL-ISHLAHIYAH GAMPONG LAMBHUK)

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Abstrak: Kegiatan pengabdian ini bertujuan untuk merancang sistem informasi pemilihan ketua remaja masjid di Gampong Lambhuk Banda Aceh. Perancangan dan pembuatan sistem ini mengimplementasikan model *software development life cycle* (SDLC). Model ini merupakan model pengembangan sistem yang paling sederhana. Salah satu model SDLC yang paling banyak diterapkan dan dapat dipahami dengan mudah adalah model waterfall. Metode pengembangan sistem ini mampu menyusun sistem dari bagian-bagian kecil. Model ini diawali dengan analisis kebutuhan dari sistem yang akan dirancang, desain sistem dan software, penerapan dan pengujian, serta evaluasi dan perbaikan sistem. Hasil testing melalui black-box test adalah tidak ditemukan adanya eror ketika aplikasi berbasis web ini dijalankan dan aplikasi ini berjalan dengan lancar. Pemungutan suara menggunakan e-voting ini dapat membantu menjangkau semua pemilih dan pemilih bisa menyampaikan suaranya tanpa harus hadir ke lokasi pemilihan. Implementasi sistem informasi pemilihan (e-voting) Remaja Mesjid ini juga dapat membantu pelaksanaan kegiatan pemilihan ketua remaja masjid berjalan efisien, cepat dan transparan.

Kata kunci: e-voting, sistem informasi, Metode SSDLC (System Development Life Cycle), waterfall

Abstract: This study aims to design an information system to elect mosque youth leaders in Gampong Lambhuk Banda Aceh. The design and manufacture of this system implement the software development life cycle (SDLC) model. This model is the most straightforward system development model. The waterfall model is one of the most widely applied SDLC models and can be easily understood. This system development method can compile a system from small parts. This model begins with analyzing the system's needs, system and software design, implementation and testing, and system evaluation and improvement. The results of testing through black-box tests are that no errors are found when this web-based application is run, and this application runs smoothly. Voting using e-voting can help reach all voters, and voters can cast their votes without having to be present at the election location. Implementing e-voting can also help elect the mosque's youth chairperson. Furthermore, these activities run efficiently, quickly, and transparently.

Keywords: e-voting, information system, System Development Life Cycle, waterfall

Introduction

As one region that enforces Islamic law, Aceh has many mosques that can be used as worship facilities. The mosque is not only used as a place of worship by the community but also for various religious activities such as recitation, a place for people to learn and listen to religious lectures, commemorate the birth of prophets, a children's place to learn the basics of Islam, conducting weddings, a gathering place for the community to conduct deliberations or exchange opinions if there are problems that occur among them (Al-Ghazali, 2018; Purwaningrum, 2021). In this case, the mosque has a vital role in community empowerment by delivering Islamic religious lectures, which can improve the quality and spiritual experience of the community

(Qadaruddin, Nurkidam, & Firman, 2016).

Because of its vital role, the mosque must be maintained routinely for comfort, security, and purity of the mosque. The community maintains and preserves mosque activities (Ridwanullah & Herdiana, 2018). In this case, it is necessary to form a management or responsible organization such as the mosque management, which consists of groups of young men and women who live in the villages around the mosque (Aslati, Silawati, Sehani, & Nuryanti, 2018).

The election of the head of the mosque youth is a routine program for the mosque management. The current non-digital election system needs to improve in cost and time efficiency. Therefore, adopting digital technology by creating a system is necessary to overcome these problems. Moreover, technological developments have encouraged various parties to use applications to solve various problems (Husna, Setiawan, Fonna, & Sanusi, 2023). For instance, many websites can be accessed now via the Internet (Husna, Iqbal, Noviandi, & Ayu Safitri, 2021; Susanto, Husna, & Murniati, 2021). The problem of electing the head of the mosque youth can be resolved by building a web-based information system.

The utilization of information technology in conducting digital voting is called e-voting (Ikhwani, 2018; Priyono & Dihan, 2010). The most crucial aspect of implementing e-voting is using computerized voting tools to collect votes in elections (Bachmid & Djanggih, 2022). This digital voting system can record, store, and process voting data, and its confidentiality and security are well maintained (Bahar & Wahid, 2020). It can solve geographical problems in election procedures. So that all people involved in the election can participate (Sujadmiko, Panggar, Sofyansah, & Meutia, 2020).

