Analyzing the Potential of Technology in Sri Lanka to Adopt E- voting: A Systematic Literature Review

Saraniya Selvanesan
Department of Industrial Management
University of Kelaniya
Sri Lanka
saranyaselva921@gmail.com

Prof. Janaka Wijayanayake
Department of Industrial Management
University of Kelaniya
Sri Lanka
janaka@kln.ac.lk

Abstract

In this digital era, technology plays a vital role in our day-to-day life. Technologies reduce human errors. Evidence shows that many of the countries moved to E-voting systems from a traditional pen and paper-based system. for fair and efficient elections. E-voting means allowing voters to cast their votes through websites or electronic voting machines. Sri Lanka is a South Asian Democratic country. In Sri Lanka, the traditional pen and paper-based methods are used for Election Process currently. Since E-voting has more advantages than the traditional election system such as E-voting is more efficient and secure and cost-effective. Although implementing E-voting technologies will expose how internal technologies are developed by a country. This study addressed the technology capability in Sri Lanka to implement an E-voting Technology. A broad systematic literature review has been done to identify how other countries such as India, Brazil, Estonia, Switzerland have implemented E-voting technologies. and what are technologies have been used to implement. Some critical factors need to be considered when implementing E-voting Such as Security, Environment, integrity, Perceived ease of use, and Perceived benefits are identified as an extension of the TAM model through a systematic literature review.

Keywords
E- voting, Sri Lankan election method, E-voting benefits, E- voting Technologies

1.Introduction
Elections play a major role in a modern democracy. It is necessary to select their representatives of the citizens. Along with the help of information technology, the voting process in many countries is no longer carried out with paper ballots. E-voting refers to voters casting their vote through a website or electronic voting machine. after the vote is cast by the voters, an electronic vote is digitally stored and transformed to the counting system from each electronic voting machine. Electronic voting machines were first used in India in 1982 on a trial basis.in the year 2004, Paper ballots were eliminated, and electronic voting machines were used totally. (Yi, 2019), (Avgerou et al.,2019), (Dalla, 2020). Brazil is a developed country, here also E-voting has been used for long and other countries such as Estonia, Norway, Finland, Switzerland is successfully implemented and other countries such as United States, Belgium, Canada, Argentina, Japan, Mexico, Peru, are partially implemented. The above countries are successfully implemented the E-voting system, but some countries have failed in e-voting adoption and cancelled or not continued E-voting method after tryouts such countries are Netherland, Paraguay, Germany. (Goretta, 2018). There are some common issues in the Paper ballot Electoral system such as many numbers of human resources needed to fulfil the election process and it takes much time to complete the selection process. From the security perspective, there are many frauds attempts such as vote manipulation, and in the vote polling state officers also can be in the part of the corruption and can be cause for fake votes, and for the paper ballots systems, the hand-counted method is using for vote counting, in that case, there can be chances to counting mistakes so this will lead to unfair election results. This

will lead to a loss the trust in government and election authority in a country. Traditional elections methods conventionally include high cost because to ensure security government need to appoint many security officers and for the election process also government need to appoint many officers for the government need to spend more money to pay their salaries. And in traditional election system ballots paper need to print for each election for that also huge amount of money spent by government officers, and These problems can only be solved with electronic voting technology. (Risnanto et al, 2019). "When comparing electronic voting system traditional voting system is far more behind and there can be some considerable issues". According to the election official's opinion also E-voting is easier and more flexible than the traditional voting system. (Ariyadasa, 2019)

There are some obstacles and limitations in the E-voting Implementation also, every country has unique needs. when implementing E-voting obstacles are difficult to change the government policies and lows and need to ensure security and reliability of e-voting system. need to ensure internet voting will be able to all socioeconomic groups, there can be a political risk related to trying a new voting system. Need experts to ensure security group. Sri Lanka is in line with the developing country where new technologies are implemented day by day such as 5G,4G online banking, E – channeling, medical and biological technologies, and Industrial Developments, when comes to the election process still we are using pen and paper-based traditional election system and hand-counted method to vote to count this is the only method for all the types of elections currently conducting by Election Commission of Sri Lanka. But Evidence shows when comparing traditional voting systems and electronic systems, the electronic voting system has more advantages than the traditional voting system. This paper mainly focuses on analyzing the applicability of E-voting in Sri Lanka. what are the critical factors and limitations that need to consider when implementing E-voting technologies, this paper can be used as a reference to implement e-voting technologies in Sri Lanka and other countries?

