

Flexi Vote – A Web-based Multifunctional Voting System

[1]Dionne Lorenzo Gabriel M. Pascua, [2]Julius Ivan I. Rodas, [3]Jeremy Ephraim N. Villa, [4]William P. Rey
[1]Mapúa University,[2]Mapúa University, [3]Mapúa University, [4]Mapúa University
[1]dionne.pascua12@gmail.com,[2]juliusrodas0626@gmail.com, [3]villejeremy12@gmail.com,
[4]wprey@mapua.edu.ph

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Abstract:

Despite the underlying issues that stem from online voting, the prospect of online voting has garnered much attention in today's world, especially due to its ease of access, feasibility, and scalability for most institutes and organizations. The power of the internet to connect people has been increasing daily in relation with the dependability of its users. This study discusses the effectiveness of the implementation and usage of FlexiVote, a web-based multifunctional voting system, on small-scale organizations and non-government electoral processes. It looks at how the multifunctional voting system affects different organizations within their respective electoral processes by providing its users a means to host their own voting processes as well as participate in it. FlexiVote differentiates itself from other similar voting systems by offering some of the more common voting templates, such as "Winner Takes All", "Party Bloc", "Bloc", and "Ranked Voting" that users can conveniently utilize and configure. The study concludes with the overall results of the user experience in their usage of the voting system.

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I. INTRODUCTION

Online voting has been a concern in recent years as people started relying more on technology. Due to this, organizations aimed to bring voting to the internet, in order to give the users an option to vote without the barriers that they have faced using the traditional way of voting. Given the scenario, the researchers aimed to provide users with an online method of voting, together with the versatility to fully customize and secure the process - something which current voting systems lack or has not developed.

Benefits of electronic web-based multifunctional voting systems include, but are not limited to, a speedier processing and counting of ballots/votes thus saving time, a reduction of cost in having to pay staff to manually count the votes, and providing easy access to the voting system to those with disabilities[1]. Expenses for online voting are also shown to decrease over time with continued use and allows the publication as well as the reporting of results in a timelier manner[2]. It has been established that the concept of online voting has had its benefits and differentiating concerns when it comes to the political world and democratic process, as well as for other smaller organizational elections

II. RESEARCH QUESTION

How will a flexible online voting system help with the electoral processes of small-scale organizations and entities

for both electoral hosts and voters alike?

III. OBJECTIVES OF THE STUDY

The general objective of this study is to provide the people with a working web-based multifunctional voting system that can be used and implemented in various voting processes as necessary, while utilizing some of the more common types of voting processes used.

In addition, the study also aims to allow the electoral hosts to customize their voting process to fit their specific needs while securing the said system with MFA, or multifactor authentication, in order to prevent attackers from disrupting the electoral process being held.

IV. SCOPE AND DELIMITATIONS

This study will focus on the implementation of an online voting system within small scale organizations such as that of a university, corporate environment, online beauty pageants, or any other electoral setting. One of the main scopes of the study is the incorporation of multifactor authentication within the online voting system. Through this type of authentication, the users of the said program will have their identities verified before being able to cast votes. The authentication processes in this study will include the usage of One Time Passwords (OTPs), mobile numbers, and the individual's email.

The multifunctional voting system will also make use of proper web hosting in order to keep the system live. In

addition, a dedicated server would also be required in order to keep track of all the necessary data and statistics. With that being said, there will always be a risk when going online, not necessarily through online voting, but in other aspects as well. There is only so much that multifactor authentication can do in order to protect the gathered data of the electoral systems, as such, absolute and guaranteed internal consistency of the users cannot be ensured.

In addition, due to constraints in time and researcher capability, the voting system will only focus on 2 types of electoral systems, mainly the Plurality and Majority electoral systems which are then sub-categorized into more specific electoral processes, namely, First-Past-The-Post or Winner-Takes-All, Bloc Voting or Plurality-at-Large, and finally Party-Bloc-Voting which are under the Plurality Electoral Systems. Meanwhile, Instant-Runoff, Ranked Voting, and Preferential Voting are under the Majority Electoral System.

Lastly, the system will not have certain features such as the ability to properly vote through mobile, SMS voting and the ability to print the resulting ballots.

