THE PROSPECTS OF M-VOTING IMPLEMENTATION IN NIGERIA

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ABSTRACT

Since independence, an average of 50% of registered voters participates in voting [1]. Similarly, an increasing rate of apathy was observed between the electorate and the elect, which was not unconnected with lack of transparency, accountability, and probity on the part of government [2]. Thus the electorate did not see the need to subject itself to any stress. Consequently, government is very committed to implementing the forth coming elections through e-voting. This paper proposes the prospects of m-voting implementation in Nigeria through the use of mobile phones, PDAs, etc. with guaranteed security, secrecy, and convenience in a democratization process. It also reviews the level of adoption of GSM in Nigeria, the implication of voting through the GSM, and finally introducing m-voting innovation in the voting process to increase voters' access and participation rate in elections.

Keywords: M-voting, Mobile devices, M-government, Mobile application and E-voting.

1.0 INTRODUCTION

According to Douglas Jones in [3], the first paper ballot began to replace oral voting in Rome in 139BC, and in the United States beginning in 1629. The first modern paper ballot, called the Australian ballot, was used in Australia in 1959. As of 1996, paper ballots were still used by 1.7% of the registered voters in United States. This method of voting is what the Nigerian system has been using in four out of five past elections that is, in 1979, 1983, 1999 and 2003 [4]. Countries in Georgia were the first jurisdictions to use punch cards and computer tally machines [5]. The marksense ballot, which utilized optical-scan technology, was used by 24.6% of registered voters in the United States for the 1996 presidential election, and their use is on the rise. Direct Recording Electronic Voting Machines (DRE) is a microcomputer implementation of a lever machine, invented in 1978. According to Kevin Bensor in [5], voters directly enter choices into electronic storage with the use of a touch screen, push buttons, or similar devices.

Electronic voting system (E-Voting) is a term encompassing several different types of voting. Electronic voting can include kiosks, the internet, telephones, punch cards, and marksense or optical scan ballots. Rick Semiatin, an American University Professor remarked that the optimal voting system is an electronic one with redundancy, or automatic back-ups, built into it [6]. Several states in the United States ran pilot programs on the Presidential Election Day 2000 to test e-voting as a valid process. These states include Arizona and California [7]. Other countries that have tested and found e-voting acceptable include Brazil, Belgium, Canada, India, Ireland, Geneva Venezuela, [4]. In California, which has a very good vote counting system, lot of it is electronic. This contradicts the punch card system used in Florida. The advantages of e-voting include streamlining the voting process, preventing ballot errors and confusion and increasing national voters

turnout [5]. Computers would streamline the voting process because they do not use paper ballot or bulky machinery. Computers are relatively easy to locate and set up in any typical polling location. Voting software could be ported to various operating systems and various machines, providing flexibility to different precincts. While Internet voting is appealing for the reasons given above, several recent studies suggest that there are still some considerable security risks. Others include voters authentication technical problems, ballot secrecy, ballot integrity, reliable vote transport and storage, prevention of multiple voting, defense against attack on internet voting machines or election computer system.

1.1 Mobile Voting System (M-Voting)

M-voting is a further development of e-voting and telephone voting system. Owners of portable phones can subscribe to a service which enables them to participate in choosing political officials into government seats. M-voting is the use of mobile devices for citizens input to political decision-making. It is an m-government initiative with tremendous potential to enhance democratic participation and serves as an enabler for more convenient ways to involve citizens in political decision making. M-voting is attractive around the world as a way of encouraging participation, particularly among the young and in remote areas. It is also potentially far cheaper than other alternatives [8]. It is simpler to administer and obviates the need for polling places and warehousing of tabulation equipment. M-voting has been deployed in a number of regions in the developed nations these include: French Assembly chamber of commerce elections in 2005 with over 600,000 voters; City of Issy-les-Moulineaux (France): First French legally binding elections in 2003; Freie Hansestadt Bremen (Germany) Regional election (A Local government election); and Kista Stadsdelsnamnd (Sweden) [9].