Technology Potential in Sri Lanka

In Sri Lankan new technologies implemented day by day. such as online banking systems, 4G, 5G technologies, medical and biological innovations. and industrial developments. But for the election process, we are currently using ballot paper and a hand-counted system for all types of elections conducting under the election commission of Sri Lanka. When talking about E-voting adoption internet availability and computer literacy level is the main 2 influencing factors. Statistical Evidence shows Sri Lanka has a similar computer literacy rate and internet user-level with countries like India and Pakistan, where India has been fully implemented an E-voting system and Pakistan partially implemented an E-voting system for the local elections. Accordingly, Table 1 Shows the computer Literacy Rate in Sri Lanka in Recent Years and Table 2 Shows that Internet User Penetration levels in Sri Lanka and finally table 3 Shows a comparison of Internet Penetration levels in India and Pakistan in the year 2020.

Table 1. Computer Literacy Rate in Sri Lanka

Year	Computer Literacy Rate	
2019	30.8%	One out of 4-person (aged 5 - 59) Computer Literate
2020	32%	One out of 3 Person (aged 5 - 69) Computer Literate

Table 2. Internet Penetration Level in Sri Lanka

Year	Sri Lanka Population	Internet Users	Increased Amount From last year	Internet Penetration
2020	21.21 million	10.10 million	399 thousand	47%
2021	21.46 million	10.90 million	800 thousand	50.8%

Table 3. A comparison of Internet penetration level in India and Pakistan in year 2020

Country	Population	Internet User (Million)	Penetration Rate
Pakistan	208.57 million	76.38	35.00%
India	1.38 billion	749.07	50.00%

Implication of the Problem
Sri Lanka has enough potential level to implement E-voting technologies. Previous explanations and tables clearly show the growth level of technology in Sri Lanka, but when considering the voting process Sri Lanka is using Pen and paper-based and hand-counted methods for all types of elections in Sri Lanka. Since other countries moved to E-voting for fair, secure, and efficient elections. Moreover, implementing these new technologies will show the world how internal technologies are implemented by a country.

Therefore, In Sri Lanka need such a system where people can vote without any problem and feel secure and no one can manipulate the results, such environment will be created through an electronic voting system.

1.1. Aim & Objectives of the Research

The study aims to analyses the current election system and suggest an authentic reliable E-voting system so that voters can securely submit their vote while maintaining time, verification, budget, and security of the entire system. to achieve this aim flowing objectives will follow. The Objective of the systematic literature review is to identify the current election process in Sri Lanka and analyze how other countries have been implemented E-voting and what are the technologies they have been used and what are the main factors that need to be considered when implementing an E-voting System.

Justification for the systematic literature review.
Evidence shows that electronic voting has more benefits than the traditional election system. Under benefits of E-voting, provide direct recording electronic machines can be used to record the voice so disable citizens to cast ballots independently. Electronic voting also helps conduct elections more efficiently and effectively, like reducing the cost associated with printing ballots and hiring extra polling staff and Security Staff. Although an Electronic voting system can also make the election process much quicker more secure and more accurately. in the E-voting process, human interactions are less when compared with the traditional voting system and here votes counting will be computerized so in the electronic voting system there are fewer chances of fraud attempts and machines are more accurate than humans so E-voting helps to reduce the human errors in generating election results. and in the electronic 12 voting system votes are saving to the database immediately so there are fewer chances to manipulate the votes. And in the electronic voting system, there are fewer chances to mark as invalid votes because the system will notify that if the invalid vote is cast so election results will be more accurate .and in the electronic voting system voters will be verified by using biometric verification so there are fewer chances to fake voters cast their votes. (Anthony & Naveed, 2017). “According to the election officers’ point of view, electronic voting machines save printing cost, easy to produce ballots in many languages and ballots also can update at last minute.” (Ariyadasa, 2019)

Statistical Evidence shows that Sri Lanka has a similar computer literacy level and internet penetration level with India and Pakistan where they have already implemented an E-voting system. for fair and secure election and when comparing infrastructure level and Economical level those India and Pakistan are more Similar to Sri Lanka, Moreover, implementing these new technologies will show to the world how internal technologies are developed by a country. Therefor In Sri Lanka need for such system where people can vote without any problem and feel secure and no one can manipulate the results, such environment be created through an electronic voting system. Thus, identified the research gab is analyze the potential level in Sri Lanka for the E- voting Adoption.

2. Literature Review

Many theories and research have been done under this E-voting area, how to make an efficient and secure voting system. This literature review covers the current election process in Sri Lanka and how other countries have been implemented E-voting systems and what are the technologies they have been used and the reviews on different e-voting systems.