Generally, the design of online election applications has begun to be implemented in several places. For example, the system built for the election of youth leaders of youth organizations has shown increased youth participation in these voting activities. The application for the election of the student council chairman was also carried out (Farhan & Wahyuni, 2020) to make it easier for students to elect the student council chairman without disrupting students' learning schedules. Furthermore, software was built by Santoso for the election of the Chairperson of the Student Executive Board (BEM) to provide convenience for students in participating in election activities (Santoso, 2022). The purpose of its implementation is almost the same as this activity, which is to overcome the problems in the service environment by applying information technology. So that all participants can vote anywhere and election activities can take place quickly and transparently. However, precisely no study has been done on the election of the leader of the mosque youth even though the online platform is urgently implemented as the latest innovation in solving the problem of mosque youth elections.

This application uses the waterfall model, a software development life cycle (SDLC) model that can create a system with small parts (Hanif, Martanto, & Adianto, 2021). It is the most straightforward system development model. Software development life cycle (SDLC) is a method for designing, building, and managing information. All stages in the software development life cycle (SDLC) framework are applied one by one linearly. Each step considers each process to be carried out precisely based on the previous stage (Samadi, 2019). This SDLC model has

many variations, and the waterfall model is the most widely applied and easy to understand (Alshamrani & Bahattab, 2015).

The creation of the Al-Ishlahiyah mosque youth election e-voting application in Gampong Lambhuk has been adjusted to the requirements of the mosque management. As a society that is accustomed to using information technology, public awareness in protecting the environment, plus the activities of young people who are very dynamic in the area, it is necessary to design an application that aims to facilitate election activities, minimize the paper expenditure budget that has been done manually, minimize the time and productivity efficiency of mosque youth, and reduce the results of error ballots. The implementation of e-voting is expected to accommodate various variants of interests by first considering how the rules and regulations of who is elected and who has the right to vote are agreed upon as a kind of game rule (Karmanis, 2021). It is flexible for voters without arranging a particular time to come to the place of the election (Zaen & Putra, 2018). Vote recapitulation is done honestly and transparently and can be accessed by the public (Zazili, 2016).

Method

This service was implemented at the Al-Ishlahiyah Mosque, Gampong Lambhuk Banda Aceh, with a Participatory Action Research (PAR) approach. It combines sustainable research and action (Pamuji & Rindanah, 2022). It is also very appropriate to be applied to service activities to solve problems in service areas (Hermanto, Subarkah, Dzakkiyah, & Wilujeng, 2023). Several stages are carried out: preparation, implementation, and evaluation of activities. Initial observations and problem identification were carried out in the preparation stage at the service area. Furthermore, the implementation stage is done by testing and using the e-voting application. The final stage is an evaluation of the testing and simulation of the application.

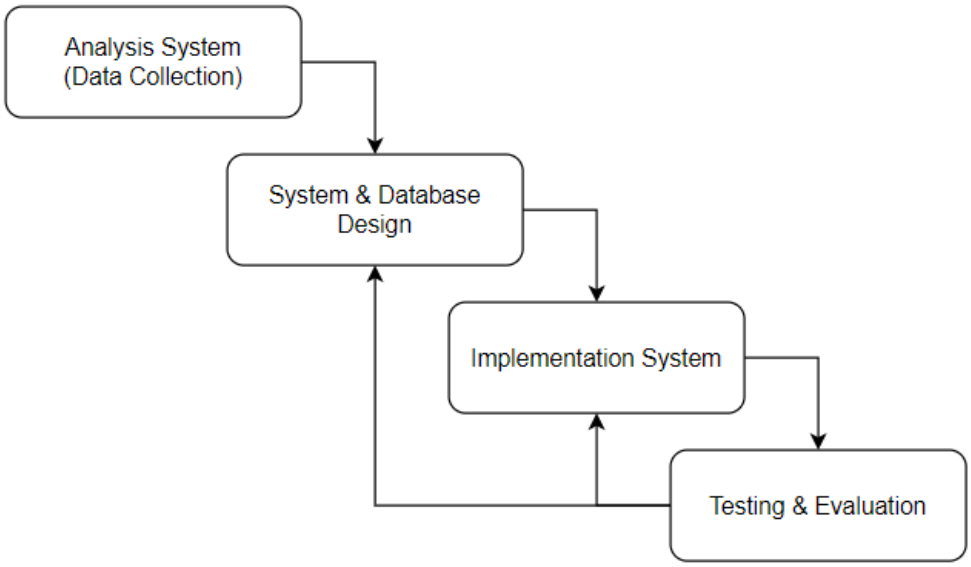

Figure 1. The steps of designing software with the Iterative Waterfall models

The e-voting application was designed using the iterative waterfall method, with a case