V. SIGNIFICANCE OF THE STUDY

The main significance of this project and how it will impact the involved entities is by allowing users to vote in a way that removes the boundaries currently being experienced in the traditional voting process. The voting system will help the individuals involved to cast a vote using their own device, while also allowing the electoral hosts to fully customize each voting processes by applying the necessary rules, policies and limitations to the voters.

With the system having multifactor authentication, this will help ensure that the individual's voting in any given electoral process are properly authenticated and belong in that specific group of people. Not only that, but by providing the users several other types of voting processes, this system can cater to the various and specific needs of the clients. Furthermore, the addition of candidate profiles will allow voters to get a thorough view of each candidate which, in turn, will help them in the process of making the proper vote.

VI. REVIEW OF RELATED LITERATURE

Online voting or e-voting uses the Internet, SMS, or other digital services to cast a vote. Online voting can be used in representative systems to increase voter turnout be it in local places or everywhere an internet is accessible. Moreover, online voting is increasingly used within organizations [4].

E-voting, an election or a referendum that involves the use of electronic devices for the means of casting a vote. With the introduction of E-voting many challenges were raised when it comes to casting votes through electronics. One of the main issues when it comes to E-voting would be the trust and confidence. It has become increasingly difficult to introduce E-voting, since, unless the citizen can trust their political and administrative systems. Another aspect that should be considered is that there should

be no exclusion of groups, such as people with disabilities or the socially disadvantaged. Developing a system that is both secure and robust takes time, aside from the need for necessary research and development time that will be set aside before introducing any E-voting systems [5].

This study uses multifactor authentication due to it currently being one of the most effective ways to authenticate a user. It works by employing multiple methods of authentication in order to complete its process. One of the most common schemes are One Time Passwords (OTPs) which sends the user a numeric code to input for a single use. However, risk is still present especially in scenarios at a public place such as a PoS terminal or an ATM booth [5].

An electoral system is a way in order to determine a singular, or at times, multiple winners depending on the scenario. It is a method that gives an organization's members their right to choose their leader, or their desired winner. There are multiple types of electoral systems used around the world, and some places even use different types of electoral systems in a single place or organization. Electoral systems can be divided into three general types, but this study will only focus on two types – Plurality and Majority Electoral Systems [3].

Plurality voting is a system in which the candidate with the most votes wins the election/process. There is usually no requirement in getting the majority of the votes. Should there be a case where there is a need to fill only one single position then it is known as: "First-Past-The-Post" or "Winner takes all". Second most commonly used electoral system for national legislatures. In the event that there are multiple positions that needs to be elected or filled then it is better known as "Bloc Voting" or "Plurality-At-Large". Voters may have as many votes as there as seats that is needed to be filled. Voters are also able to freely vote for any candidates regardless of the party. [5].

Much like the plurality system this system also needs the candidate to receive the majority of votes to be declared as the winner. Though unlike the plurality system the majoritarian system can take place through the use of "Ranked Voting" or "Preferential Voting". Wherein, unlike the first system the voters get to rank the candidates in their preference. There are different types of ranked voting systems. One such system is the "Instant-Runoff Voting". The ballots are then counted to know who the voter's top choice were. In the event that the candidate has the least numbers of votes, then they will be eliminated. Should a voter have their top candidate eliminated then their vote on that candidate will be added to their next choice in their preference. [5].

VII. VOTING SYSTEM FLOW DISCUSSION

Figure 7.0 shows the generalized program flow and the system architecture of the voting system accordingly. As shown in the figure, the user must first register into the system using a valid email address, mobile number, and security questions. These factors are crucial as it authenticates the validity of the user involved in the voting process. In the situation where the user has a verified account, the option to Host or Vote is made available on the user dashboard. If a user has decided to host an electoral

process, a One-Time Password shall be required before proceeding. After the verification, the user, now an electoral host, can create, manage, edit, and delete electoral processes and candidates involved.

If a user decides to participate in an electoral process, user login as well as a respective Electoral Code are required by the system before a user can vote. Upon casting a vote, a One-Time Password is once again used to verify the authenticity of the vote, before it is recorded into the system.