Current Election Process in Sri Lanka
There are 5 types of different elections currently held in Sri Lanka. All the public elections are conducted by the Election Commission of Sri Lanka. The Election Process start after the official announcement of the Election Commissioner. Then candidates will register under their party and Paper ballot and voter's card will print, and the voter's card is used to identify the voters. It’s unique for each voter and voter’ card sent via post to voters. The election commission will allocate a particular place as a polling – booth in every regional Area. One day before Election Day ballots and ballot boxes will transfer to polling – booths with high security. The election commission will allocate

many government officials to every polling – booth to conduct the election smoothly. On the election day, voters can go to polling - booth and can show voters' card and national identity card to verify their self by officials. To Ensure whether a person is eligible for cote casting, Officials will check with the voters' list. Once voter verification is successful voter's card will be destroyed and ballot paper will be given to the voter and the voter can cast his/ her vote in a private place in the polling – booth, mark the vote need to be put into the ballot box.

End of the Election Day ballot boxes sealed by officers and will transfer to the counting center. Then Vote Counting Process will be started. Votes are counting by hand – counted method and this is the only method currently used for all types of Election and Recording the preferences received by each candidate or each party in the tally sheet and making a summary sheet into a district list for a party or group which will give the total number of votes received by each party or candidate in the electoral district. After results will be created and published to the public through media then Election Commissioner will announce the overall result and state the end of that election. (Ariyadasa, 2019)

E-voting in other countries

This Section will describe how E-voting has been Implemented in other Countries and what are technologies have been used.

- **Brazil: -**

Brazil is a developed country. Brazil started to use E-voting in 1996 for municipal elections. Mainly for two reasons Brazil have started to use E-voting. those reasons are Economic and fraud prevention. In the year 2018, there were 147 million votes cast through the DRE Voting Machines. [Risnanto.et.al, 2019]. Full E-voting has been Implemented in the year 2002, and this is the First Country Fully Implemented E-voting for elections. In the year 2009, A hacking competition was organized to make confidence in the technology. The CEV (Collector of Electronic Votes) is known as the first E-voting machine used for Elections and voter authentication and vote casting and calculation could be done by using this machine. In the beginning, a paper trail was also included in the system later because of the technical issues it was removed. Biometrics E-voting machine has been introduced and start implemented in the year 2012 after much advanced research. (Farog.et.al ,2016)

- **Estonia**

The E-voting idea was introduced in Estonia in the year 2001. But E-voting has been introduced in Estonia in 2005 but the voting process is through internet voting so there is not any specific E-voting machine. In the year 2011 around 24% of votes were cast online. There were two main objects behind implementing Internet voting in Estonia, those are increasing voters' participation in elections by increasing the interest of the young generation in voting and making voting easier with the use of ICT. In Estonia, internet voting is conducted for 7 days, and it starts 10 days before Election Day. To authenticate the voters' digital signature is currently being used, to verify themselves voters must give their legally accepted digital signature. Mobile Id, Identity document, and digital identity document can be used as a tool to give the digital signature. Since 2015 Election organizers must provide a possibility to the voter to check the integrity of the recorded vote. Voters can verify whether their vote has arrived safely, for this purpose a separate smart device (Mobile Phone, tablet) can be used. This method helps to increase the probability of detection of attacks. (Risanto.et.al, 2019)

There is a double envelops system based on an asymmetric encryption system was provided to separate the voter's details from the vote. A group of security experts have analyzed the system and verified that system doesn't have any security loopholes. Estonian ballots are comparatively simple, and the system is easy to handle. Most of the politicians are in favor of E-voting. (Farog.et.al ,2016)

- **India**

India is one of the largest democratic countries in the world. Electronic Voting Machine called "EVMs" in India, first used in 1982 for a limited number of polling stations in the state of Kerala. Before the introduction of E-voting India used traditional Paper ballots and hand counting methods for the Election Process. but it was so criticized because of fraudulent voting and booth capturing. The EVMs were first used in selected states such as Rajasthan, Delhi and Madya Pradesh for experimental purposes. The EVMs were used in the general election to the assembly of Goa in 1999 for the First Time. In the year 2011 various parties have alleged cases against the EVMs for failing to defeat the incumbent. after the ruling of the Supreme court of India and Delhi High Court in 2011 directed the Election Commission to include a paper trail to ensure the reliable operation of EVMs. then the election commission introduced a voter-verified paper audit trail (VVPAT) system between 2012 and 2013 and the improved system was tried in 2014 for Indian general Elections. In the year of 2019 Supreme court of India ordered to Election Commission of India to use VVPAT for every assembly constituency. (Farog.et.al ,2016). The EVMs were developed by the Election Commission of India with Bharat Electronics Limited and Electronics Corporation of India Limited. EVMs includes 2 units one is a ballot unit and the other one is a control unit these 2 units are separated by a 5m cable. The ballot unit

has labelled buttons so the voter can vote through the ballot unit while the control unit controls the ballot units. 7 Segment LED used to display the Results.