M-voting is not the replacement of e-voting, rather it complements it. While mobile devices are excellent access devices, most of them, particularly mobile phones, are not suitable for the transmission of complex and voluminous information. Despite the emergence of more sophisticated handsets, mobile phones do not have the same amount of features and services as PC-based Internet applications [10]. However, there are more people who do not have access to PCs than there are people who do not have cell phones or other wireless devices [11]. M-voting also means that a citizen does not have to go and search for kiosks, or even get a connection to the house. People now carry a mobile access terminal with them wherever they go. Other benefits of using mobile devices for voting include: portability and mobility, flexibility, convenience, remote accessibility, ease of use and utility.

2.0 MOBILE TECHNOLOGY AND DEMOCRACY IN DEVELOPING NATIONS

Developing nations now recognize mobile technology to be a powerful tool for enhancing citizen engagement in public policy making. Many of these nations have begun to experiment with a range of ICTs (e-government and m-government) to enable greater citizen involvement in policy–making and the initial experiences illustrates the opportunities, dynamics and limits of these new tools [12]. Most governments are working to bridge the digital divide and recognize the need to ensure that all citizens whether online or not, continue to enjoy equal rights of participation in public sphere [13]. The initial lessons and experiences draw out the following points:

a. Mobile technology is an enabler for participatory democracy. The integration of these tools with the existing structures will make the most enhancing public participation in democratic processes [14].
b. The barrier to greater citizen participation in m-voting is cultural, organizational and constitutional but not technological. Overcoming these challenges will require

greater efforts to raise awareness and capacity both within government and among citizens.

The value of m-government comes from the capabilities of applications supporting mobility of the citizens, businesses and internal operations of the government. For example, supporting law enforcement agents who are on patrol is a distinctive advantage of m-government services over conventional government implementations.

2.1 Mobile Device Penetration

Mobile devices are now taking significant roles in our daily and business life with one third of the world population currently having access to mobile phone. This growth has been spectacular especially in European countries after the telecom industry de-regulation and adoption of Global system for mobile (GSM) communication [15]. Also, in Africa, particularly in Nigeria, with the introduction of mobile communication in 2001 mobile phones are no longer used only for voice communication but are a convenient way of connecting to the Internet. They are also used for transferring data, exchanging e-mails, decision making such as voting, and doing small business transactions. Next to increase in the adoption of mobile phones comes the growth rate of PDAs and Pagers. In 2001 the total sales of PDA was estimated to be well over 20 million worldwide [15].

A 2005 study by the Centre for Economic Policy Research and backed by the UK mobile phone giant Vodafone found higher rates of economic growth in developing countries with high mobile phone penetration. According to the study, a developing country which has an average of 10 more mobile phones per 100 populations between 1996 and 2003 would have enjoyed per capita GDP growth that was 0.59 percent higher than an otherwise identical country [16].

Over 85 percent of small businesses run by black individuals in South Africa rely solely on a mobile phone for telecommunications. The results of this study suggest that growth in the African telecom market will continue to pay off for African economies. In 2001, Africa became the first region where the number of mobile subscribers exceeded those using fixed lines.

Year	Subscribers
1998	2 million
2002	28 million
2003	51 million
2004	82 million

Table1: Number of cell phone users in Africa [17].

Mobile phones are particularly suited for developing countries such as Nigeria because, Internet access rate is low but mobile phone penetration is growing rapidly, particularly in urban areas where the number of mobile phones has surpassed the number of fixed/ wired phones. Total telephone lines as at 2003 in Nigeria, amounted to 853,100 [18], and mobile cellular phones in use as at December 2005 amounted to 19 million. Daily Trust newspaper of 16th March, 2006 records that about 20 million Nigerians have mobile phones [19]. Also research carried out by eShekels publication [20], estimates that mobile phone owners will grow to 28.8million by 2007. This number by far outweighs the total number of telephone line users. Furthermore, with the current deployment of 2.5G by operators in the country, the type of phones in present circulation may face a replacement demand.

