

U-Vote: Ubiquitous Voting Model For General Election in Global Pandemic

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Abstract— for democratic countries, elections are usually scheduled according to applicable law. At the end of 2019, the world was shocked by the discovery of a new corona virus variant in Wuhan province - China, which was later named Covid-19. Not only in China, all countries in the world are affected by a pandemic in which people are not allowed to touch one another and gather directly. All social, cultural and political activities cannot be carried out, including elections that are scheduled according to the constitution. E-voting technology that has been around for about 30 years can be the solution as an alternative method to carry out elections in the pandemic era. The contribution of this research is the ubiquitous voting model for general elections, changing traditional e-voting for elections in the pandemic era, so that in practice, voters do not need to go to the polling station. Elections use the existing technology in the community and are carried out wherever voters are located, so that elections will continue to take place during the pandemic.

Keywords— *e-Voting, Ubiquitous voting, general election, Covid-19 pandemic*

I. INTRODUCTION

Elections are something that is normal for a democratic country [1], which can be carried out periodically and simultaneously in accordance with the laws in force in the country. Nowadays, all activities can be done with technology, and so is the election. Election technology namely e-voting has existed in this world since 30 years ago [2], and has been widely implemented in developed and developing countries. Some countries that have carried out e-voting are: India, Brazil, The Philippines, Argentina, United States, Belgium, Canada, Japan, Mexico, France, Peru, Australia, Costa Rica, Finland, Guatemala, United Kingdom, Ireland, Italy, Kazakhstan, Netherland, Germany, Paraguay, Norway, Switzerland and others [3],[4]. Of all those countries, not all of them continue this technology, for various reasons. Only four countries carry out simultaneously, namely: India, Brazil, The Philippines and Estonia [5].

At the end of 2019, the world was shocked by the detection of a new corona virus variant in Wuhan Province, China, which was subsequently named Covid-19. The spread of the virus is very fast throughout the world, so countries

affected by the pandemic following the World Health Organization (WHO) recommendations, by implementing restrictions on social relations. Gathering and direct communication are strictly not permitted. All social, cultural, political, and other activities cannot be carried out, as well as with elections, even though elections are the constitutional mandate for democratic countries.

E-voting technology which is used in this world, which has ever been or is being used by some countries is mostly in the form of a kiosk or a device that is installed in the crowd and polling stations [6]. In the four countries that simultaneously using e-voting in their general elections, three countries used technology installed in both polling and kiosk. Certainly this voting method was not in accordance with health protocols during the pandemic. Norway is the only country that implements e-voting using gadgets or computers [7]. The voters did not have to come to the location so that they could minimize the polling booths and do not create crowd.

Ubiquitous is a new technology that makes it easy for users to carry out their activities with media that are close to the user. E-voting, which has so far been used by countries in conducting elections, is still in the form of traditional tools. Ubiquitous voting (U-Vote) is the next generation of e-voting in which voters can vote using a media that is close to them. This technology can be applied to elections in the pandemic, because crowd and direct communication do not exist in this technology.

In this study we propose the U-Vote model or in the old term called remote voting, which can be used for the implementation of e-voting in the pandemic era. It is hoped that this concept can contribute to the advancement of e-voting technology, which of course in the future U-Vote will dominate more. Especially with the existence of a pandemic, all countries still have to carry out general elections during the pandemic. U-Vote is the only technology that is suitable for use.

II. LITERATURE REVIEW

Electronic voting or E-Voting is an election activity by technology. Voting activity is not done by paper ballots but

by choosing through machine and save votes or ballots in digital form[8]. E-voting is an election activity in which the recording and counting of votes are done by electronic media[9]. This activity can control parties who are not entitled to vote. The electronic voting machine is intended to reduce errors and speed up the counting process. According to kumar [8] the advantages of e-voting are:

1. Eliminating the possibility of invalid and questionable votes, which in many cases are the root causes of controversy in elections.
2. Making the vote-counting process faster and more accurate than conventional systems.
3. Reducing the amount of paper used, making it environmentally friendly.
4. Reducing printing, distribution and committee costs.