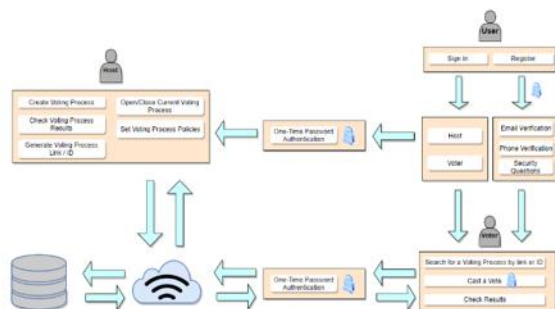


Figure 7.0 System Architecture

The general flow of using FlexiVote can be broken down into the following:

- Login and Registration
- Electoral Process Creation and Configuration
- Vote Casting
- Viewing of Electoral Results

A. Login and Registration

Users are initially required to register by creating an account that will be verified through their email address. Registered accounts will be unable to login without having their email address verified first. Figure 7.0 shows the dashboard that users will see once logged into the system. It contains information such as the username, user ID, user first name, and brief descriptions on the actions available to the user.

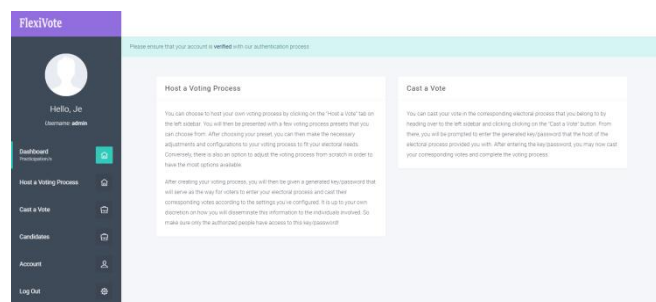


Figure 7.0 User Dashboard

B. Electoral Process Creation and Configuration

Users will have the option to choose from four (4) different electoral process templates, which are the “Winner Takes All”, “Bloc”, “Party Bloc”, and Ranked Voting. Figure 7.1 shows the modal button that appears when selecting one of the electoral process templates. Users can then input the respective name of their process as well as the range of date.

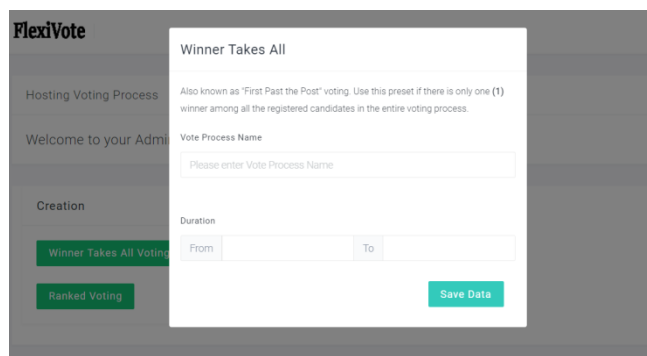


Figure 7.1 Electoral Process Creation

A voting process would be created once the necessary information and values have been inputted by the user. Further configuration options, such as the addition of candidates and editing of voting process, are available to the user which can be seen in Figure 7.3.

Hosted Voting Systems

| Winner Takes All | | | | | | |
|----------------------|-----------|------------|------------|---|--|---|
| Voting Name | Vote Code | Start Date | End Date | Candidate Actions | Edit Actions | Actions |
| Mr and Mrs SOIT 2019 | 1406 | 02/12/2020 | 02/26/2020 | Add Candidates View Candidates | Edit Delete | Invite See Votes |

Figure 7.3 Voting Process Configuration

As soon as an electoral process is made available, the host can then add candidates to the specified electoral process. Only the corresponding electoral host can add, edit, and delete a candidate that is linked to a specific electoral code. A list of candidates on a specific process can be retrieved by the system, allowing the host to utilize the stored data.

C. Vote Casting

Users will be prompted to login using their credentials and the Electoral Code given to them by the electoral host as shown in Figure 7.4. Electoral Codes are 4-digit numbers, unique to every created process, and can only be seen by the host. As soon as the user logs in with a valid account and electoral code, the page will redirect the user to the voting page, where the candidate name and picture is displayed, along with the selection button.