The growth in mobile phone users has also been identified in many individual nations, including 49 middle income and 6 lower income countries. Among these countries are Burkina Faso, Chad, Honduras, Indonesia, Jordan, Mexico, Mongolia, Philippines, Saudi Arabia, and South Africa. According to a recent study, the population of global SMS users will grow to 1.36 billion in 2006 [10].

In Table 2 a comparison of the four main categories of mobile devices with their differing properties and penetration is shown.

Type of Device	Weight	Capability	Battery Life	Penetration
Mobile Phone	60-120 g	*	****	****
Handheld PC	90-200 g	**	***	**
Tablet PC	80 – 1200 g	***	**	*
Notebook	1500-400g	****	**	***

*= low, **= medium, ***= high, **** = very high

Table 2: Comparison of Mobile Devices [21]

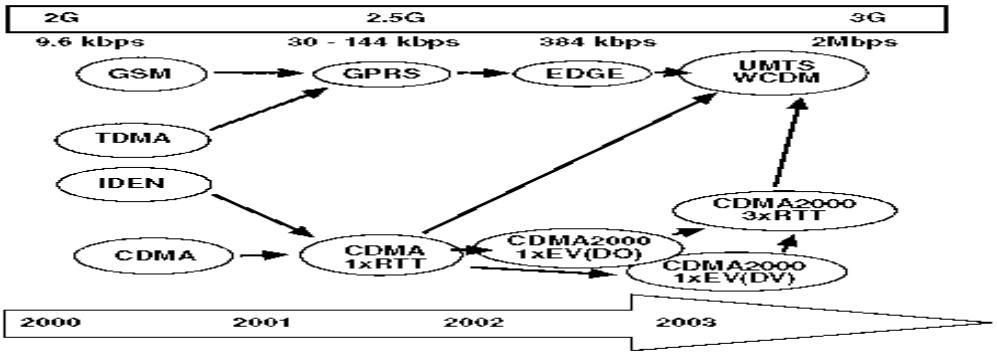
Figures released in March 2005 from the London Business School reported that Africa has seen faster growth in mobile telephone subscriptions than any other region of the world over the last five years. At the end of 2004 Africa's largest mobile phone firm, Vodacom, had 14.4 million users while MTN had 14 million subscribers. As Vodacom's chief tells Reuters, "Telecoms are Africa's big success story - perhaps the only one."

2.2 Major Concerns of Voting via Mobile Phones

1. The ability to convince the responsible political decision-makers of the advantages of m-voting. Therefore it is very important not to present the idea isolated from e-voting programs, but to put both of them in a close relation. M-voting and its tools have to be presented as a complement to e-voting and in addition to existing ways of participation.
2. The problem of persuading the users of mobile technology of the security of the system. This problem does not concern the whole democratic process, but above all the voting. Telecommunication companies and the federal authorities will have to work closely together and to work out an acceptable program [22].

2.3 Mobile Networking

One of the main components of m-voting system is wireless networking. Being wireless, gives the users opportunity to vote from anywhere the wireless network covers. There are different technologies for mobile networking and the bandwidths and speed rates of these technologies affects the types of applications in mobile networking. Figure 1 shows the different networks and bandwidth rates.



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and these includes; 1G, 2G, 2.5G and 3G. Figure1 and Table 3 shows examples of evolution of 2G networks to 2.5G and 3G networks and their data services.

