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E-Voting Information System for the General Election of the Head of the Community with Black Box Testing and Dummy Variable Regression Analysis

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ABSTRACT

General elections are basically still carried out conventionally, namely by using paper media in voting. This will lead to weaknesses in the calculation of votes such as a waste of money and time. This study aims to develop a website-based e-voting information system in the general election for the chairman of the RW which is expected to minimize the weaknesses of conventional elections. This system was developed to make the voting process more efficient and easy to use. This application is designed using the PHP programming language and MySQL database, using the waterfall method. By doing black box testing, it is hoped that the e-voting system can run well functionally without any error, and dummy variable testing to determine the influence of voters in selecting candidates based on graduation rate

1. Introduction

Technological developments are believed to be able to improve quality and are predicted to be able to make social changes from a business perspective. One of the benefits of technological developments is the implementation of e-voting. General elections by means of e-voting become a process tool that provides convenience in the election process and produces good efficiency, and can increase trust in the organizers.[1] One of the advantages of e-voting is that it can carry out the process quickly and precisely so that it can provide e-voting solutions to increase voter security, and make the election process easier [2].
Basically, the current general election is still carried out in a conventional way, namely by using paper media as the calculation of ballots. General elections are conventionally carried out by voting on the ballot paper. This method is considered ineffective and efficient so that it can cause many shortcomings, including waste of costs[3], takes a lot of time to count ballots, and risks leaking election secrecy. By utilizing technological developments, problems that arise in general elections with conventional processes can be resolved by using an e-voting general election system. The purpose of e-voting is to carry out the process of selecting candidates with a faster and more efficient process, the use of e-voting can also save costs, and is safer and easier to use.[4]. However, e-voting has its own weakness, which is to create a low level of public trust in technological developments, and can be misused by other parties.[5].

With the renewal of the general election system by means of e-voting, it is hoped that voters can easily carry out the process of selecting a candidate for the head of the RW without having to come directly to the polling station. As well as being able to maintain the security and confidentiality of the vote which refers to the principles of the general election, namely direct, general, free, secret, honest, and fair (luberjudil) [6].

2. Methodology

In this study, the application was developed using the waterfall method. The waterfall method is one type of application development model, namely the process is carried out sequentially from the first process to the end [7]. In developing a system using the waterfall method, there are several stages carried out as

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shown in Figure 01, including:

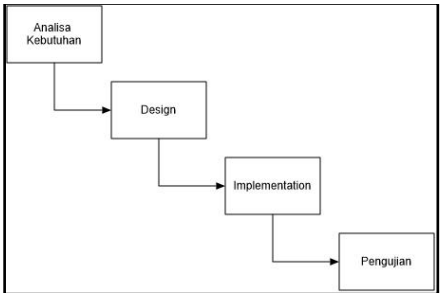

Fig 1. The process of the waterfall method

In the process of developing an e-voting system using the waterfall method, the stages are:The first thing to do is to do a needs analysis by conducting a survey to understand the expected software. The second stage is the creation of an application design that aims to have a clear picture of the database design and interface to be designed. At this stage, the preparation of a design system is carried out which uses the UML (Unified Modeling Language) design model to model a system that uses object-oriented, using diagrams including, Use Case Diagrams, Activity Diagrams, and Entity Relationship Diagrams. The third process is the implementation and coding where the author translates the design form that has been made into a machine-readable code or language. In this e-voting design, the programming language used is PHP (Hypertext Preprocessor) with a design display using HTML (Hyper Text Markup Language) and utilizing the MySQL database as a database server. And the fourth stage is the testing stage to test whether the e-voting system application can run without errors. And tested regression analysis using dummy variables to determine the effect on the e-voting process.

3. Results and Discussion

3.1 Needs Analysis

Based on the analysis process, there are needs in making e-voting system applications, where what information can be obtained from the system.

a. Functional Needs

Table 1
Functional Needs

No	User	Form	Information
1	Voter	Main page	Voters can see the home page of the application, there is information regarding Rangga Mekar Village, candidate details, and the results of the vote
		Voter Login	Form to enter the e-voting application by entering username and password
		Vote	Form to start the voting process by selecting candidate candidates
2	Committee	Main page	The committee can see the home page of the application, there is information regarding Rangga Mekar Village, and candidate candidates, and the results of the vote
		Committee Login	Form for logging in to the admin information system by inputting a username and password
		Candidate Data	The committee can see the data of candidates who have been registered
		Voter Data	The committee can see the registered voter data
		Recapitulation Results	Form to see the results of the vote
3	Administrator	Main page	Administrators can see the home page of the application, there is information regarding Rangga Mekar Village, and candidate candidates, and the results of the vote
		Admin Login	Form for logging in to the admin information system by