study approach at the Al-Ishlahiyah Mosque in Gampong Lambhuk. This method is beneficial when the system needs to be updated; the implementation becomes more accessible, which can be done at the initial stage of iteration (Ipan & Oktarina, 2023). Moreover, this model is appropriate for team system development (Samadi, 2019). This software development methodology consists of the stages of needs analysis and system design, followed by software development in the form of coding using programming languages, testing, and final evaluation. The method emphasizes sequential and systematic phases, but the stages will be repeated if errors or deficiencies are found during the evaluation step. Figure 1 is an illustration of the stages of making applications using the iterative waterfall method (Aroral, 2021; Herawati, Negara, Febriansyah, & Fatah, 2021; Trivedi & Sharma, 2014).

In this case, more details will be explained about the system requirements analysis, design process, and software implementation. Furthermore, testing and evaluation will be further described in the results and discussion section.

Analysis System

This section analyses the things needed to design and implement the software. The analysis is carried out in several stages focused on analyzing the current system, designing system requirements, and gathering the initial data needed. Data is collected directly by interviewing the Al-Ishlahiyah mosque youth management as required data needs before design. Documentation from the needs analysis stage is needed to determine the functionality implemented in the proposed e-voting system design based on user needs. Table 1 is data on system requirements in the form of responsibilities and authorities of software users.

Table 1. System user access rights and features

User	System user access rights and features
Admin (Mosque Management)	1) User data management (members and voters). 2) Management of candidates' profile data for the Mosque Youth chairman. 3) Printing reports on the election results of candidates for chairman of the Mosque Youth. 4) View statistics on election results. 5) Show and use other users' features (mosque youth members and the outside community).
Mosque Youth Member	1) Identity data management. 2) View the profile (vision-mission) of the candidate for chairman of the Youth Mosque 3) Vote during the election. 4) View statistics on the election results of candidates' election for the Mosque Youth chairman 5) View all features that external users can access
Outside society	1) View the Al-Ishlahiyah Mosque profile. 2) View the Al-Ishlahiyah Mosque activity schedule. 3) Register for certain activities if authorized

System Design

The design and design stage of the e-voting software for the election of the head of the Al-Ishlahiyah mosque youth consists of several parts, namely:

1) Making context and data flow diagrams to provide a general description of the system in the form of workings and data flow between entities outside the system. The context diagram of the e-voting for the election of the chairman of the Al-Ishlahiyah Mosque youth group is shown in Figure 2.