To ensure the security of the system, the controller used in EVMs has Its operating system Embedded permanently in the silicon by the manufacturer when Manufacturing. after the controller is manufactured no one can change the Program. The control unit is handled by one of the officers in the polling booth and the balloting unit is handled by the voter in privacy. once the officer confirms the voter's identification then only the electronic ballot unit activate to accept a new vote. EVMs relate to an ordinary 6-volt alkaline battery, this design ensures the use of EVMs throughout the country without worrying about power interruptions because server areas of India do not have a power supply. The Control unit and ballot unit cannot work without another one. At the end of the election day, 2 units are separated, and the control unit is locked and stored separated in the high-security premises. Hardware is can only be programmed when manufacturing, those cannot be reprogrammed. To ensure security both units have many tamper-proof protocols. and those do not have any internet interface or related hardware and wireless communication components inside. After the 2013 upgrade, Indian EVM can offer to a maximum number of candidates 384 and the "None of the above "option was added. The EVM is Securely tracked by the Election commission of India on a real-time basis with EVM Tracking Software. The M3 version of EVM with VVPAT is currently being used in India and it has embedded hardware and software that ensure that only a particular control unit can be used with a particular voting unit. Indian EVMs are stand-alone, not connected with the network. The balloting unit shows the voter with blue buttons particular party symbols and names are horizontally labelled. After the last voter cast his votes, the polling booth officer presses the "Close" button after that EVM does not accept any vote. In the vote-counting process, results will be displayed by pressing the "Result" button. After pressing the Close button only, the Result button can be pressed. The result button will be hidden and sealed, only the designated officer can press that button. Though there are some limitations in the EVMs one is, A candidate can be known how many people have voted him from a polling station. Bhutan Nepal, Kenya, and Namibia have purchased Indian EVMs. (Prasad.et.al, 2010)

- **United Stated of America (USA)**

There was a huge need for E-voting in the USA for a long time but there were many technical issues. but finally, in the year, 2004 E-voting was used fairly on large scale for National Elections. in that year 40 million votes were cast Electronically. After introduced E-voting People were more willing to move to E-voting Rather than paper-based Systems. Direct Recording Voting Machine (DRE) is mostly used by people in the Election Process. In the year 2000, 12.5% of votes were cast through DRE but in the year 2004, 29.5% of votes were cast through DRE. In the year 2013, there was an expert group was assigned to evaluate the system, and they recommended not to use the system for the election process because they mentioned there are many threats and the possibility of attacks on voter's computers. and there can be Internet vulnerability and Supplier could control the system. (Zafar, 2007). From the year 2012 DRE machines and optical Scans are used as E-voting machines and later these systems offer a paper audit trail for the voter verification process. In some states, voters can vote through the internet. US election site was hacked by hackers after that US government still in the process of Improved the Security of the System. (Farog.et.al ,2016)

- **Switzerland**

In a year Switzerland has 4 to 6 elections or referendums. So, there is a huge need of introducing E-voting in Switzerland. And because of this frequent election voters' participation is the law for the elections. There were many surveys has done to analyze public opinion and the survey showed that people have strong support towards E-voting around 66% of people want to have experience on E-voting and political parties and political administration also in favor of E-voting. Since 2004, Internet voting offered in 15 cantons. First decided to distribute CD-ROM to all voters, then a solution was found that is based on separate keys, one key is to log in to the system, another one is for the receipt from the ballot receiver and the other one is for authentication of the vote. E-voting is mostly influenced by the young generation. And People who have higher education level have chosen to E-voting than less education level. (Farog.et.al ,2016).

- **Australia**

Australian Electronic voting system called ACT, and it's first used in October 2001 for parliamentary elections and then again used in 2004. Personal Computers are used as voting terminals and voters authenticate themself by using barcodes. Each voting terminal is connected to a server in every polling station by using a local area network for security purposes. Remote voting is unavailable, public network like the internet is not using for transmitting any votes. Electronic voting is available in pre-poll voting centers from 3 weeks before the polling day. And in some polling stations available on election day. Voters can select whether to vote electronically or on paper ballots in polling

places. Electronic vote counting is the process of combines the counting of electronic votes and paper ballots. Linux open-source software is used to implement the entire solution because to ensure that election software is transparent and open to stakeholders, voters, and candidates. (Farog.et.al ,2016).

