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# Electronics Voting Machine, a necessity for Nigerian Democracy

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**Abstract:** An Electronic Voting Machine was designed and constructed based on the approved parties in Nigeria. This is aimed at alleviating the problems of rigging, nullifying of elections, invalid votes and other electoral malpractices, which is the major setback in Nigerian democracy. The circuit consists of 8951 microcontroller, which controls the overall operations of the entire circuit, the decoder and the display unit. As the votes are cast, the machine decodes every voting and displays them on the screen and the results at each point of voting are seen by every voter at the polling station. Each voter's card which is inform of smart card can only be used once for a particular voting exercise and the machine was designed to rejects multiple voting from already used card, and hence audible alarm mode will be activated in such circumstances which will attract the attention of voters and security agents. The machine has a storage device that stores voter's choice of candidate and the stored results can be retrieved by electoral officials even in case of any eruption of violent.

**Key words:** Voting · Machine · Democracy · Microprocessor · Microcontroller · Display unit · Decoder · Transistor

## INTRODUCTION

Elections in Africa have always been characterized by diverse reactions from different quarters both locally and internationally. In Nigeria for instance, elections conducted have nightmare since democracy started. Elections have been characterized by different types of malpractices and rigging, including killing, burning of houses, destructions of properties, snatching of ballot boxes, nullifying of votes cast and falsifying of figures [1-4].

In most cases, elections in Nigeria have been referred to as free and fair elections, but elections tribunals keep receiving petitions of irregularities. Hence the so acclaimed free and fair elections were been nullified by various tribunal sitting in various states in Nigeria. These force the Independent Nigerian Electoral Commission, INEC to re-conduct the nullified elections thereby wasting the economic resources that could have been used in other sectors in the country [1, 2, 4, 5].

In most cases, the first person declared winner by INEC is been won by the opponent in court due to electoral irregularities after some months or years as in Edo state, Anambra state to mention but few. And that is why such state conducts their governorship election in a different day than other states in Nigeria [2, 3, 5].

These problems of elections malpractices, rigging and nullification of votes and candidate after declaring results and winner could be reduced the barest minimum with the adoption of electronic voting machine. Electronic voting systems employ the use of an electronic voting and counting processes [5-8].

The first system of voting that was generally adopted by states and organization was the paper ballot system in 1847. This system employs uniform official ballot of various stock weights on which the names of candidates and their parties are printed. The voters select their choices in private by ticking the boxes to the candidate and then drop the voted cards in the sealed box provided by the electoral commission or board. The paper ballot systems was adopted first in Australian State of Victoria in 1851 and in the other parts in subsequent years, hence the system become the Australian ballot. In United States of America, New York became the first State to adopt the paper ballot system for state wide elections in 1889. In Nigeria, this paper ballot system was adopted since independence till date. This system have been characterized with a lot of electoral irregularities with challenges ranging from snatching of ballot papers/boxes, mutilations of results, multiple voting, destruction of ballot papers to mention but few [2-5].

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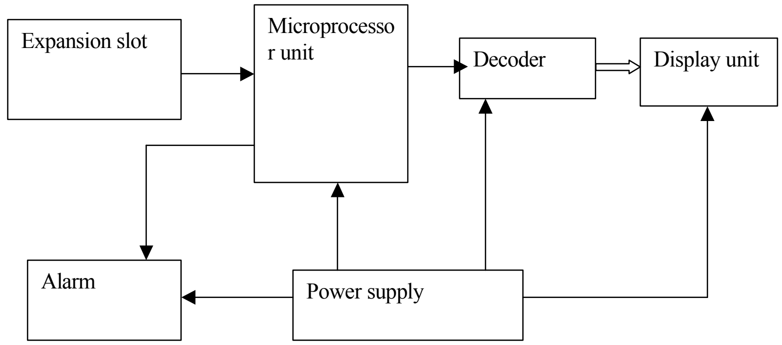


Fig. 1: Block diagram of the designed and constructed electronic voting machine

In 1892, a lever type voting machine known as Myers Automated Booth was first used in Lockport, New York. The machine was subsequently employed on a large scale in city of Rochester, New York and other parts of the state. In this machine, the name of each candidate or ballot issue choice is assigned a particular lever in rectangular array of levers in front of the machine. Then a set of printed strips visible to the voters to identifies the lever assignment for each of the candidates. This mechanical lever machine has been replaced with computer based mark sense or direct recording electronic systems. In 1964, Fulton and De Kalb countries in Georgia adopted the use of punch cards and computer tally machines for primary elections [4-7].

Then in November, 1964, Lane County, Oregon and San Joaquin and Monterey countries in California joined in using this for presidential elections. Punch cards systems employ a card(s) and a small clipboard sized device for recording votes. Voters punch in the cards opposite to the candidates of their choice. At the end of voting, the voter place the ballot card in a ballot box or this may be fed into computer voting tabulating device. In 1996, about 37.7% of registered voters in United State of America used some variation of punch card systems. Other voting systems used were marksence (optical scan) system. These systems employ the use of a ballot cards on which candidates and issue choices are printed next to an empty rectangle, circle, or oval or by completing the arrow. At the end of voting, the voters either place the precinct and the tabulating device reads the votes using dark mark logic whereby the computer selects the darkest mark within a given set as the correct choice of candidate. The marksence technology existed for decades and extensively in many areas such as standardized testing and wide lotteries. These systems of voting were used by about 24.6% of registered voters in 1996 presidential election in United States of America.

The recent electronic voting is the direct recording electronic voting and on-line voting. In this system, there is no ballot papers, the voters directly enters choice of their candidates with the use of touch screen, push buttons or similar devices. An alphabetic keyboard is often provided with entry device to allow for the possibility of write-in votes. The votes were stored in these machine and results displayed at the end of voting [2-5].