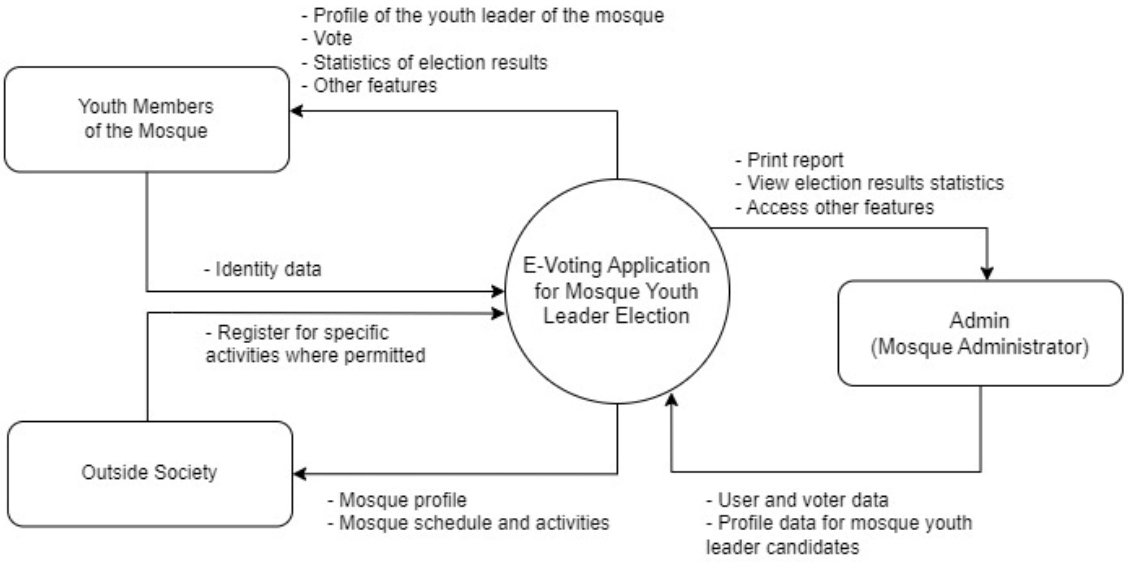

Figure 2. Flow model of e-voting application

The mosque management doubles as the voting committee. Based on the agreement of the teenagers in the mosque, they are appointed as the admin of the e-voting application. The admin has the authority to manage user data, consisting of member and voter data. While user members and the wider community have limited access to the system, this is intended for security and restrictions so that the system can be maintained from irresponsible parties.

2) The database is designed to be a data storage place consisting of tables and relationships between tables. This database appears after knowing the data flow in the DFD. Furthermore, data relations are described using the Entity Relationship Diagram (ERD) concept. The ERD modelling of the e-voting system design is shown in Figure 3.
3) UI/UX design is required to integrate user needs, aesthetic aspects, and functionality. The optimal UI/UX design for this e-voting application prioritizes readability and responsiveness. This case involves creating an intuitive interface with straightforward navigation and a simple layout to ensure a smooth user experience. The clarity in the application's appearance, a font size that is easy to read, and adequate color contrast ensure accessibility for various user groups. In addition, the e-voting application is designed to be responsive on various devices with a display that makes it easy for users to understand the voting

process. By focusing on a user experience that is easy to understand, this application can give users the confidence to use it as an efficient and accurate voting tool.

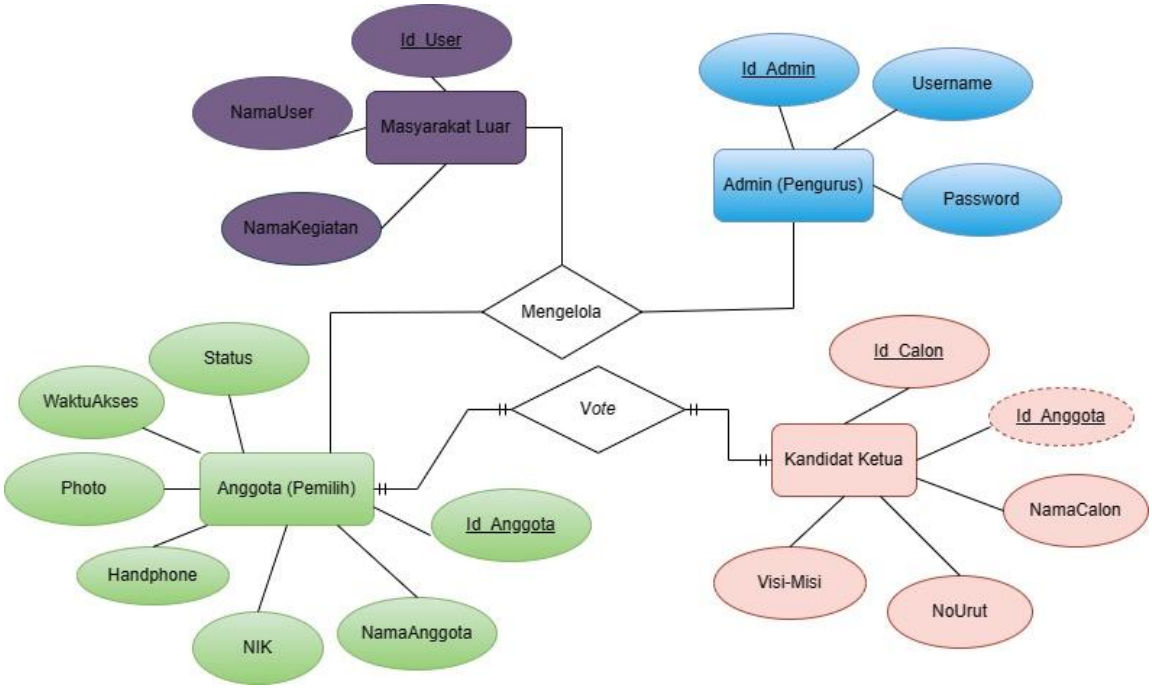

Figure 3. The entity-relationship flow of the e-voting system

System Implementation

This application uses PHP and MySql programming languages to produce a web-based e-voting system. The creation of the application is based on system requirements, data flows, and relationships in DFD and ERD, as well as UI/UX design that is translated into menus and sub-menus. A crucial feature is voter data management (DPT), which displays and stores member and community data. The voting menu is the core of this application, which makes it easy for voters to vote. After casting a vote, the user can see the provisional results in graphical form and continuously monitor the vote collection data. In this case, the calculation of vote results becomes very fast compared to the results of the conventional election system.

