Electronic Election for Small Medium Non-Profit Organizations in Indonesian Cities

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Abstract. Elections in Indonesia often include direct voting, enabling every community member to immediately contribute to the election process and support their chosen leader. The digital divide, the security of data and systems, verification and transparency, and the legal and social-cultural acceptance of online elections are some of the challenges and issues that must be addressed for a successful implementation in Indonesia. To focus on the feature and parameter development of e-voting, this study was implemented in small-medium Non-profit Organizations with similar social cultures. Waterfall's Information Systems Development Method is implemented to ensure the functionality of the Electronic-Elections product. This study highlights two critical points during the development until the election event. First, in the early stage, the committee and developer must communicate clearly and explicitly about the operational procedure, data authority, and data privacy to elevate the trustworthiness. The elements of the system should encompass five key aspects, including fairness, generality, directness, freedom, truthfulness, and confidentiality. Second, during preparation and election event, the simulation must be attended together to assess critical aspects, and the developer accompanies the committee and monitors their working systems. The researchers choose to employ the Technological Acceptance Model (TAM) to assess the readiness and acceptance of technology in the context of this case study. The objective was to determine how these factors contribute to mitigating the negative consequences of electronic elections.

Keywords: Non-Profit Organization, Online Election, Technology Acceptance, User Experience

1 Introduction

Beginning a new technology is always challenging. Many operational, technical, social, and cultural can distract our technology adoption process in real case studies[1]. The user acceptance test is an important aspect of making a successful software product acquisition. Before implementing this software product, the project manager and product owner must analyze and mitigate each case study's unique challenges, especially in the elections domain[2][3].

Online elections are attracting attention and have been tested in numerous nations worldwide. Although the history of online elections is relatively young, several significant milestones and developments have occurred. Electronic voting in general elec-

© The Author(s) 2023
M. Hartono et al. (eds.), *Proceedings of the 4th International Conference on Informatics, Technology and Engineering 2023 (InCITE 2023)*, Atlantis Highlights in Engineering 21,
https://doi.org/10.2991/978-94-6463-288-0_40

tions has been extensively adopted. India, Brazil, Estonia, and the Philippines are examples of nations that have effectively implemented it. [4]. Since 2005, Estonia officially celebrated general elections over the Internet [5]. For almost two decades, Estonia's electoral continued to develop an electronic system because this system was born before cyberattacks and electronic hacking became trends. Indirectly, Estonia's citizens can easily adapt to new technologies. Estonia has a highly developed national electronic identification system manages citizen data and daily transactions. Secure digital identities are widely use in private and public section in this nation. The high cost of political and administrator wasn't happened again.

Different with Estonia and the other nation with homogeneous people, Indonesia is the largest archipelagic state and the fourth-most populous country in the world with huge numbers of people and diverse culture. To celebrate the presidential and parliamentary elections from 2004 until now, the committee must print out the name of leaders and give a small place to ensure the election secret. The committee's cost and workload are too huge, impacting their health [6]. The usability of technologies in the political domain is being debated nowadays. Not only for inclusivity and cultural aspect but also how the system communicates transparently and correctly based on the authority. The heterogonous way of thinking and medium-to-low digital literacy leads to the difficulties of implementing electronic election.

Although it has not been implemented nationally, many organizations have implemented electronic election for internal purposes in regional scale. This study examines the deployment of an electronic election system and associated procedures for small to medium-sized non-profit organizations, with the aim of contributing to the existing research on the practical application of electronic voting. Furthermore, this study emphasizes the crucial aspect of identifying an appropriate solution to address the issue inside this small-medium enterprise..

2 Research Methodology

This study emphasizes information systems development method from analysis, design, construction, and verification validation [7]. This approach was chosen in this study to directly figure out the vital parameters of project success. To holistic of the requirements and user's need, waterfall approach still relevant into this studies [8]. The detail of research steps is described in Fig 1.

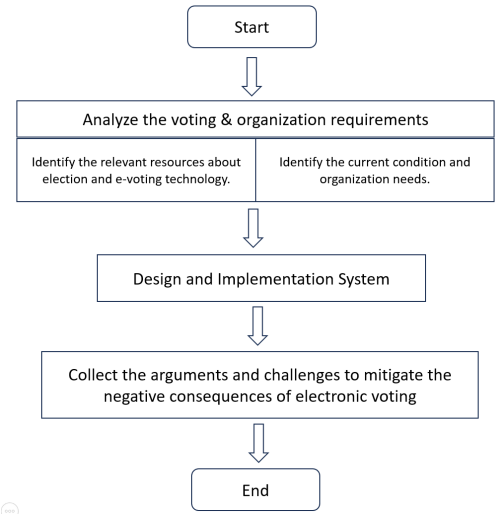

Fig. 1. Research Procedure

From the analysis phase, this study also focusses on the operation and human need. First step, this study tries to figure out about what the voter feels free using technology in critical case such as: financial and privacy issue. This phase is also collecting many aspect success stories in e-voting application in various specific area. In the small design phase, this study describes the data structure and flow of system to preserve the evidence of e-voting requirements. In the implementation phase, this study describes the strategies to implement in real cloud-hosting. In the verification & validation phase, this study interviews and survey with committee and voters to assess technological adaption model in this application.