Various Proposed E- voting Ideas.
Many authors proposed many different E- voting technologies, table 4 shows various proposed E- voting Ideas.

Table 4. List of Contributions of researchers on E- voting Systems

SN	Authors	Inventions / Finding / Results
1	(Manasingh ,et al ,2020)	System based on IOT and RFID, mainly focused on the improvising Security
2	(Komatineni and Lingala, 2020)	E- voting system based on face recognition with Eigen face-based recognition algorithm and minutiae-based algorithm, two factor authentication for voter verification,
SN	**Authors**	**Inventions / Finding / Results**
3	(Mohan, et al 2020)	E- voting System Based on the Arduino Uno, system mainly focused on improving protection and voter authentication will be done by fingerprint authentication.
4	(Shakkeera et al, 2020)	E- voting system based on the cloud-based technology and blockchain, system mainly focused on integrity and data confidentiality, and reduce extra storage and time consumption in voting process.
5	(Li, et al 2020)	E_ voting system based on IOT and Blockchain, self – tallying systems in decentralized technology
6	(Khoury et al, 2019)	Proposed decentralized voting system based on blockchain and Ethereum protocol to make sure the security and integrity of voters and vote.
7	(Apiramy et al 2019)	By using fuzzy logic and hamming distance developed a retina-based smart voting system.
8	(Shaw et al, 2018)	Developed a Smart voting system based on Arduino Uno, Fingerprint based authentication for voter verification to avoid fraud attempts.
9	(Mello-Stark & Lamagna, 2017)	Developed an E- voting system based on authenticity and integrity from end to end, make sure to Security, and system based on a open source platform which capable of auditing.
10	(Deepika et al, 2017)	Proposed a smart E- voting system based on RFID and fingerprint technologies. This system for Indian Scenario, Aadhar and fingerprint details are stored in a single database for speed up the election process.
11	(Anik et al, 2017)	E- voting solution based on solar power, AVR ATMEGA8(28 pins) microcontroller is the main component, 3 main section 1- control section consists of LCD and keypad, by using Keypad need to input password ,3 stage password for ensure the security, 2- ballot section for cast the vote, 3- power supply section. System can use for vote casting and cote counting and publishing results 100% accurate, can store the data for long term and vote records kept confidential and if system is damaged, there is a option to retrieve the data.

12	(Selvarani et al, 2017)	Designed a e- voting system based on SMS, Cryptography and OTP, SMS is used for Voting and voter registration, Cryptography is to ensure the Security and OTP is used at the registration time and voting time. System mainly focused on Security.
13	(Barnes, 2016)	A fool proof e- voting system based on blockchain because blockchain is unchangeable so it' s used to secure voting and make sure that vote manipulation is impossible.
14	(Steam et al, 2015)	Proposed a technique based on micro controller, it used to compare iris, if comparison is unsuccessful an alarm buzzes and error message will display.
16	(Patil et al 2015)	Proposed a secure voting e- voting system based on AADHAR database and iris Scanner for the Indian Voting Scenario, voters verification will be done by compare the iris with Aadhar Database.
SN	**Authors**	**Inventions / Finding / Results**
17	(Malladi et al, 2015)	Proposed a voting system that uses terminals with automatic teller machine, to confirm the security and authentication OTP and Random security questions were used and this system provides cost – effectiveness and scalability and robustness.
18	(Matharu, et al 2015)	System based on the cloud computing all the necessary information stored in the cloud. And system used cloud computing power. Because of the cloud environment it added more value to the system such as scalability, cost effectiveness, system provide the quick and efficient data transfer. voters can vote from anywhere, because of the flexibility system will achieve higher percentage of turnout
19	(Nikkam et al, 2015)	System based on Near field communication (NFC). System ensure verification, integrity, confidentiality.
20	(Dixit et al, 2015)	System based on GSM technology with cryptography and iris techniques, GSM devise and cryptography technique used to keep the number of voters and voting information, stored immediately in database and iris technology used to voter authentication process.
21	(Ujir et al, 2014)	Proposed a secure voting system based on 3D face recognition. Three types of different modules used
22	(Agarwal and pandey, 2013)	E- voting system based on the unique voter identification of the user, password provide to ensure the safety.
23	(Adeshina and Ojo, 2014)	Online web portal. focused on technical configurations and implementation, system can be used to voter verification, and balloting and vote counting
24	(Mythili et al, 2014)	Voting system based on the SMS voting method
25	(Saranakumar et al, 2007)	E-voting system based on Fingerprint, fingerprint Images joining with voter Id, if vote casted successfully, message will send to the mobile number and there is a buzzer for find invalid attempts for security purpose.