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No	User	Form	Information
			inputting a username and password
		Candidate Data	Administrators can process information data about prospective candidates
		Voter Data	Administrators can process information data regarding voter data
		Recapitulation Results	Form to see the results of the vote

b. Non-Functional Needs

Table 2
Non-Functional Needs

No	Needs	Tool	Specification
1	Hardware	Laptops, PCs, Notebooks	Intel(R), 2GB RAM
		Android Smartphone	Android 7.0 Nougat
2	Software	Servers	Xamp Server
		Internet Browser	Google, Mozilla Firefox, Opera

3.2 System Design Design

In designing the e-voting system model, UML (unified modeling language) modeling is used. UML modeling is a visual modeling process that functions for designs that implement object-oriented systems. UML is used to simplify a human language into a system language [8].

The design stages describe the system design in the form of use case diagrams, activity diagrams and Entity Relationship Diagrams.

a. Use Case Diagrams

Use Case Diagram is a process of interconnected interaction between the system and the actor. The function of the Use Case Diagram is to show the activities of a process between the user and the system that can make it easier for the system needs to be made.

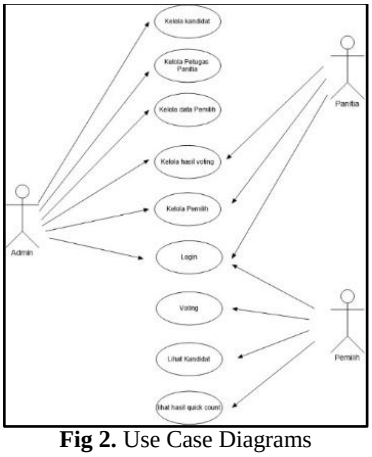

Fig 2. Use Case Diagrams

Figure 2 explains UML modeling using use case diagrams, where there are 3 actors, namely Admin who has the right to manage candidate data, manage committee officers, manage voter data, manage voting results, and view quick count results. The next actor is the Committee Officer who has the right, sees the voting results, sees the voters, and sees the quick count results. And the next actor is voters, who have the right to vote, see candidates, see quick count results.

b. Activity Diagrams

Activity diagram is a system activity process that describes in general business processes and sequences to produce an output result. So that the process of the designed system can be understood easily as a whole.

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1) Activity Diagram Admin
The activity diagram in Fig 03 explains that the process of system activity for Admin users who can access candidate data processing, committee data, and voter data, by carrying out the CRUD process (create, read, update, delete) on the system and the data is stored in databases.

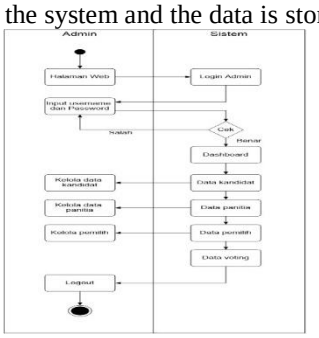

Fig 3. Activity Diagram Admin

2) Committee Activity Diagram
The activity diagram in Fig. 04 explains that the system activity process is for Committee users who can access the admin page but committee users cannot access candidate data processing, committee data, and voter data, but committee users can access general election vote recapitulation results.

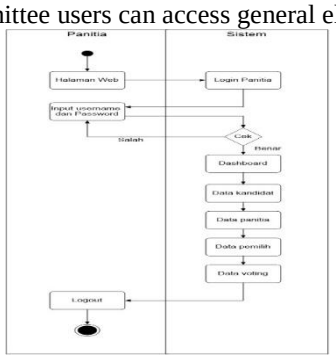

FIG 4 COMMITTEE ACTIVITY DIAGRAM

3) Committee Activity Diagram
The activity diagram contained in Fig. 05 explains that the process of system activity is on the Voter user. Before conducting the voting process, voters are required to login first using the username and password that has been registered by the administrator. Voters can view candidate profiles and view quick qount results. Voting results will be processed into the database, and the system will record for the user who has voted, so that the election can only be done once.

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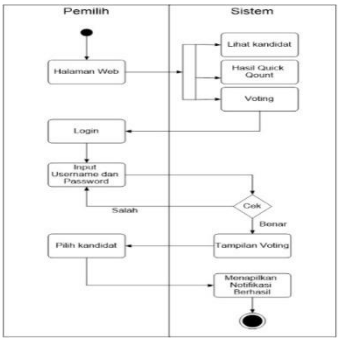

FIG 5 ACTIVITY DIAGRAM SELECTOR

c. Entity Relationship Diagram

Diagrams are made to relate between tables in the e-voting database. The diagram is made using the form of ERD (Entity Relationship Diagram).