3 Literature Reviews and Data Collections

Electronic voting is one of the alternative ways to express democracy. Essence of democracy is how to citizen can secure and enjoy their process of election and express their opinions [9]. Generally, there are three roles that involved in the voting system:

1. Voters: who have a right to vote
2. Registration Authorities: who ensures that only registers voters are allowed to vote.
3. Tallying Authorities: who capable the right authorities to display the results after the time voting is expired.

The procedure of primary e-voting is described in Fig 2. A voter must first open the application and complete a self-identification procedure, during which the system verifies the voter's identity and compares it to the voter database on the central server. The next stage, if the verification process is successful, is to vote on the voting card

and save it in the application system, which will automatically store the data on the server.

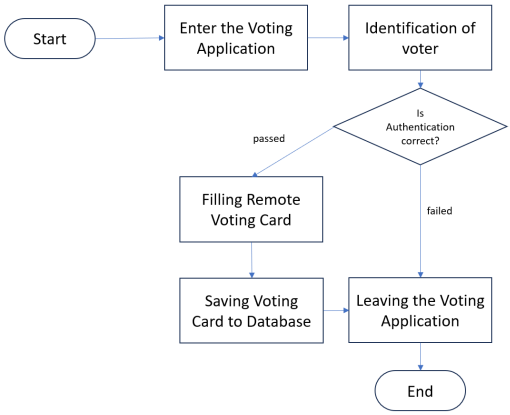

Fig. 2. Principles of E-Voting's Flow Model [9]

In the law aspect of election [10] in Indonesia is

1. Direct. Voters have the right to vote directly according to their conscience, without the use of intermediaries.
2. General. All citizens over the age of 17 or who are married have the right to vote, and those over the age of 21 have the right to be elected without discrimination.
3. Free. Voters have the right to vote according to their conscience without any outside influence, pressure, or coercion.
4. Confidential. Voters are assured that no party will know who they vote for or to whom they cast their vote.
5. Truthful. The committee, the government and political parties participating in the elections, election supervisors and observers, including voters, and all indirectly involved parties in accordance with applicable law and regulation.
6. Fair. In conducting elections, all political parties participating in the election receive the same treatment and no party commits misconduct.

Implementation of Electronic voting wasn't innovation technology issue in Indonesia. Many countries try and success to implement it. Estonia [5] is one of the countries that successful celebrate the election with technology. The success stories of Estonia are followed by another countries like Philippines, Bangladesh, and Bulgaria. The other country was finishing the electronic election is Australia, United State, India, Belgium, and Brazil. Indonesia is also discovering the opportunity to hold the general election. Since 2019, the research of electronic election has been explored from two general points of view such as: technology aspect and human aspect.

In technology aspect, Hyperledger Electronic election has been introduced to elevate secure data and process of election [11]. The benefit of block-chain is explored more to mitigate data leaks and abuse. Furthermore, the block-chain system must be

implemented in the real-world to know about security issues and improve performance because of massive access. A ballot design based on block-chain transaction was proposed. This study focused on the simulation of electronic voters with purposed ballot with UUID version 4, a modified block structure using SHA3-256 hash algorithm, and a voting protocol [12]. This simulation is implemented only the one device and for next development must be tested inter-devices with local area network and secure API.

The human aspect of technology is also an interesting issue. The researcher try to compare what different operation and rules between Indonesia versus Brazil and Australia [13]. The background of Australia electronic election is to avoid missing ballot and maladministration that happened in 2013 with paper-based voting. It was serious and not effective to solve manually. Brazil's e-voting run with on-premises system that the voters data embedded in specific personal computer. The data would transfer with USB from district to national committee election. The challenge is difficult to trackback the vote counting because there weren't features to count individual data in the report section.

Exploration about technology adoption existed. Transition between paper-based voting and electronic voting has been discussed with Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI). The aim of this study is to discover the readiness of e-voting implementation in Indonesia [14]. From this study, the readiness of those who use the electronic voting system is one of the determining factors for the system's successful implementation. Even though the privacy of voters is also important. In general, based on the survey of this specific respondent, they can agree with the purposed model and help the implementation at the future new technology.