Meanwhile Riera and Brown [10] detailed some of the advantages of electronic elections, including:

1. Speed up the vote count
2. The results of vote counting are more accurate
3. Saving printed material for ballot
2. Save on the cost of sending ballot
3. Provide better access for people who have physical limitations (disabilities)
4. Provide access for people who have limited time to go to the polls
5. Ballot can be made into various language versions
6. Provides access to more information regarding voting choices
7. Can control parties who are not entitled to vote, for example because they are underage or they have exceeded the age limit of the voters that have been determined.

The word "ubiquitous" is more often paired with the word "computer" or information technology terms. Ubiquitous computers are a method for increasing the number of computer users by creating multiple computers in the user's physical environment[11]. Ubiquitous computers are new communication technologies, in which each node, both users and machines, can communicate with each other[12], making wider chances for innovation in software and computer engineering[13]. All tools can contribute to each other as a source of data such as gadgets, RFID or other tools.

The use of ubiquitous voting in electronic voting is a challenge for e-voting researchers, because the use of e-voting in particular for the implementation of elections has many problems in its implementation, ranging from constitutional factors[14], public trust in technology[15][16] and others. Only four countries that have successfully and sustainably held elections using e-voting technology, namely India, Brazil, the Philippines and Estonia [4]. However, that does not mean that e-voting is not visible to be used. It is sure that eventually technology will be used in these activities[17] and countries with advanced thinking will adopt e-voting technology later[18].

In December 2019, an outbreak of coronavirus 2 (SARSCoV-2) infection, an acute respiratory infection, occurred in Wuhan, Hubei Province, China, and spread throughout China and abroad. On February 12, 2020, WHO officially named the disease caused by the coronavirus novel as Coronavirus 2019 (COVID-19)[19]. At present, co-19 has become a pandemic because it has infected almost all countries in the world[20]. WHO often revises the health

protocol guidelines, because of their rapid spread Social restrictions are included in the health protocol, in which people are prohibited from carrying out social activities such as gathering and shaking hands. This rule has an impact on government and political activities. Election is one of them, because it will certainly result in a crowd at the polling station, so physical contact is inevitable.

The e-voting technology currently used mostly uses machines installed at polling stations[6]. A surge in e-voting technology is needed for general elections in the pandemic era. U-voting is the solution for such problem. The election process does not need to be postponed, and voters do not need to go to the polling station. Only by using gadgets to choose the candidates, and the elections can be carried out with cost and time efficiency.

III. PROPOSED MODEL

The principles of electronic elections are not much different from the principles of conventional elections, including:

1. Implemented directly by voters
2. Voters cannot vote more than once
3. Voters cannot see the results of other voters' choices
2. Election results can be trusted and can be audited through the voter track record (ballot paper)

A. TECHNOLOGY MAPPING

For the implementation of U-Vote, the most important thing is the readiness of the technology infrastructure. What should be underlined here is the mapping of components in the implementation of U-Vote, including:

- 1) The population database must be updated and stored in the population information system. This is important, because voter data is in it, and will be accessed during the election process and after the election.
- 2) Communication technology. One that is very important in the implementation of U-Vote, functions as the transmission of data on the delivery of the results of the vote to the election server. Communication technology must reach all regions of the country so that all citizens' rights to choose are served.
- 3) End user technology / software. There is a need for software that can reach voters' all models of gadget, and should be easy to use.
- 4) Security. Security is very important and vulnerable to all sides, namely: the selection process, the process of transferring data / ballots, the calculation process, and others.