SIGN IN

Username

Password

Electoral Code

Login

[Return to Previous Page](#)

[New Here? Register](#)

Don't have an account? [Sign up](#)

Figure 7.4 Voter Login Screen

D. Electoral Results

Electoral hosts can monitor the votes of any of their ongoing processes through the Vote Count button which can be found on the electoral process page. This allows the host to view all the candidates participating in the process and see their respective vote count as shown in Figure 7.5.

| Candidate | Total |
|-------------|-------|
| Candidate 1 | 1 |
| Candidate 2 | 0 |

Figure 7.5 Candidate Vote Count

VIII. METHODOLOGY

In order to gain insight on the how the users of the voting system feel towards FlexiVote, the researchers used a type of usability testing through survey questions with the Likert scale as its primary psychometric rubric that can accurately scale the corresponding responses. Both the users hosting their respective electoral processes and the ones voting in them will have the opportunity to answer these survey questions.

Each user had a different survey to answer, depending on what their role was during the electoral process. This means that the user who hosted an electoral process answered a survey that is slightly different from that of what a regular voter would take. Figure 8.0 and 8.1 shows the survey forms answered by electoral hosts and voters accordingly.

| Question | Strongly Agree | Agree | Neutral | Disagree | Strong Disagree |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1 The interface of the website is user-friendly and easy to navigate through. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2 The design of the website is appealing and neat. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3 The mechanics of voting in an electoral system are easy to learn. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4 I believe that using Flexivote will help me in participating in my corresponding electoral process. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5 The information provided in the website is clear and easily understandable. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6 I believe that Flexivote is a great alternative to other small-scale voting processes. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7 The given templates of electoral processes offered in Flexivote are exactly what I need. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 8 I can easily vote in my corresponding electoral processes and keep track of the processes I've participated in. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 9 Overall, I am very satisfied with the Flexivote. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 10 It is easy for me to recommend Flexivote to my friends/family/colleagues/acquaintances. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 8.0 Survey Form (Electoral Hosts)

| Question | Strongly Agree | Agree | Neutral | Disagree | Strong Disagree |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1 The interface of the website is user-friendly and easy to navigate through. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2 The design of the website is appealing and neat. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3 The mechanics of hosting an electoral system are easy to learn. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4 I believe that using Flexivote will help me in creating/hosting my own electoral process. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5 The information provided in the website is clear and easily understandable. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6 I believe that Flexivote is a great alternative to other small-scale voting processes. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7 The given templates of electoral processes offered in Flexivote are exactly what I need. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 8 I can easily manage my electoral processes and keep track of the useful statistics through Flexivote | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 9 Overall, I am very satisfied with the Flexivote. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 10 It is easy for me to recommend Flexivote to my friends/family/colleagues/acquaintances. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 8.1 Survey Form (Voters)

Although the surveys have differing questions regarding what they ask from the corresponding user, they both accomplish the objective of obtaining the user's inputs on the voting system. A user is defined as an individual who has participated in either making an electoral system on the website or casting their vote in an already existing one. The respondents will only have the opportunity to access the survey once they have completed an electoral process.

IX. RESULTS

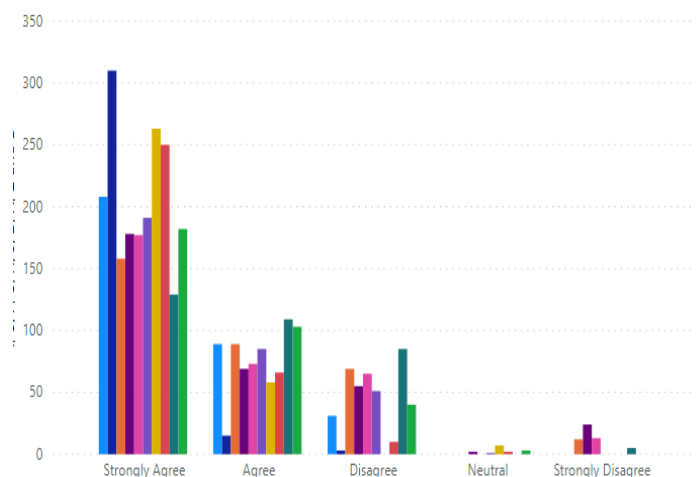


Figure 9.0 Survey Questionnaire Results

Figure 9.0 shows the results of the conducted survey after using the system. The graph describes that more than 50% of the users were agreeing that the program has helped them vote in a more convenient manner and that they are satisfied with the system itself. Out of 328 users, most participants were satisfied with the impact of online voting within their organization. However, a minority of voters were not fully content with the new approach to voting.

Usability Test

A. The interface of the website is user-friendly and easy to navigate through

Results of the first question show that 250 users strongly agreed, 66 agreed, 2 answered neutral, 10 answered disagree, and none strongly disagreed.