The next step, this study also forum-group-discussion (FGD) the head of committee and their members to know about what the current issue and the operational election before (Table 1). The committee told the members of organization is about 60 people and the age is about 10 until 25 years old. The background study of members is various. Most of the members are juniors until high school members. The platform of smartphone is Android OS and iOS. Each member has a smartphone with Google Mail integration. About the operation, the committee highlights about several issue:

1. How can the system handle one voters only get one voting transaction?
2. How can voters easily access and register themselves into this system with smartphone and internet-connection?
3. How can the committee select eligible voters from this internet-based system? This issue is important because of the conflict with the second point.
4. Can the committee roles know who already voted or not?
5. How to maintain the privacy of each voter's choice?
6. How to show publicly each voter's choice anonymously to calculate the result? This statement is important to make this celebration election livelier like the paper voting.

From the several issues and the voting requirements, this study tries to map the requirements and the law aspect of e-voting.

Table 1. The correlation of the real issue and the law aspect of Voting

Number #	Description	Aspect of Voting
1	How can the system handle one voters only get one voting transaction?	Fair, General
2	How can voters easily access and register themselves into this system with smartphone and internet-connection?	Direct, Free
3	How can the committee select eligible voters from this internet-based system?	Truthful
4	Can the committee roles know who already voted or not?	Truthful
5	How to maintain the privacy of each voter's choice?	Confidential
6	How to show publicly each voter's choice anonymously to calculate the result	Confidential, Truthful

4 Proposed System and Result

From the analysis system, this study purposed online voting management over the internet. The purposed system design runs over HTTP protocol and uses web browser to accommodate the variation of operating system variations (Fig 3).

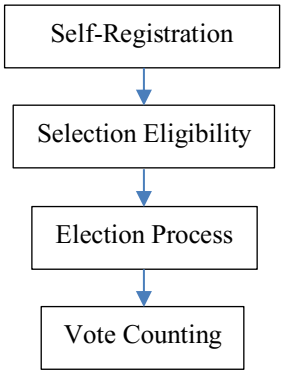

Fig. 3. Proposed Technology Architecture Framework

The system topology of this system is illustrated on Fig 4. The voters can easily access the system inside or outside the event room. Web server only accepts the HTTPS for secure the transactions. Polling Display screen is used to accommodate the real-time statistics voting process to know what number voters are already voted or not. After finishing the voting phase, the polling screen is used to display the vote count accumulated in the system. The purposed design data capture in Fig 5. Furthermore, this subchapter will explain details about phase of voting such as: Registration, Selection Eligibility Voters, Election Process and Vote Counting.

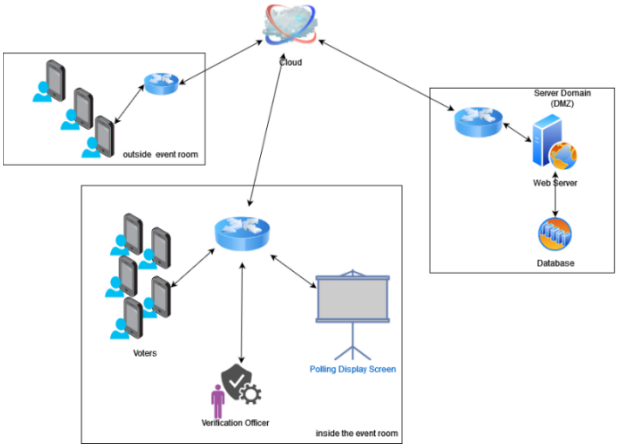

Fig. 4. Proposed Technology Architecture Framework

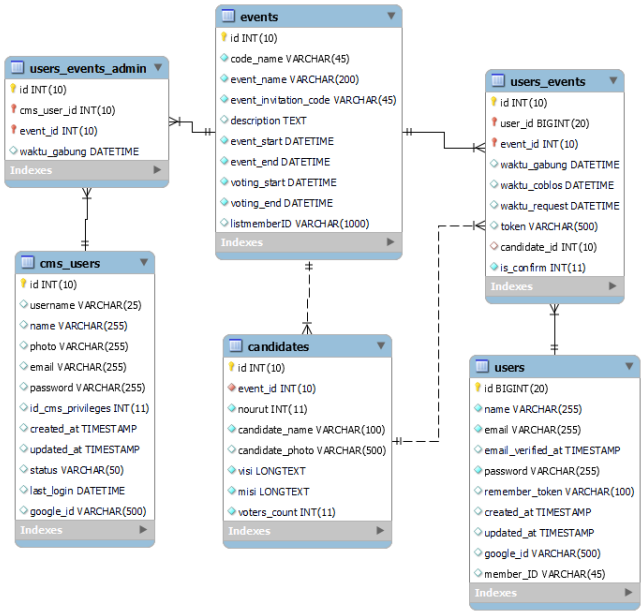

Fig. 5. Design Data System based on Analysis.