The e-voting system is designed to run on various platforms managed through a web server on web hosting. Creating a responsive user interface allows access to the application from various devices, such as laptops, tablets, and smartphones. In addition, post-implementation system deployment and maintenance strategies are essential to the consideration. Thus, the system runs smoothly and can be effectively managed and upgraded over time, preventing problems from arising when technological changes occur.

Security and Risk Management Mechanism

In securing data in the Al-Ishlahiyah mosque youth e-voting system, several information security mechanisms and risk management have been considered. Holistic risk management, identification, evaluation, and mitigation of risks that may occur during implementation are integral to maintaining information security. Regarding authority, some parts can impact maintaining information security, namely proper coding during application development and the protection provided by web hosting when the application is running on the server.

In terms of making applications, choosing the correct programming language and framework can minimize the emergence of security gaps. The Codeigneiter framework is one framework that has excellent modules and prevention mechanisms. The next step is using data encryption in the database to protect sensitive information while saving data. In addition, careful access management for users and administrators has become an important focus.

In addition to these mechanisms, continuous monitoring and regular system updates are crucial to maintaining application security. Choosing the right web hosting and integrating the latest security technologies on the server side can help improve security, maintain data integrity, and protect the system from the growing threat of cyberattacks. Strict network protection, such as firewalls and intrusion detection systems, controls traffic in and out of the server and detects suspicious activity. Data encryption on servers, such as HTTPS, can protect data as it is transferred and stored. In addition, regular software updates, such as upgrading to the latest version of the web server, can reduce or even close security holes that may exist. Strict access management with solid authentication and regular backup services for data recovery are expected to maintain data security in a web hosting environment.

Results and Discussion

The final result is a web-based mosque youth election e-voting application with several main features. These features can be accessed through website pages such as the login page, which directs users to enter the voting system. It can be accessed by men and women who have previously registered using the ID Card number. The user can only vote through the home page after validating data by admin. Then, the user will be directed to the vote page, as shown in Figure 4. The candidate's profile is displayed on the voting page, consisting of a photo, serial number, term of office, vision mission, and the "Vote" button. Before voting, users can see the candidate's vision and mission.

Users can vote only once by clicking the "vote" button under the candidate's photo, as displayed in Figure 5. If a user who has already voted tries to reaccess the voting page, a notification will be displayed, "You Have Voted," and the user cannot vote again. Furthermore, users have access to a page that displays statistics on voting results, both in the form of numbers and graphs.