Services	**2G**	**2.5G**	**3G**
E-mail	SMS	Text-based with small	Full attachment

		attachment	
Instant Messaging	SMS	Text-based	With Audio/Video clips
Web Browsing	Short text screens	100KB Web (text + image) page takes approx. 30 seconds to download	100KB Web page takes approx. 2 seconds to download
Streaming Audio/Video	No	Short clips	Yes
VoIP	No	Limited	Yes
File Transfer	No	500KB document takes approx. 2 minutes to download	500KB document takes approx. 10 seconds to download
Access to Corporate applications	Very limited	Text-based	Yes
Access to Corporate intranet, Databases	Very limited	Text-based	Yes
Location-based Services	No	Limited	Yes

Table 3: Examples of Data Services for 2G, 2.5G and 3G Networks [24]

2.4 Security Issues in M-Voting

User activities, weak username, and passwords, excessive permission, and users being deceived into revealing too much information can lead to security breaches in interactions between users and mobile devices.

Several mechanisms such as authentication, biometric authentication, smart card and so on can be used to alleviate these vulnerabilities. For the mobile client (mobile device), mechanism such as automatic logout, credentials re-entry, data destruction, database encryption and encryption of code-embedded usernames and passwords can be implemented to better protect mobile devices. Also code signing method should be used to ensure secure transfer of data to and from the server.

The wireless environment is less secured than the wired, and considering the importance of the voting process in a democracy, it is recommended that a third party (interswitch) be involved. This would forestall intrusion, denial of service attack and the 'gap-in-wap' syndrome

3.0 REQUIREMENTS FOR MOBILE VOTING SYSTEM

The development of any mobile application must address several types of requirements. Below are some lists of requirements for the mobile voting application development:

1. From the user's side, their mobile devices (mobile phones) are required which are already available. From the server side, servers and communication links will be required.
2. The capacity of the system will be made sufficient to deal with peak periods. Because network congestion could cause considerable frustration for people attempting to cast a vote [25].
3. The m-voting services should be such that the services are free of extra charges and also user-friendly as much as possible, so as to establish the citizens' confidence in the system and its applications.
4. It will be required that public law be put in place that this additional possibilities of politicking keep the same conditions as the traditional ways do. Legal restrictions have to be observed in areas such as: security and secrecy, integrity and

authenticity, and Data Protection Act. It is expected that adherence of the legal presuppositions will be of the biggest requirement of the system considering our polity.

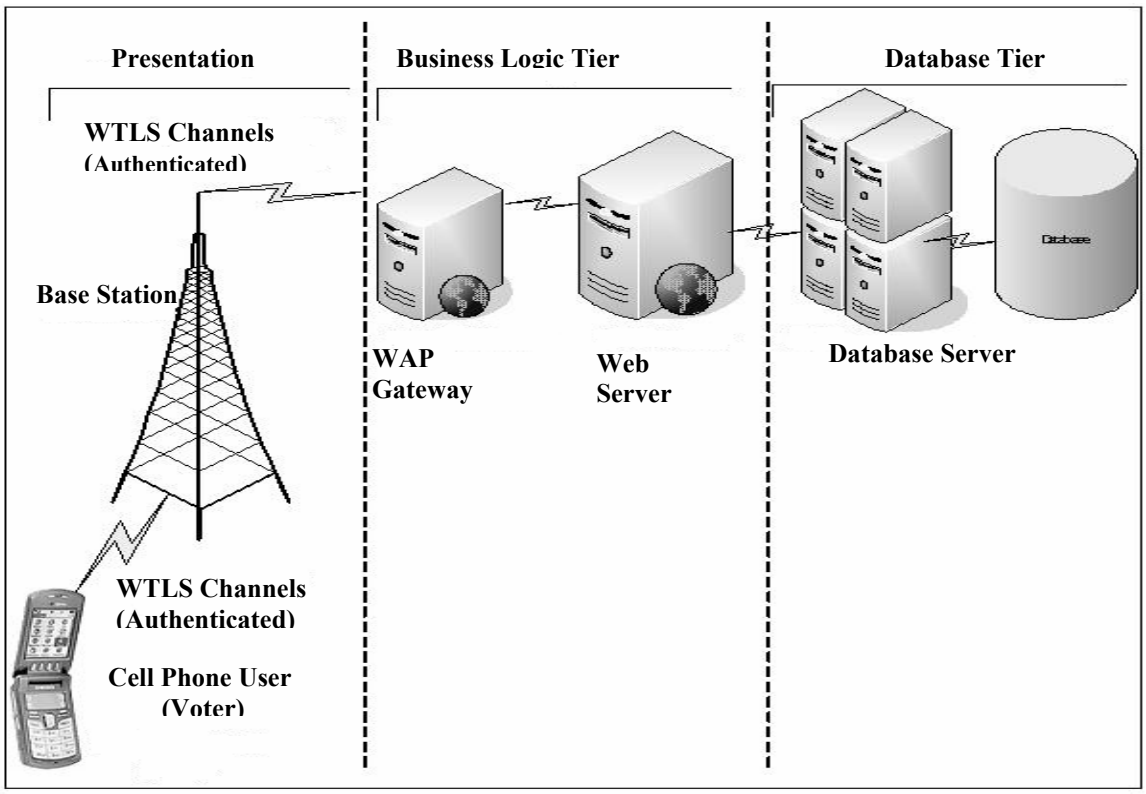
5. Election Requirements which include Eligibility and Authentication, Uniqueness, Accuracy, Verifiability and Auditability, Reliability will also be required.