4.1 Self-Registration Process

For accommodate the value of “Direct” in voting process, the system provides self-registration of each user. The critical point of self-registration is member ID, event ID and active email. Google single-sign-on (SSO) is implemented in this section. The usage of SSO helps elevate the security system that the voters’ authentication and gives direct access into new system. SSO reduces the risk of leaked user data and increases use productivity by allowing mobility and access multiple service with sin-

gle authenticated data [15]. Voters don't need to remember new username and password for this system [16]. Google SSO is the familiar authentication methods and already implemented in real-world problem, so the mechanism is easy to accept the votes [17].

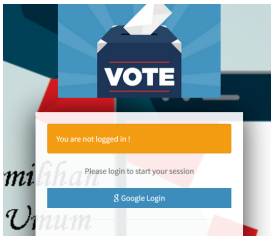

Fig. 6. User Interface of Self-registration Voter Process

4.2 Selecting Eligible Voters

After voters authenticated, they must submit the member ID and event ID like Fig.7. Each email correlates with a single member ID to reduce voter duplication. To verify more precisely, verification officer should verify the new voters that already join in this event. The list of member ID should be inserted into the system before one day of the election event and stored into table `events` and column `listmemberID`. From the committee's point of view, they can accept the new registered voter based on the member-ID and name (Fig 8.). For the detailed information, the system also provides the three timeseries such as Request Date, Join Date and Voting Date.

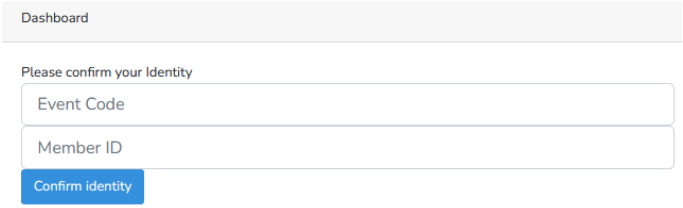

Fig. 7. User Interface of Request Voter

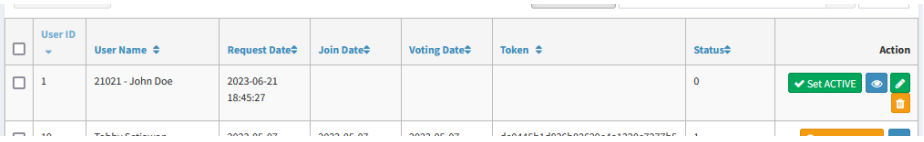

Fig. 8. User Interface of Verification Office

4.3 Election Process

The election process must be limited by time series. Each event must configure first about what time the event starts, what time the event ends, what time the election

starts and what time the event ends. This configuration must be declared by committee in the first time of event created. This limitation will impact when voter want to submit event-ID and member-ID. If an event's time start and end isn't fulfilled, then the system denies the process.

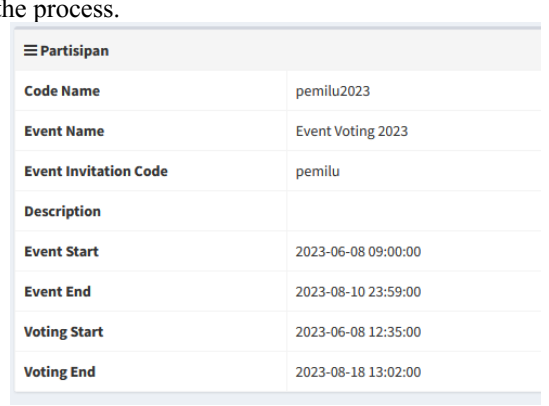

Fig. 9. Event Configuration

During the election, the system needs a one-page dashboard consisting of four dimensions like: the number of Voters, the number of Verified Voters, the number of voters who have voted, and the number of voters who have not yet voted. This page must show on the big screen or the TV or LCD Projector (Fig. 10).