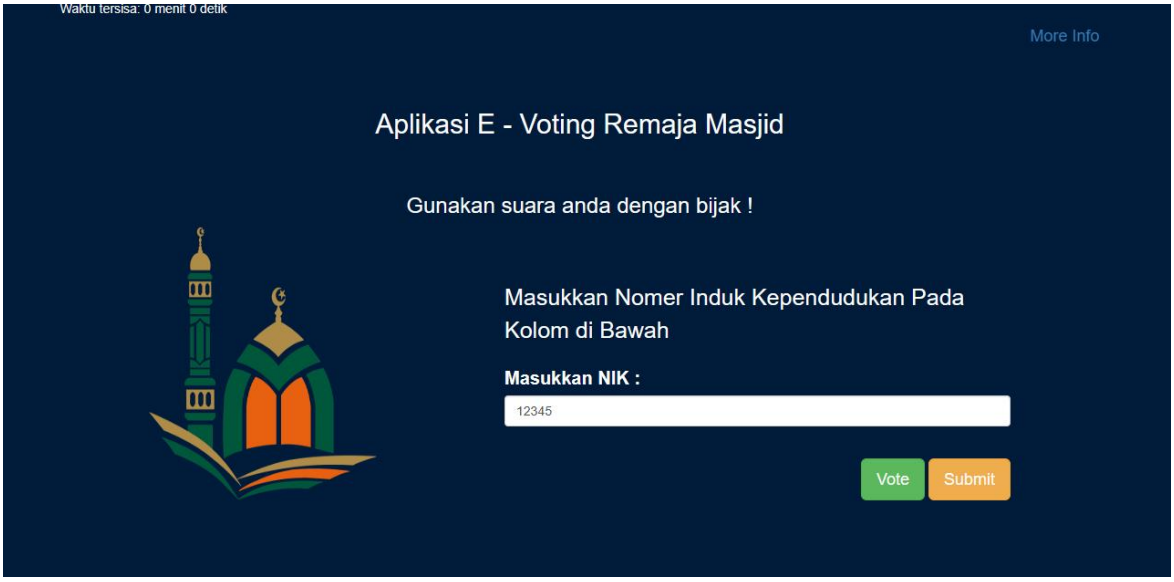

Figure 4. User's home page

Figure 5. Implementation of vote menu

Users who have voted will be detected and can no longer vote again. It became a provision made by the organizing committee. Through this page, users can continue to monitor voting progress in real-time. Figure 6 is a display of voting results in the form of graphs and numbers. The main admin page has a DPT admin feature to input and edit data and save it into the DPT. It is shown in Figure 7.