An overview of the mapping of U-Vote technology components can be seen in the image below:

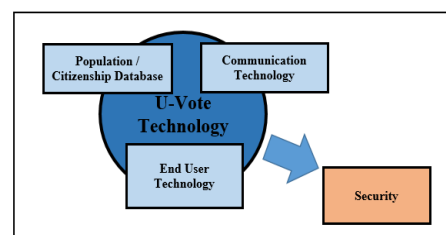


Fig 1. U-Vote Technology mapping

B. ARCHITECTURE

The next is the U-Vote architecture. There are needs of communication media mapping used by the public, and communication technology currently used by the State for various activities. In general, technology / gadgets that are

generally used by the public nowadays are smartphones, laptops and PCs. The existing of communication technology in general is the communication technology that is synchronous with the technology / gadgets used by the public. The proposed U-Vote architecture for general elections can be described below:

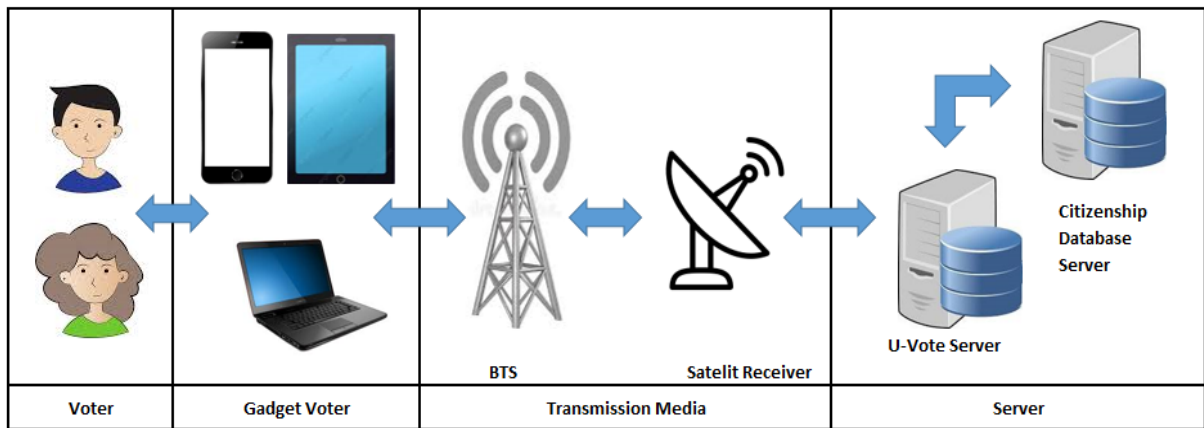


Fig. 2: U-Vote Architecture

C. VOTING PROCEDURE

1) Preparation

- U-Vote server retrieves eligible voter data, according to the existing regulations from the population database server.
- The general election commission prepares the applications for the registration of telephone numbers for the election activities. Later on, the telephone numbers will be sent via the general election software download link and OTP (one time password).
- Voters who have been set up prepare their personal IDs and telephone numbers that will be used in the election activities. Voters download and install the

registration application. Voters can install the application on their own gadgets such as smartphones, tablets, laptops and personal computers with any operating system model, then register their phone number through the application.

- The U-Vote server will verify and store voters' Personal ID and telephone number, which automatically saves the gadget's International Mobile Equipment Identity (IMEI) / Media Access Control (MAC) address when the voters have installed the general election application.

At this point the preparatory activities have been completed. The illustration of the above activities can be illustrated below:

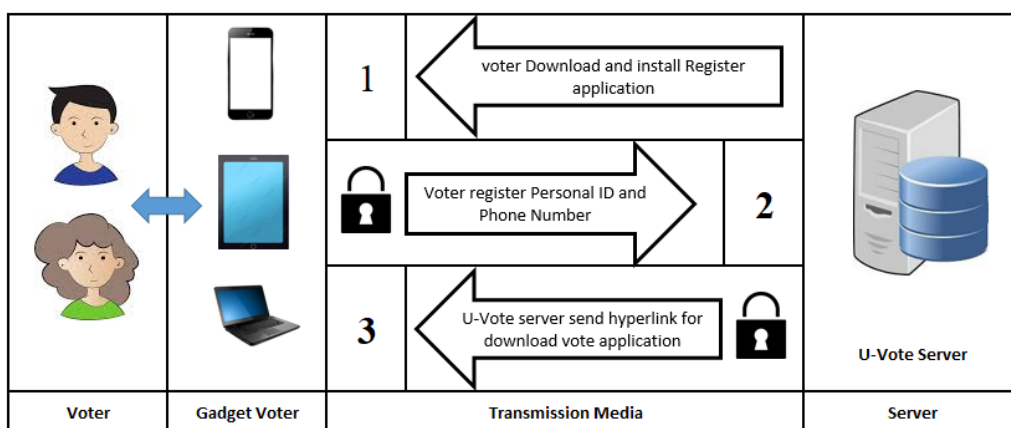


Fig. 3: Preparation Architecture

2) Voting Activity

- Voters open the general election application on a personal gadget. In this first stage, the voter writes

the Personal ID, then sends it to the U-Vote server.