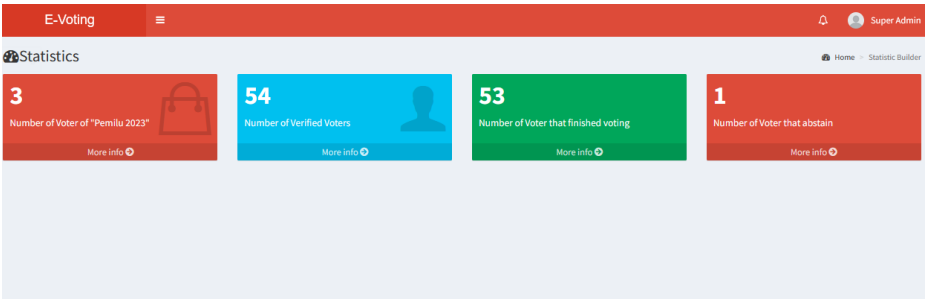

Fig. 10. Polling Display Screen during Election Process

In Voter's point of view, the system provided the active event and invite the voter for use their voting rights. To clarify more, the User Interface must declare with Voting deadline and Closing Time. This value is according with the early configuration. When it was time to vote and they didn't already vote, the "Vote" button will be active and appear on the screen (Fig 11.). The best method to implement is hiding the html element and protecting the router. Because of crucial action, this "Vote" button must be protected by confirmation box (Fig. 12)

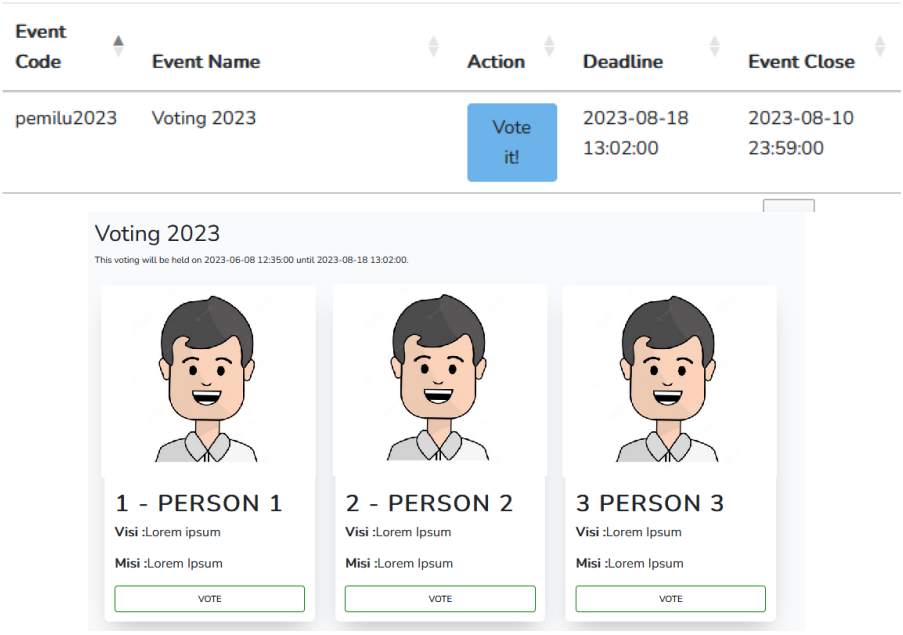

Fig. 11. Voter's User Interface during the election

```
@if(!$isvoted && $isWaktunyaVoting)
<button class="btn2 btn--block card__btn"
      onclick="return confirm('Are you choose {{$candidate->candidate_name}}?')">Vote</button>
@endif
```

```
0 references | 0 overrides
public function submitPemilihan($candidateid)
{
    $userLogged = Auth::user();
    $userid = $userLogged->id;
    $event = DB::table('candidates')->where('id', $candidateid)->first();

    $isvoted = VotingModel::checkStatusVoting($userid, $event->event_id);
    $isWaktunyaVoting = VotingModel::isVotingProcess($event->event_id);

    if($isvoted || !$isWaktunyaVoting){
        return redirect('/home');
    }
```

Fig. 12. Snapshot Code of Protected Voting Process from Controller and View

4.4 After Election and Voting Count

After voters execute this election and the election time is still active, they can't vote again. The Vote button disappeared, and the system gives the alert to give the vote

transaction ID (Fig. 13). This mechanism maintains duplicate voting. In the committee point of view, when the voting is still running, the “Result” button disappeared to maintain the privacy and unexpected effects because of data leaks.

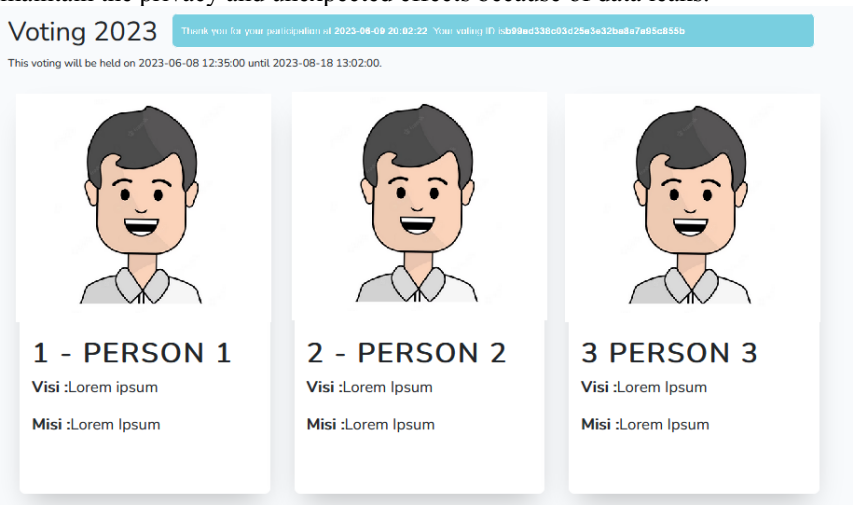

Fig. 13. User Interface after voter finished vote their leader.