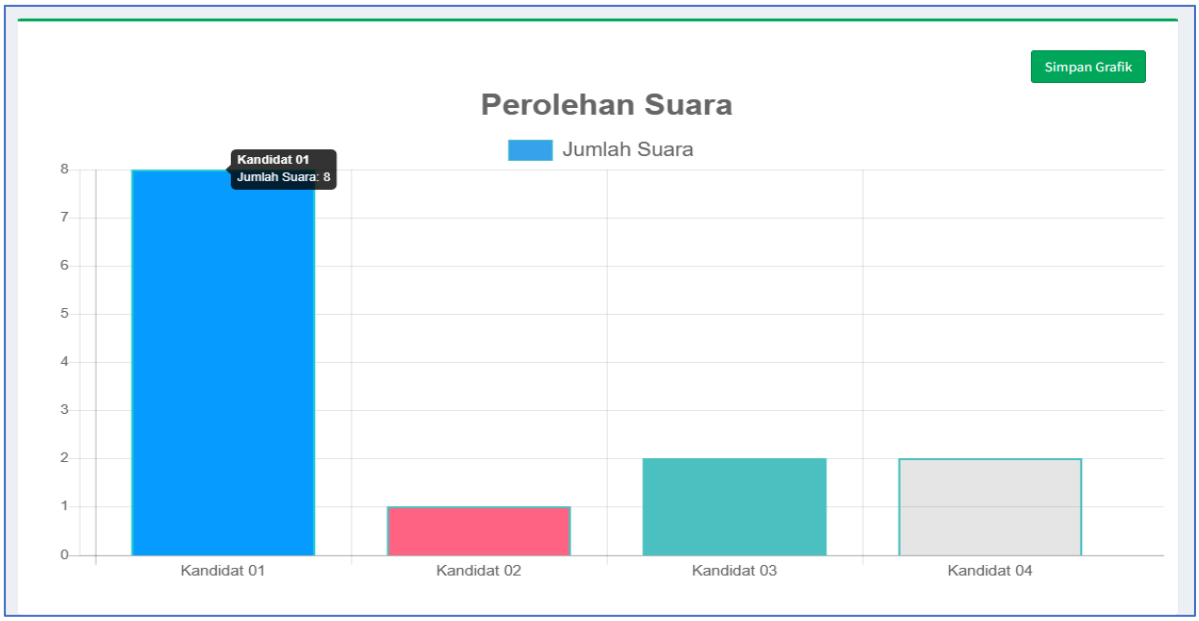

Figure 6. Statistical graph of voting results

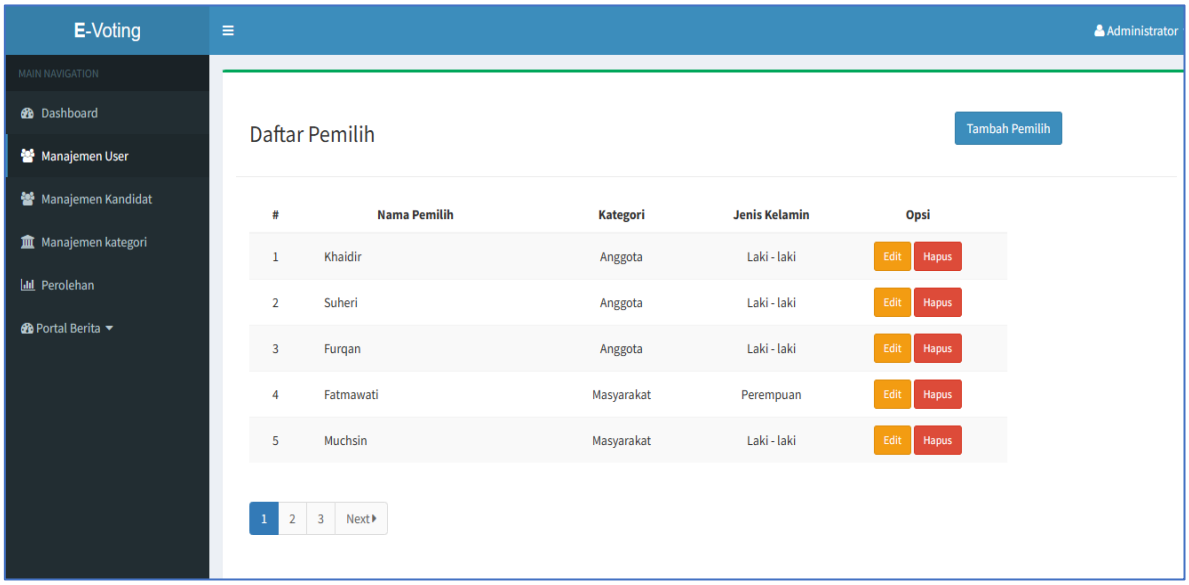

Figure 7. Implementation of DPT list menu

One of the main menus on the admin dashboard page is candidate data management. With this menu, the admins can add candidates for mosque youth leaders by inputting data, such as names, uploading photos, adding candidate visions and missions, or deleting candidate data if needed, as shown in Figure 8.

It can help to correct data input errors. Incorrecting data can be corrected without deleting and repeating entry data. On the edit page, as shown in Figure 9, there are several editable items, such as the candidate's name, photo, vision, and mission. You can press the "update candidate" button if the data has been successfully edited.