In Nigeria, the use of ballot paper/box are still been used in different arms of voting till date. This is why the elections in Nigeria were attributed with a lot of irregularities which always result to sometimes not getting the masses choice. The level of illiteracy and underdevelopment in Nigeria makes it difficult to adopt the recent electoral voting in developed world which include the on-line/ internet voting or even modern electronic voting machine. In this paper, the electronic voting machine was designed and constructed to overcome the challenges and reduce the irregularities noticed during elections in Nigeria.

The block diagram of the designed and constructed electronic voting machine is shown in Fig 1.

**Power Supply:** The power unit consists of a transformer, bridge rectifier circuit, filter circuit and voltage regulator. A step down transformer of rating 240V/12V, 500mA was used, with a 7805 voltage regulator to supply a steady +5V dc to the circuit [14-18].

*For 8951 microprocessor*

Maximum current, $I_{max} = 10m.A$

Supply voltage, $V_{cc} = 5V$

But $P = I_{max} \times V_{cc}$

$= 10 \times 10^{-3} \times 5 = 50mW$

For $74LS138$,

$I_{max} = 10mA, V_{cc} = 5V$

$P = 10 \times 10^{-3} \times 5 = 50mW$

For three components,

$P = 3 \times 50mA = 150mW$

For BC 557,

$I_{max} = 5mA, V_{cc} = 5V$

$P = 5 \times 10^{-3} \times 5 = 25mW$

For 27 components,

$P = 25mW \times 27 = 675mW$

For seven segment display with 20 components

$P = 140mW \times 20 = 280mW$

For speaker, $P = 500mW$

$\therefore$ *Total power requirment of the components = 50mW +150mW + 675mW + 280mW + 500mW = 4.175watts*

Power rating of the transformer = 4.175+0.835= 5.01 watts

But $P = IV$

$$Then\ I = \frac{P}{V}$$

where $P = 5.01$ and $V = 12V$

$$\therefore I = \frac{5.01}{12} = 0.418A = 418mA$$

Therefore, a 240/12V, 500mA transformer was used in the design.

**Microprocessor Unit:** The microprocessor unit controls the overall operations of the entire circuit. It controls the sequence of operation of the system. It collects the data, processes it and gives an output. When an instruction is received from the input buttons, the processor decodes the instruction, executes it, and assigns an output to the particular seven segment display designated for the data. The processor sends data to the display unit with the aid of the 3-to-8 line decoder [14-18].

**Display Unit:** The seven segment display used in this construction is the common anode arrangement. The supply voltage was connected to the anode of the light emitting diodes that made up the seven segment display. The common anode was connected to the supply voltage through a switching transistor. The transistor, which is pnp transistor, is based by the output of the decoder. When the the transistor is biases, current flows to the seven segment display. The emitter of the pnp transistor was connected to the supply voltage, the collector was connected to the seven segment display. The base of the transistor was connected to 74LS138 through a 1k resistor. The a, b, c, d, e, f and g inputs of the seven segment were connected to the buffer, 74244. The output of the microcontroller which is '0' through the buffer and the segment displays are connected to the ground. The microcontroller selects the segments to be energized by sending a '0' to bias the base of the transistor, hence amplified and send to a, b, c, d, e, f and g of the seven segment display. In this design, twenty seven segment displays were used in the connection. Each of the segments was connected to the microcontroller through a common bus [14-18].

For pnp transistor, BCC 557

$I_{b(max)} = 5mA$

$V_{cc} = 5V$

since $V = IR = I_{b(max)} R_b$

$$R_b = \frac{V_{cc}}{I_{b(\max)}} = \frac{5}{5 \times 10^3} = 1000\Omega$$

$$\therefore R_b = 1000\Omega$$

Therefore, $1k\Omega$ *resistor was used as the base resistor*

A bridge rectified circuit was used with a filter capacitor of $10pf$ to remove the pulsating ripples in the output of a rectified circuit.

Table 1:

| Registered voters | Voting | Working principle | Party voted for |
|---|---|---|---|
| Voter 1 | Card one slotted and button pressed | Indicator light shown and displayed increment 1 | APC |
| Voter 2 | Card two slotted and button pressed | Indicator light shown and displayed increment 2 | PDP |
| Voter 3 | Card three slotted and button pressed | Indicator light shown and displayed increment 3 | Labour party |
| Voter 4 | Card one slotted and button pressed | Audible alarm sounds, display 4 does not increment | Nil |
| Voter 5 | Card four slotted and button for voting pressed | Indicator light shown and displayed increment 4 | PDP |

**Working Principles:** Every registered voter will be issued with a unique voter's card in form of smart card. Each card will only be used for a particular voting exercise once. In an event for any voter(s) to attempt to cast multiple votes, the machine rejects the card and audible alarm sounds to alert everybody in the vicinity of such development. And the security agent will immediately arrest such person. The machine was designed to accommodate the number of political parties we have in Nigeria such as PDP, APC, APGA, Labour party, and etc. At the end of the construction, the device was tested and the following results were obtained.

From the result obtained in Table 1, the machine was designed to reduce the issue of multiple voting. The voter's card issued inform of smart card to the voters can only be used once in a particular election. The use of this machine reduces the possibility of tug, rigging and other associated irregularities that is prominent in paper ballot system as it were been noticed in Nigerian elections. The machine is easy to operate to accommodate illiterate voters and disable voters. Hence, it reduces the number of invalid votes that were been noticed in the usage of paper ballot system.

## CONCLUSION

The electronic voting machine was designed and constructed to take over the usage of paper ballot system that were being used for voting in Nigeria. Nigerian elections have been attributed with lot irregularities, and hence needed to be upgraded to modern ways voting worldwide.

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