Summary of the Literature Review

The literature review consists of three sections, section one explains what the current election process is carried out in Sri Lanka and. Section two briefly described how other countries have been implemented e-voting technologies, what are the limitations they have faced and section three, explain different E-voting ideas. According to the background study and analyzing literature explain about what are the factors that need to be considered when implementing an E-voting system and what are the strengths and weaknesses of this technologies. By analyzing the literature can be identified that there is a research gap in the Adoption of E-voting in Sri Lanka, no research hasn't done under this topic in Sri Lankan Context and the authors haven't talked about the feasibility of E-voting adaption in Sri Lanka in the technical point of view and what are the affecting factors on the E-voting Adaption in Sri Lanka and what are the influencing factors, Sri Lankan people and election commission officers opinion on the E-voting Adaption. Therefore, this research will be conducted to address the identified research gap and the identified problem in the Sri Lankan Context about the Adoption of E-voting in Sri Lanka.

3. Method

PRISMA 2020 theory was used for carried out the Literature Review.

Identification of the Literature

A literature search was conducted to support these studies. many web-based search engines Google Scholer, Research Gate, Emeralds, Semantic Scholar were used to identify related topics. Search term used as 'Adoption to e- voting', 'E-voting', 'benefits of E- voting', 'E- government'. Through the database, the search could identify (107) records and identify (5) registers by searching the reference list of published articles. It was not feasible to screen so many studies so some of them were removed because of Research papers not up to standard (5), difficult to understand the language, and those papers were published before 2005 (8). And there were some duplicate studies (18) that were removed.

Screening the Literature

After the inclusion and exclusion criteria, I got (81) records to be screened but within those records, 18 papers were excluded. And the reason was when reading the abstract of those papers that do not satisfy my research questions, so there is no point in including those records in my studies. After Excluding those records, I got (63) records to seek to retravel but within those records, 18 were removed because for those records I could not access the full text so cannot use those records for further studies. After removing those records, I got 45 records to check the eligibility of the record.

I checked the eligibility of the records within 45 records. Within those 45 records, 5 records were removed because those records did not have enough supporting agents, and 4 records were removed because of Unclear Hypotheses, and 3 Records were removed because of poor data analysis.

Include Literature

After removing all those records finally, I got 33 records to include in my studies. Literature was selected under the following criteria. Those are E-voting adoption, E-voting advantages, and disadvantages, E-voting Implemented

countries and E-voting technologies. Figure 1 Shows how PRISMA Flow diagram used for the systematic literature review.

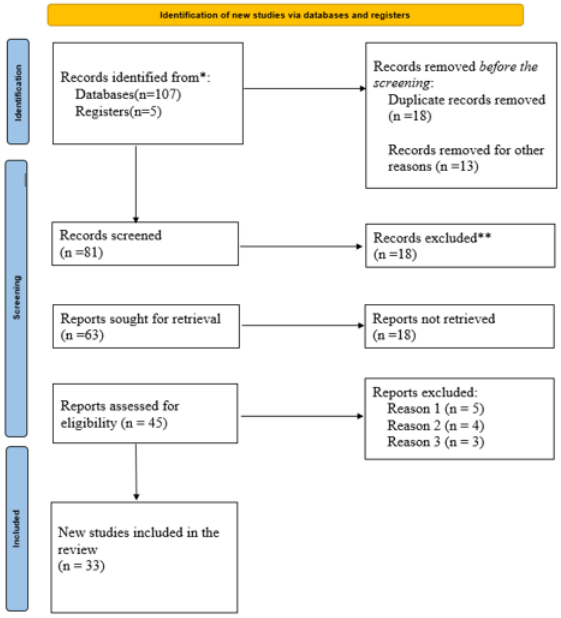

Figure 1. PRISMA flow diagram for systematic literature review

4. Results and Discussion

According, most of the identified literature talked about E-voting technologies, what are the various technologies used by different countries to implement E-voting for fair and secure Elections and when implementing an E-voting system what are the technologies that can be used in the future and what are the factors that need to be more considered. in that case, most of the literature talked TAM model or its Extensions such as perceived ease of use, Perceived benefits, and other critical factors identified from the literature. Most literature talked about security because security is the key aspect in the election process and E-voting technologies make sure to eliminate fraud attempts and vote manipulation in the election process. At the security confidential level is important, E-voting technology only allows an eligible citizen to access the system, to keep the security of the system, software and hardware components should be up to date. Although the E-voting system needs to ensure the voting and voters integrity. and the system should be cost-effective and less time consuming to fulfil the requirement. and should be easy to use by disabling citizens without any assistance. E-voting should provide a vote counting facility also then only election results will be more accurate. E-voting systems need to prevent data losses. When implementing E-voting technologies need to consider environmental factors such as power supply, internet availability, government policies and laws and political environment.