- The U-Vote server verifies the Personal ID, whether it is registered, whether it has been

selected, and whether the IMEI / MAC Address number has been registered.

- U-Vote server sends OTP (one time password) via short message service (SMS) to the voters' telephone numbers that have been registered.
- Voters enter OTP in the voter application then enter the voting room.
- Voters choose the candidate of their choice then click send.

- U-Vote server verifies, saves the choice, marks the personal ID as the identity of the voter who has chosen and deactivated the application installed in the selector gadget and sends a letter as a description of the vote. Up to this point the selection activity is finished

The illustration of the above activities can be illustrated below:

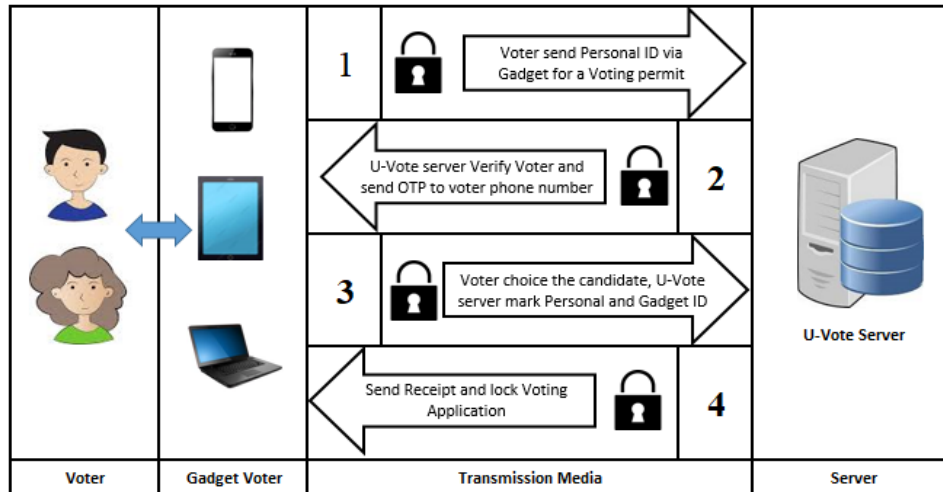


Fig. 4: Voting Activity Architecture

From the U-Vote model proposed for the general election during the covid-19 pandemic, it can be concluded that:

- There are efficiency of time, place and cost, because it does not require funds as much as conventional elections or e-voting, that use polling stations, storage of e-voting machines at polling stations, and committees.
- By the absence of a polling station (Polling Booth) and E-Voting machine placed at the polling station, this U-Vote model can be used in the moment of a pandemic because it does not create crowds and voters does not need to use tools alternately. The election process can be carried out at home, so that the general election process can still be carried out during the lockdown due to the pandemic.
- Start from the preparation process and the voting activities, the security factor is maintained, all data traffic is encrypted to anticipate virus attacks.

IV. CONCLUSION

The general election during the covid-19 pandemic can still be held even during the lockdown and social distancing. This Ubiquitous voting model does not require polling stations that create crowds, or voting machines placed at polling stations that are thought to be unhealthy because voters might use the machines alternately. The voting process uses a voter gadget, so that it can be carried out wherever the voters are.

However, technology is not the only thing that creates success in its implementation. Many factors might influence it, such as public trust and the distribution of technology used in the society. For further research, it is recommended that there should be research for the security of data transmission

and ballots, and the need to build a framework [17],[21],[22],[23],[24] for the implementation of U-Vote so that every country can use it.

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