B. The design of the website is appealing and neat

Results of the second question show that 263 people strongly agreed that the website was neat, 58 agreed, no neutral response was received, 7 disagreed, and none strongly disagreed.

C. The mechanics of voting in an electoral system are easy to learn

Results of the third question show that 310 people strongly agreed that the electoral system are easy to learn. 15 people agreed, no users answered neutral, 3 people disagreed, and no respondent strongly disagreed which can be seen in Figure 9.1.

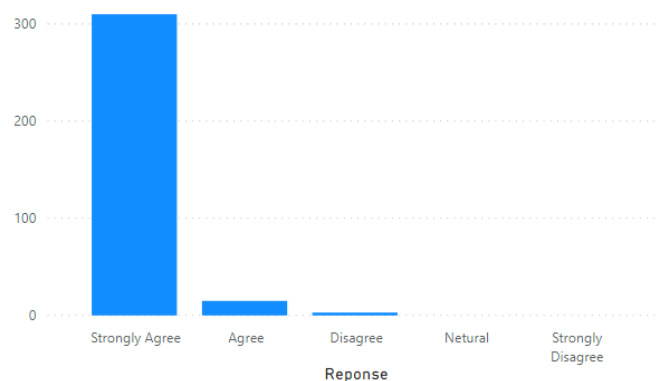


Figure 9.1 Survey Results (Question 3)

D. I believe that using FlexiVote will help me in creating/participating in my corresponding electoral process

Results of the fourth question show that, 182 people strongly agreed, 103 agreed, 3 answered neutral, 40 answered disagree, and no respondents strongly disagreed.

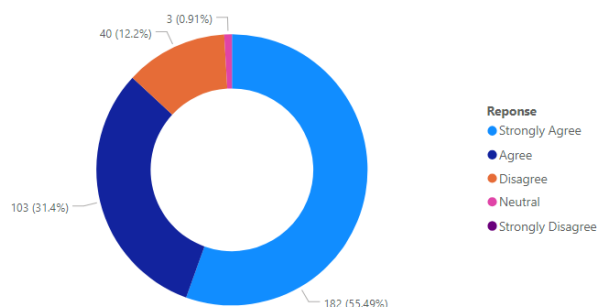


Figure 9.2 Survey Results (Question 4)

E. The information provided in the website is clear and easily understandable

Results of the fifth question show that 129 strongly agreed, 109 agreed, 0 answered neutral, 85 answered disagree, and 5 strongly disagreed.

F. I believe that FlexiVote is a great alternative to other small-scale voting processes

Results of the sixth question show that 158 users strongly agreed, 89 users agreed, none answered neutral, 69 disagreed, and 12 strongly disagreed which is shown in Figure 9.3.

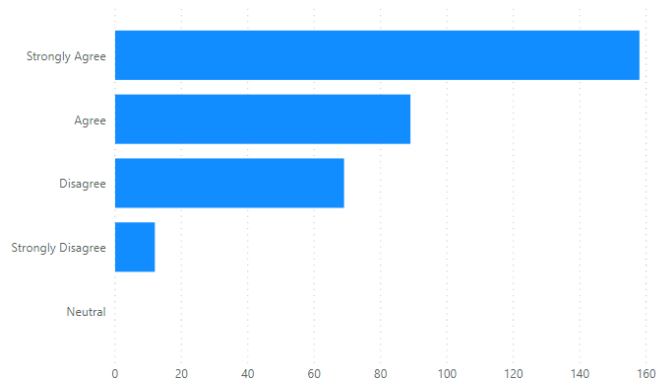


Figure 9.3 Survey Results (Question 6)

G. The given templates of electoral processes offered in FlexiVote are exactly what I need

Results of the seventh question show that 178 strongly agreed, 69 agreed, 2 answered neutral, 55 answered disagree, and 24 strongly disagreed.