5. Conclusion

E-voting adoption is a proactive area. Many studies have been conducted worldwide in this area and its technology; Many countries moved to E-voting for efficient elections, and they have used various new technologies. These E-voting technologies are updated year by year. Sri Lanka is a developing country, has the potential to adopt new technologies Sri Lankan internet penetration level and computer literacy rate is increasing every year but In Sri Lanka Pen and paper-based elections method is still in Action. E-voting has many advantages over pen and paper election systems such as being cost-effective, secure, and efficient. so above study talked about Sri Lankan technology potential level and E-voting Advantages and how other countries have implemented E-voting and what are the technologies they used and what are the technologies that can be used in future and what are the critical factors that need to be considered when thinking to adopt E-voting such as Security, Perceived Ease of use, Perceived benefits and integrity, Environment. When implementing e-voting these factors should be considered if not e-voting results will be not

accurate, it will lead to a democratic voting process. So, when implementing E-voting in Sri Lanka, these factors need to be considered to achieve better outputs.

References

Haibo Yi, Securing e-voting based on blockchain in P2P network, *EURASIP Journal on Wireless Communications and Networking*,2019

Avgerou, C., Masiero, S., & Poulymenakou, A., Trusting e-voting amid experiences of electoral malpractice: *The case of Indian elections, Journal of Information Technology*, 34(3), 263-289, 2019

Dalla. L, The sustainability efficiency of E- voting techniques development and requirement techniques based on components specifications consistent: A Literature Review (LR), *International Journal of Engineering and Modern Technology* E-ISSN 2504-8848 P-ISSN 2695-2149, Vol.6 No.3, 2020

Goretta . H , Porbandar . B , Kumaralalita . L , Anggoro . O, Technology criteria analysis and E- voting adoption factors in the 2019 Indonesian Presidential election, *International Conference on Advanced computer Science and information Systems (ICACSIS)* , 2018

Risanto . S , Rahim . Y , Herman . N, Preparatory component for adoption E- voting, *IEEE 13th International Conference on Telecommunication Systems, Services and Application (TSSA)*, 2019

Ariyadasha. S, Applicability Of an Electronic voting System in Sri Lankan Context, *International Journal of Scientific and Research Publications*, Volume 6, Issue 2 , 2016.

Farog .M, Khan.M, Umair, Ahemed, E-voting System, 2016

Zafar. Ch, Pilkjaer.A, E- voting in Pakistan, 2007

Prasad. H, Halderman.J, Wustrow.E,Wolchok.S, Security Analysis of India's Electronic Voting machines.*Proceedings of the 2017 ACM Conference on Computer and Communications Security, CCS 2010, ChiCago , lllions,USA* , 2010

Anik. A, Rankhambe , Raikwar , Kashyap , Secured – E voting Using NFC Technology , *International Journal of Computer Science and Information Technologies*. Vol 5, 2017

Sarankumar. V , Sasikumar .M , Sathishkumar .K , Stephen.G , AADHAR Based Electronic voting systems Using Biometric Authentication and IOT , *International Journal of Research Trends in Engineering Research* , 2007

Apiramy. P , Retina based E- voting system using fuzzy logic and hamming distance , *International Journal of Advanced Research Ideas and Innovation Technology* , 2019

Khoury.D, Kfoury.E,Kassem.A, Harb.H , Decentralized Voting Platform Based on Ethereum Blockchain , *IEEE International Multidisciplinary Conference on Engineering Technology* , IMCET 2018

Shaw.S,Poddar.S,Dorga.S , Design and Implementation of Arduino based voting Machines , *Proceedings of International Conference on 2018 IEEE Electron Device Kolkata Conference*, EDKCON 2018,

Deepika, J., Kalaiselvi, S., Mahalakshmi, S., & Shifani, S. Smart electronic voting system based on biometric identification survey, *3rd IEEE International Conference on Science Technology, Engineering and Management*, 2017

Mello-Stark, S., & Lamagna, E. A. The need for audit-capable E-voting systems. *IEEE International Conference on Advanced Information Networking and Applications Workshops.* 2017