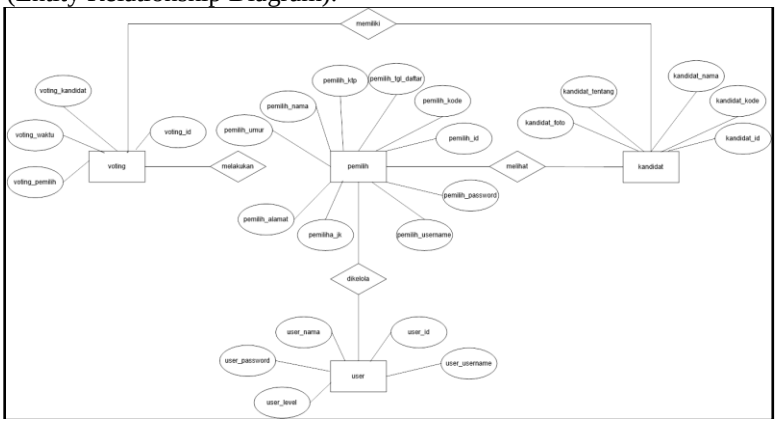

FIG 6 ENTITY RELATIONSHIP DIAGRAM

3.3 Implementation and Coding

Based on the design of the system design that has been made, the next stage is implementation or coding, this application was developed with the PHP programming language and MySQL database.

a. Interface Design

In this interface design, it describes how the appearance of the e-voting information system application.

1) Main page

In Figure 7. is the main display page of the e-voting information system for the general election of the RW chairman. Users can see the submenus located on the main display, namely, quick count results, see candidate profiles, as well as a menu to start voting.

FIG 7 MAIN PAGE VIEW

2) Login Page

The Voter Login page is a display for verifying the voter user, by entering the username and password that has been registered by the Administrator

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FIG 8 VOTER LOGIN DISPLAY

3) Candidate Details Page

In Fig 9. This is a display of the candidate detail page, before voting, you can see the details of the candidate for the chairman of the RW to be elected, there are photos of the candidates along with the personal data of the candidates

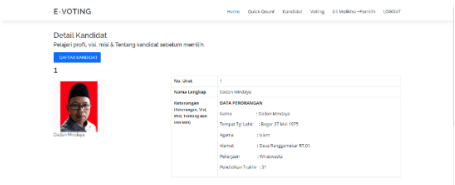

FIG 9 CANDIDATE DETAIL VIEW TAMPILAN

4) Voting Page

In Fig 10. This is the display of the candidate voting page, after the voter user has logged in, the voter can access the voting display to choose the candidate for the head of the RW. There is a photo of the candidate along with the candidate number. Voters only need to activate the radio button on the selected candidate, then click voting to finish. After the voter has voted the system will proceed to the success message notification page. And the voting results will be stored in the database.

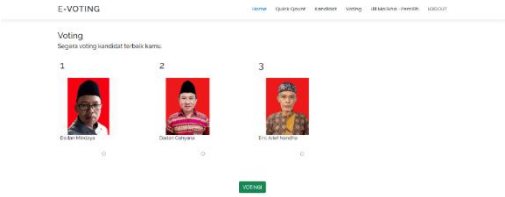

FIG 10 VOTING VIEW

5) Admin Dashboard Page

In Fig 11 is the display of the admin dashboard menu, the display will appear after the admin has logged in admin first, by entering the registered username and password. On this page the admin can process candidate data, voter data, user data to add, delete and edit data. In addition to the admin page, there is a committee dashboard page that looks the same as the admin page. However, the committee page cannot access create, update, and delete data.

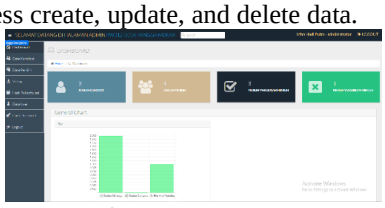

FIG 11 ADMIN DASHBOARD VIEW

6) Recapitulation Results

In Fig 12 is the admin page on the recapitulation sub menu. This page aims to filter data to see the results of voting data for voters who have already voted.

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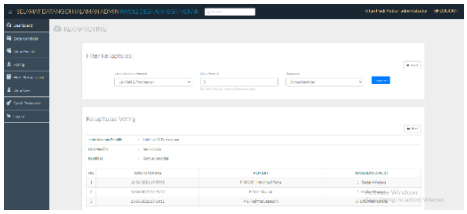

FIG 12 RECAPITULATION RESULTS PAGE

3.4 Test

a. Black Box Test

From the results of the system design that has been made, the software is tested.