When the voting ends, the result button will appear and show into Polling Screen. To make similar with paper-based voting, The system will count the votes sequentially from one to ten. The value of one means accumulating 10% of the initial total voters and so on until ten values. The user interface will automatically refresh in one second. To implement it, this study uses auto-refresh JavaScript method (Fig 14). At the end of result page, the confetti’s effect will show up to give the additional experience on the voting process (Fig 15). This study use HTML canvas for this implementation.

```
<script>
    function mulaiHitungVoting(){
        @if($progress < 100)
        setInterval(myTimer, 1000);
        @endif
    }

    function myTimer() {
        window.location.href =
        "{{ route('calculateVote',['eventid'=>$event->id,'progress'=>$progress+10]) }}";
    }
</script>
```

Fig. 14. Snapshot of Implementation of Countdown Timer

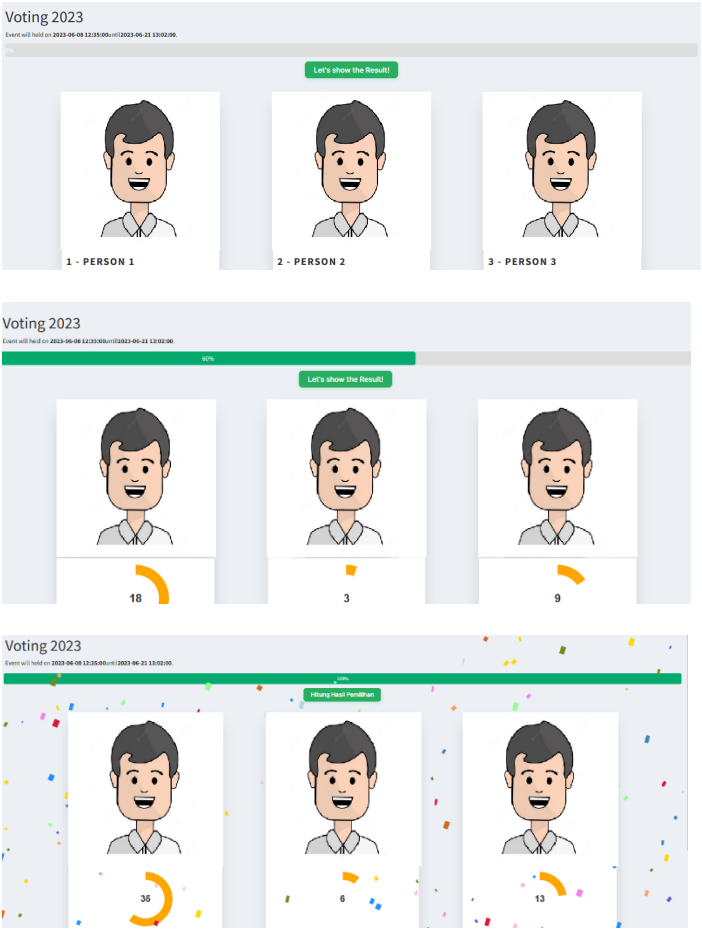

Fig. 15. User Interface of the Vote Countdown

5 Discussion

In this chapter, this study discusses about the evaluation of this system using technological acceptance model (TAM) corresponding with e-voting issues and attributes. Each voter fills the questionnaire about the usage of this system. Each question is formed with Likert scale from number 1 until 4. The small value means less or not contribute with this question. In contrary, the high value means strong contribute with the question. Total 53 respondent has already contributed. Table 2 show the detail of question that will be filled with voters.

Most of technology solution is already accepted by voters more than 95%. The system capable to handle voting process and mitigate the unknown voters join this event. With Google Single-Sign-On, the purposed system helps present and remote voter to

join the event with simple instructions. Selection process and monitoring progress during election process is running well. From voter's point of view, the system capable to secure the voter's privacy because no voter's name mention in polling screen. From the committee's point of view, setting the rules for "Vote" and "Vote Calculation" button based on events are important features to avoid wrong interactions. The "calculation process" have a minimum value because several votes are already left the event before the event end. In the system, there's no feature on voter's role that can show the result of voting. By design, the result of voting can access from committee's side.