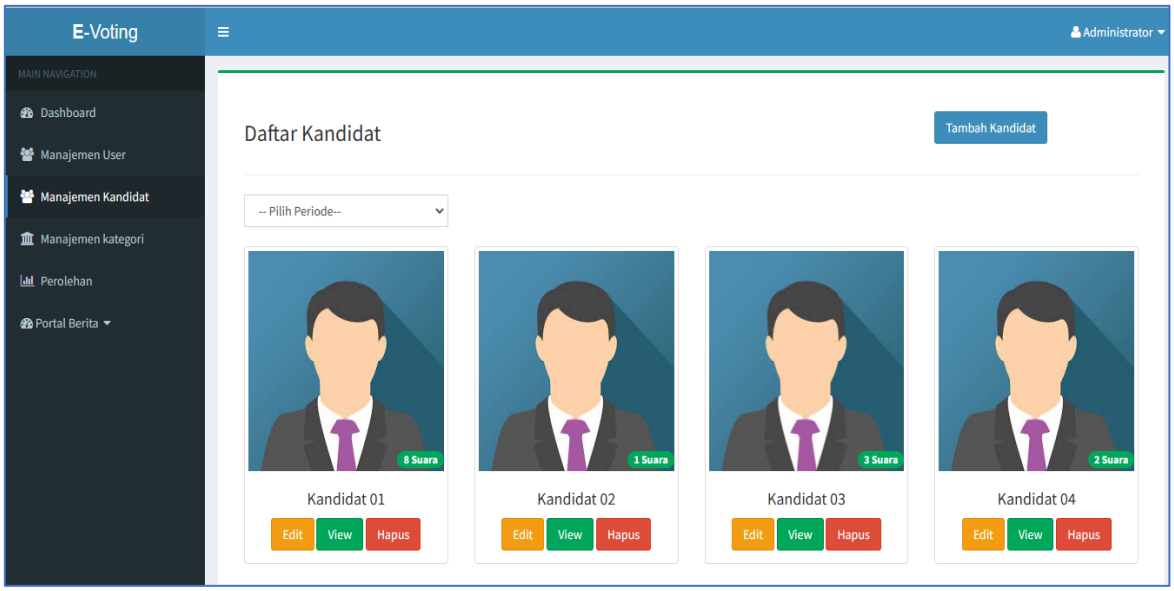

Figure 8. The candidate data management menu

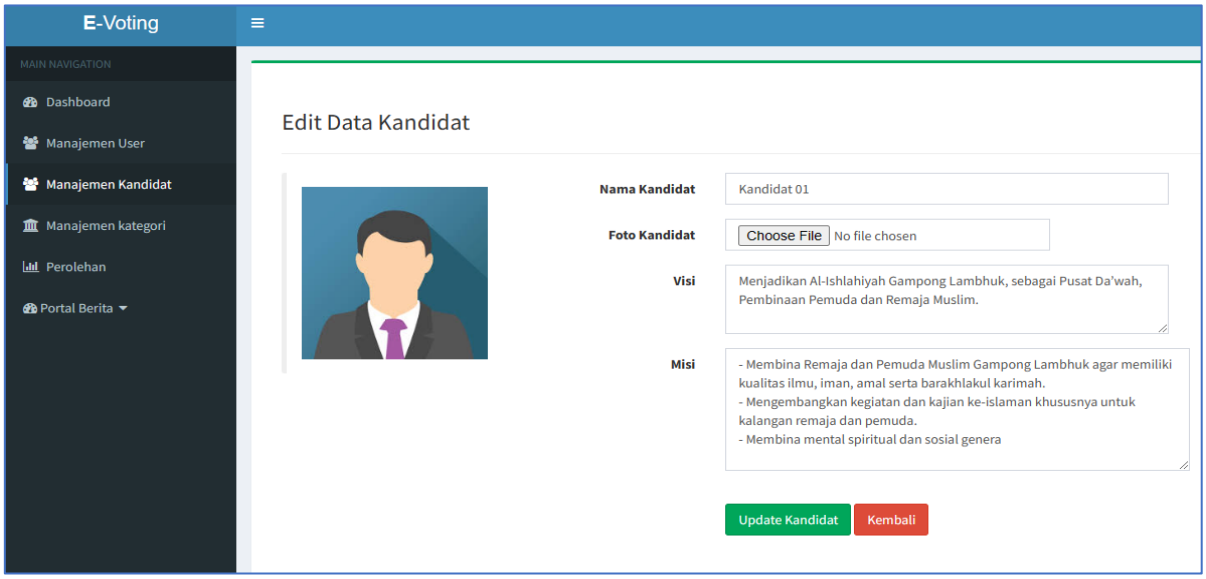

Figure 9. Candidate profile edit menu

The next stage is testing and evaluating the system using the black-box testing method. It is used to see whether the application's input and output (IO) functions and the features that have been built can run properly. The test results can be seen in Table 2. Based on the test results, it can be concluded that the e-voting application has run as expected and has valid features.

Tabel 2. Application testing with black box method

No	Test Procedure	Expected Results	Description
1	Leave the username and password blank when log in	Displays the notification "Username cannot be empty"	Valid
2	Log in using the wrong username and password	Display the notification "Incorrect Login."	Valid

No	Test Procedure	Expected Results	Description
3	Input appropriate voter data	Voter data input is successful and displayed in the DPT table	Valid
4	Input the wrong voter data	A data input error dialog can be displayed	Valid
5	Upload permanent voter data	Displays the "successfully uploaded data" dialog that shows the table data	Valid
6	Click the vote button on the chair candidate	"We have saved your vote, thank you for your participation" dialog is displayed	Valid
7	Display the result report	The election result is displayed	Valid

Conclusion

Based on the results of the implementation and testing of the e-voting system for the Al-Ishlahiyah mosque youth election, it can be concluded that this application has the functionality users require. Some of the advantages of this e-voting application are increased accessibility by allowing voters to vote from anywhere as long as they are connected to the internet and facilitating broader users. The system also offers efficiency with a faster counting process and announcement of results, reducing the cost and administrative complexity associated with traditional election methods. The results of testing the application's features found no bugs or errors. Although it has several advantages, the mosque youth election e-voting application has certain constraints and disadvantages. They are security issues related to the risk of cyber attacks, vote manipulation, or data leakage that can threaten the integrity and trust in the election results. In addition, the accessibility aspect is also a challenge, especially for those who do not have stable internet access or are familiar with digital technology. Furthermore, public trust in the security and integrity of the e-voting system is also a challenge. Some people still need to learn about the transparency and validity of the election process.

Several recommendations can be adopted to overcome these obstacles. Improving security requires adopting more sophisticated security technologies, such as solid cryptography, strict authentication, and more effective monitoring systems.

For accessibility, an inclusive approach must be considered, providing alternative options for voters who may have problems accessing technology. Voter education and training on using e-voting applications are also necessary to increase participation. Furthermore, to increase public trust, transparency of the e-voting process needs to be improved, including clear documentation of how the system works and independent testing to ensure system reliability and integrity.

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