4.0 THE M-VOTING SYSTEM ARCHITECTURE

The mobile voting application provides an example of mobilizing an existing web application so that it supports mobile devices such as the cellular phone. In this design, users are expected to have a constant network connection, and so we did not need to develop a fat client application for the mobile device. We merely have to create new WAP sites on the server that support a variety of mobile devices. It is expected that prior to the election, voters are physically registered at various designated registration centers where a voter's cards will be obtained. This is where the name, age, the thumb print, candidates ward, state of origin, local government area, sex, and other relevant voter information are captured. It is at this point that eligible voters are physically authenticated and registered. After registration the eligible voters obtain a voting card. The card will consist of a PIN code and a password which will be used to gain access to vote. Also, a code of five digits will be given to enable the voter gain access to the m-voting service. It is also expected that only WAP enabled mobile phones will be used. The m-voting system will be displayed on a mobile device (Cellular Phone).

4.1 System Architecture

The architecture of the mobile voting application is illustrated below. The mobile clients consist of the WAP browser (cellular phone). The mobile application consists of the following as depicted in figure 2, Presentation objects, Business objects, Data access objects and Databases. The mobile client has a zero application code layer on it. This means that it is a thin client. The server holds all the application code and it is organized as three-tier architecture.



This forms a simple architecture where the mobile client is assumed always to be connected to the server. Therefore there is no provision for storing application data on the mobile device. If the mobile device becomes disconnected, it will not be able to obtain up-to-date information until the connection is re-established.
The mobile clients are expected to cast their votes from different remote geographical regions. Each of these geographical locations will have its own server to ease congestion and easy administration during the voting periods. These servers collect all the data from that region and thereafter transfer it to the main voting server where the result will be collated.

5.0 CONCLUSION

When we weigh the requirements and the inherent roadblocks, m-voting appears to be relatively simple and a cost effective solution to open the citizen to ways of participation in elections. M-voting is easier to turn into action than e-voting projects; above all, the penetration of the mobile phone devices is much higher than that of the Internet, much easier for the users, and independent of location and time. The only risk that remains and which implementers should not run into is to consider m-voting as an isolated solution. M-voting is an ingenious voting initiative when considered in combination with or as a complement to other electronic voting systems. Furthermore, m-voting if adapted would enhance greatly the level of participation in elections as the elites who cannot stand the stress of voting in public domains can do so within the comfort of their homes. Similarly, the 3G licensing in the country will enhance the efficiency and reliability of data and video streaming through the WAP enabled mobile phone devices.

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