Table 2. Questions and result about user acceptance

#	Topic	Quality Aspect	Questions	Points *(Up to 4.00)*
1	Handle once voting process for each voter.	Fair	Is there any similar behavior between voters?	3.87 (96.75%)
		General	Is there any similar action between younger or older voters?	3.93 (98.25%)
2	Easy to access.	Direct	Is there any difficulty to direct access the application?	3.91 (97.75%)
		Free	Is there any complex direction to login or registration?	3.92 (98%)
3	Select eligible voters.	Truthful	Is there any dialogue between committee and voter about voter's activation?	3.85 (96.25%)
4	Monitor Voting Progress.	Truthful	Is there any transparent data during the election progress?	3.87 (96.75%)
5	Maintain privacy.	Confidential	Is there any specific name that show in public about voter's opinion during election process?	3.88 (97%)
6	Calculate the voting result.	Confidential	Is there any specific name that show in public in voting countdown that inform voter's choice?	3.72 (93%)
		Truthful	Is there any transparent process to calculate the result based on number of voters?	3.71 (92.75%)

Table 3. Score acceptance test of each Aspect of E-Voting

Aspect	Score	Percentage (%)
Fair	3.867924528	96.69 %
General	3.924528302	98.11 %
Direct	3.905660377	97.64 %
Free	3.924528302	98.11 %
Truthful	3.811320755	95.28 %
Confidential	3.801886792	95.04 %

Table 3 show average score between each aspect of e-voting from Table 2. Based on the Table 3, we examine two aspects, Truthful and Confidentiality, have a minimum value. Several voters and committees are arguing about how the system calculates the score. Due to time constraints for socialization and education about the calculation process in detail, this issue arose. Only a few core committee members who have participated in the program since its beginning are aware. The other arguments is about technical issue such as security and trust with technical committee. If the system builds for national-wide, there're many various intentions to make this project failed with many various hacking methods. From the construction software system and data must be secure and difficult to change from technical such as databases. With this purposed method, that still using relational database with MySQL, the trust level to developer should the primary aspect.

The successful deployment of e-voting in this case study necessitates effective communication between the committee and the developer, emphasizing the human element. During the development phase, there was a significant amount of communication conducted through online social platforms as well as face-to-face meetings. The need encapsulates the characteristics of a single-share platform that aims to foster transparency and honesty in its operations. Prior to the commencement of the event, a simulation was conducted using an online platform to acquire knowledge regarding the entire procedure, spanning from its initiation to its conclusion. Engaging in this activity holds significant importance in establishing trust and providing substantiating evidence for the committee. The e-voting method involves the collaboration of developers and committees to facilitate the voting procedure. It is recommended that the developer actively participate in the vote process until its completion, aiding the committee in effectively managing and operating the system. To ensure responsibility following the event, the committee additionally provides a report containing the specifics of the voters' activity within the system.

6 Conclusion, Limitation and Future work

Indonesia's online elections face numerous obstacles and problems. The heterogeneous way of thinking and moderate to low digital literacy delay the implementation of electronic elections. Even though, researcher should discover and explore the aspects of acceptance with electronic election in Indonesia. Primary aspects, trust and homogenous vision between committee and voter, elevate the adaptation and willingness for voters to follow the new technology. To figure out whether acceptance technology measurement can help the implementation of e-voting in national area, then this study applies to a small and homogeneous organization.

Based on the proposed method, exploring technological requirements and the point of view of human experience with the system is an important point. Communication between committee and openness the procedural system must explain clearly. Core features of e-voting such as mitigate double vote, maintain privacy and easy to access must be stable and with zero errors to increase the people's adaptation. Detail of user experience and similarity between system experience and interaction with paper-

based voting become equally crucial factors. Direct communication from committee and developer should be consistent during this project to increase the trustworthy and decrease the denial of technology usage. For the future works, block-chain technology become important research to improve encryption data with decentralize method. This method can prevent the developer or hacker to modify data inside traditional database platform.

References

[1] E. T. Straub, "Understanding Technology Adoption : Theory and Future Directions for Informal Learning," *Rev. Educ. Res.*, vol. 79, no. 2, pp. 625–649, 2009.

[2] C. Unger-Windeler, J. Klunder, and K. Schneider, "A mapping study on product owners in industry: Identifying future research directions," *Proc. - 2019 IEEE/ACM Int. Conf. Softw. Syst. Process. ICSSP 2019*, no. May, pp. 135–144, 2019, doi: 10.1109/ICSSP.2019.00026.

[3] O. Springer and J. Miler, "A comprehensive overview of software product management challenges," *Empir. Softw. Eng.*, vol. 27, no. 5, pp. 1–38, 2022, doi: 10.1007/s10664-022-10134-5.