Selvarani, X. I., Shruthi, M., Geethanjali, R., Syamala, R., & Pavithra. S, Secure voting system through SMS and using smart phone application. *International Conference on Algorithms, Methodology, Models and Applications in Emerging Technologies* ,2017

Barnes, A., Brake, C., & Perry, T. Digital Voting with the use of Blockchain Technology. *Computing with Plymouth University*, 2016

Stem, I.-, Nithya, M. J., Abinaya, G., Sankareswari, B., & Lakshmi, M. Iris recognition-based voting system *International Conference on Science, Technology, Engineering & Management*, 2015

Patil, P. S. A., & Kote, P. G. IRIS Detection in Voting System. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, 3(8). 469-473, ISSN: 2321-9653, 2015

Malladi, K., Sridharan, S., & Jayprakash, L. T. Architecting a large-scale ubiquitous e-voting solution for conducting government elections. *International Conference on Advances in Electronics, Computers and Communications,* 2014

Nikam, R., Rankhambe, M., Raikwar, D., &Kashyap, A. Secured E-Voting Using NFC Technology. 5(6), 8325–832.2014

Matharu, G. S., Mishra, A., & Chhikara, P. (2015). CIEVS: A cloud-based framework to modernize the Indian election voting system. *IEEE International Conference on Computational Intelligence and Computing Research*, 2014

Ujir, H., Sing, L. C., & Hipiny, I. A modular approach and voting scheme on 3D face recognition. *International Symposium on Intelligent Signal Processing and Communication Systems, 2014*

Agarwal, H., &Pandey, G. N. Online voting system for India based on AADHAAR ID. *International Conference on ICT and Knowledge Engineering*, 2013

Adeshina, S. A., & Ojo, A. Design imperatives for e-voting as a sociotechnical system. *11th International Conference on Electronics, Computer and Computation* (ICECCO). 2014

Dixit, P., Phalke, S., Ubale, R., Gavali, A., Prajkta, S., & Aparna, S. A Biometric-Secure E-Voting System for Election Process. *International Journal of Advanced Engineering and Global Technology*, 2015

Mythili, K., Kanagavalli, K., & Shibi, B. An efficient method to avoid false voting using SMS voting approach. *International Journal of Computer Science and Mobile Computing*. 2014

Mansingh, P. B., Titus, T. J., & Devi, V. S. (2020). A Secured Biometric Voting System Using RFID Linked with the Aadhar Database, *6th international conference on Advanced Computing and communication Systems (ICACCS)*, 2020

Shakkeera, L., Prasanth, C., Sabareesh, Begum, Sumaiya., & Vali Sharmasth. Cloud Database Security in E-Voting System using Blockchain Technology. *International Journal of Recent Technology and Engineering (IJRTE),* 2020

Mohan, M. Madhu, M. Prakash, M. Madhusudan, and A. Kishore Kumar. Design of Secured Biometric Voting Machine. *International Journal of Research in Engineering, Science and Management*, 2020

Komatineni, S., & Lingala, G. Secured E-voting System Using Two-factor Biometric Authentication. Fourth *International Conference on Computing Methodologies and Communication (ICCMC)*, 2020

Li, Y., Susilo, W., Yang, G., Yu, Y., Liu, D., & Guizani, M. A blockchain-based self-tallying voting scheme in decentralized IoT, 2020

Biographies

Saraniya Selvanesan is an undergraduate. Pursuing a Bachelor of Science (Honours) in Management and Information Technology at the University of Kelaniya, Sri Lanka. Her Specialization area is Information and Technology. She is passionate about new technologies and implementations, and she is good at with problem solving and analytical thinking and time management. She is a good team player.

Prof. W M Janaka, Wijayanayake received a PhD in Management Information Systems from Tokyo Institute of Technology Japan in 2001. He holds a bachelor's degree in Industrial Management from the University of Kelaniya, Sri Lanka and a master's degree in Industrial Engineering and Management from Tokyo Institute of Technology. He is currently a Senior Lecturer in Information Technology at the Department of Industrial Management, University of Kelaniya Sri Lanka. He has experience in research and teaching in Information Technology related subjects at the undergraduate level as well as postgraduate level in Sri Lankan universities and foreign universities. His research findings are published in prestigious journals such as Journal of Information & Management, Journal of DATABASE, Journal of Business Continuity & Emergency Planning, International Journal of Business Continuity and Risk Management and many other journals and presented in many international academic conferences. His research interests are Information System Engineering, Data Engineering, Software Engineering, Business Intelligence, and Knowledge Management.