TABLE 3
BLACK BOX TEST

No.	Test	Expected results	Test result status
1.	Login user who has been registered	Voters can log in to the website to vote	Corresponding
2.	Voters do voting	If the voter presses the voting button when selecting a candidate, the data will go directly to the database, and the voter can only vote once satu	Corresponding

b. Implementation of Dummy Variable Regression Analysis

The dummy variable is a variable that quantifies qualitative variables. For example: gender, location, situation, season, and quality. Dummy variables are often also called dummy variables, categorical binary or dichotomous [9]. The dummy variable equation is as follows:

$$Y = a + b1D + e \quad (1)$$

Where : Y : correlation result
D : dummy variable
a : coefficient of intercept
b1 : regression coefficient
e : error

The variables used in the regression analysis consist of:

1) Independent variables are qualitative data or categorical data which are symbolized as quantitative data, namely the numbers 1 and 0, such as the gender variable.
2) The dependent variable is quantitative data such as data on prices, sales, salaries, etc.

The usefulness of the dummy variable is to calculate the effect of the nominal-scale independent variable on the variable depending on the interval scale [10].

Decision making in the regression analysis of this test dummy variable can be used in two ways, namely seeing the significant value of the SPSS output by:

1) If the significance value is less than <0.05, then there is an effect of the independent variable (X) on the dependent variable (Y).
2) If the significance value is greater than > 0.05 then there is no effect of the independent variable (X) on the dependent variable (Y).

After the implementation and coding in the e-voting application, then a dummy variable regression analysis test technique was carried out using the IBM SPSS application with the effect of the passing rate of the candidate for RW chairman candidate, on the gender of voters in the election of the RW chairman. Gender is the independent variable which is coded 1 for male and 0 for female. The number of voters is 61 male voters, and 39 female voters. While the graduation rate for junior high school is given a value of 1, for high school graduation rates is given a value of 2, and the graduation rate for higher education is given a code of 3.

Ho : There is no influence between the passing rate of the candidate for RW chairman and gender
Ha : There is an influence between the passing rate of the candidate for RW chairman and gender

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a. Graphics Output

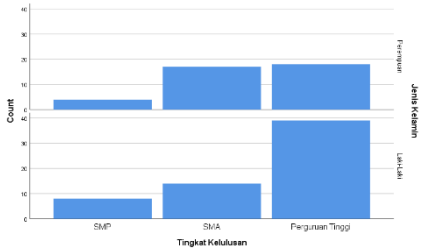

FIG 13 RESPONSE GRAPH OUTPUT

In Fig. 13, it is explained that there are 39 responses of male voters choosing a college graduation rate, 14 responses choosing a high school graduation rate, 8 responses choosing a junior high school graduation rate. Then for female voters, there were 18 responses that chose the college graduation rate, 17 responses chose the high school education level, and 4 responses chose the junior high school graduate level.

b. Regression Table

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,104[a]	,011	,001	,701

a. Predictors: (Constant), Jenis Kelamin

FIG 14 OUTPUT MODEL SUMMARY

In Fig. 14, the R number is 0.104, indicating a small correlation between the graduation rate of the RW head and the gender of the voter.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,530	1	,530	1,077	,302[b]
	Residual	48,220	98	,492		
	Total	48,750	99			

a. Dependent Variable: Tingkat Kelulusan

b. Predictors: (Constant), Jenis Kelamin

FIG15 OUTPUT ANOVA

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	2,359	,112		21,002	,000
	Jenis_Kelamin	,149	,144	,104	1,038	,302

a. Dependent Variable: Tingkat Kelulusan

FIG 16 OUTPUT COEFFICIENTS

In Fig 15 and Fig 16 it is known that the value of F is 1.077 with a sig value of 0.302. This figure is greater than the value of 0.05, so it can be said that under the influence of the gender variable, it is not significant to affect the graduation rate of the candidate for RW chairman. From the regression equation it can be concluded;

$$Y = a + b1D + e$$

In Fig 15 and Fig 16 it is known that the value of F is 1.077 with a sig value of 0.302. This figure is greater than the value of 0.05, so it can be said that under the influence of the gender variable, it is not significant to affect the graduation rate of the candidate for RW chairman. From the regression equation it can be concluded;

Male voter = 2.359 + 0.149.(1)

= 2.359 + 0.149

= 2,508

Female voter = 2.359 + 0.149.(0)

= 2,359 + 0

= 2,359

Because the effect is not significant, the regression equation is not interpreted further. From the results of the sig value and the results of the calculation of the regression equation, it can be concluded from the hypothesis that Ho is accepted and Ha is rejected because the output value is significantly greater than > 0.05, so there is no effect of the independent variable (X) on the dependent variable (Y) with a value of 0.302 > 0.05.

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4. Conclusion

From the results of system design that has been tested on the application, conclusions can be drawn, namely:

a. The e-voting information system in the election of the RW chairman can run well without any errors.
b. From the results of testing using a dummy variable, the graduation rate of the RW chairman does not affect male and female voters.
c. With e-voting the results of the general election of the RW chairman can run quickly

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