[4] S. Risnanto, Y. Bin, A. Rahim, and N. S. Herman, "Success implementation of e-voting technology in various countries : a review," *Proc. 2nd Fac. Ind. Technol. Int. Congr. Int. Conf.*, pp. 150–155, 2020.

[5] P. Ehin, M. Solvak, J. Willemson, and P. Vinkel, "Internet voting in Estonia 2005 – 2019 : Evidence from eleven elections," *Gov. Inf. Q.*, vol. 39, no. 4, p. 101718, 2022, doi: 10.1016/j.giq.2022.101718.

[6] M. Wahdini, "The Effectiveness of Simultaneous Election 2019," *J. Bina Praja J. Home Aff. Gov.*, vol. 14, no. 1, pp. 123–134, Apr. 2022, doi: 10.21787/JBP.14.2022.123-134.

[7] D. Young, "Software Development Methodologies," 2013. [Online]. Available: https://www.researchgate.net/publication/255710396_Software_Development_Methodologies.

[8] T. Thesing, "ScienceDirect ScienceDirect Agile Agile versus versus Waterfall Waterfall Project Project Management : Management : Decision Model for Selecting the Appropriate Decision Model for Selecting the Appropriate Approach Approach to to a a Project Project," *Procedia Comput. Sci.*, vol. 181, pp. 746–756, 2021, doi: 10.1016/j.procs.2021.01.227.

[9] F. Bachmid and H. Djanggaih, "The Future of E-voting Implementation in Indonesian General Election Process: Constitutionality, Benefits and Challenges," *Varia Justicia*, vol. 18, no. 1, pp. 34–51, 2022.

[10] Frenki, "Umum Di Indonesia Menurut Fiqh Siyasah," *J. Huk. Ekon. Syariah*, vol. 8(1), pp. 54–65, 2016.

[11] D. Seftyanto, A. Amiruddin, and A. R. Hakim, "Design of blockchain-based electronic election system using hyperledger: Case of indonesia," *2019 4th*

Int. Conf. Inf. Technol. Inf. Syst. Electr. Eng. ICITISEE 2019, vol. 6, pp. 228–233, 2019, doi: 10.1109/ICITISEE48480.2019.9003768.

[12] G. C. Prasetyadi, A. B. Mutiara, and R. Refianti, "Blockchain-based electronic voting system with special ballot and block structures that complies with indonesian principle of voting," *Int. J. Adv. Comput. Sci. Appl.*, vol. 11, no. 1, pp. 164–170, 2020, doi: 10.14569/ijacsa.2020.0110121.

[13] V. Taniady, B. Aditya Prawira Arafat, and H. Sutra Disemadi, "Sistem e-voting dalam pemilihan kepala daerah 2020 saat pandemi covid-19: Perbandingan Indonesia, Australia dan Brazil," *EKSPOSE J. Penelit. Huk. dan Pendidik.*, vol. 19, no. 2, pp. 1055–1064, 2020.

[14] D. I. Sensuse, P. B. Pratama, and Riswanto, "Conceptual model of e-voting in Indonesia," *Proc. 2020 Int. Conf. Inf. Manag. Technol. ICIMTech 2020*, no. August, pp. 387–392, 2020, doi: 10.1109/ICIMTech50083.2020.9211156.

[15] V. Radha and D. H. Reddy, "A Survey on Single Sign-On Techniques," *Procedia Technol.*, vol. 4, pp. 134–139, 2012, doi: 10.1016/j.protcy.2012.05.019.

[16] P. Pandey and T. N. Nisha, "Challenges in Single Sign-On," *J. Phys. Conf. Ser.*, vol. 1964, no. 4, 2021, doi: 10.1088/1742-6596/1964/4/042016.

[17] A. Purwinarko, W. Hardyanto, and M. A. Adhi, "Implementation of google single sign on (SSO) in the library management system," *J. Phys. Conf. Ser.*, vol. 1918, no. 4, 2021, doi: 10.1088/1742-6596/1918/4/042129.

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Atlantis Highlights in Engineering
Editor-in-Chief: Zheng Zheng

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Proceedings of the 4th International Conference on Informatics, Technology and Engineering 2023 (InCITE 2023) · Volume 21

OPEN ACCESS

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ISSN 2731-7927 ISSN 2589-4943 (electronic)
Atlantis Highlights in Engineering
ISBN 978-94-6463-287-3 ISBN 978-94-6463-288-0 (eBook)
https://doi.org/10.2991/978-94-6463-288-0

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part of Springer Nature
The registered company address is: Van Godewijckstraat 30 3311 GX Dordrecht Netherlands

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