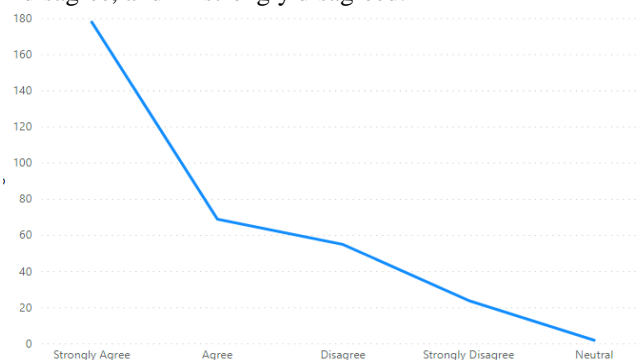


Figure 9.4 Survey Results (Question 7)

H. I can easily manage/vote in my corresponding electoral processes and keep track of the processes I've participated in

Results of the eighth question show that 177 people strongly agreed, 73 people agreed, 65 people disagreed, and 13 people strongly disagreed. No respondents answered neutral.

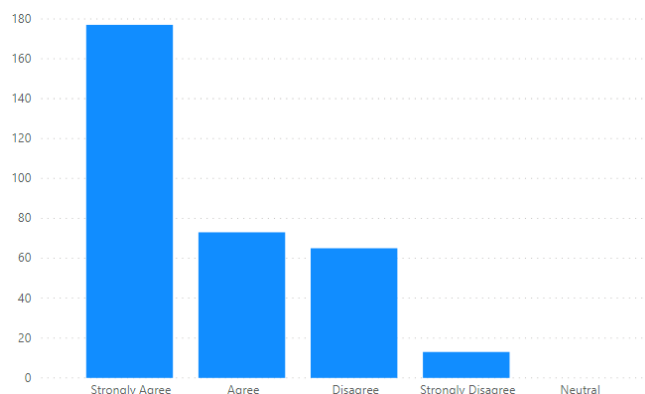


Figure 9.5 Survey Results (Question 8)

I. Overall, I am very satisfied with FlexiVote

Results of the ninth question show that 208 people strongly agree, 89 people agreed, none answered neutral, 31 disagreed, and none answered strongly disagree as seen in Figure 9.6.

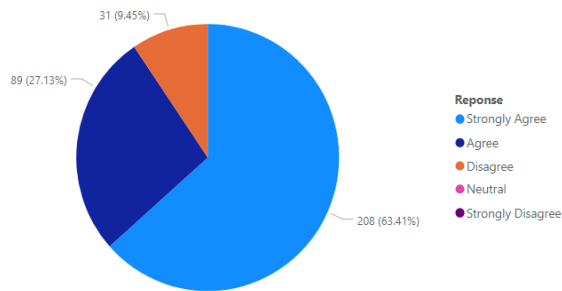


Figure 9.6 Survey Results (Question 9)

J. It is easy for me to recommend FlexiVote to my friends/family/colleagues/acquaintances

Results of the tenth question show that 191 people strongly agreed to the question and 85 people agreed. 1 user answered neutral, 51 response disagreed, and none strongly disagreed.

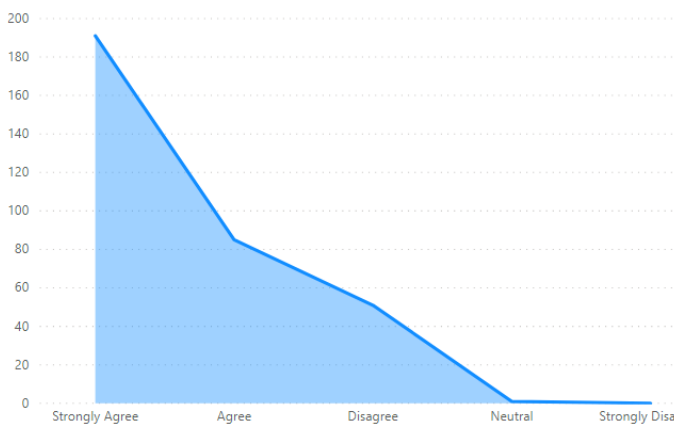


Figure 9.7 Survey Results (Question 10)

X. CONCLUSION

This research aimed to identify if a flexible online voting system would help with the electoral processes of small-scale organizations and entities for both electoral hosts and voters alike. Based on the data analysis of the results of the survey given to the users of FlexiVote, the majority found the system to be highly satisfactory and catered to their specific needs. By analyzing the survey results of the participants according to their corresponding electoral process, almost all responded positively to their overall experience using FlexiVote. In conclusion, the researchers were successful in achieving the objectives and goals of this study by providing proper service through their web-based multifunctional voting system.

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