DESIGN AND CONSTRUCTION OF AN ELECTRONIC VOTING SYSTEM WITH DIGITAL DISPLAY

BY

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2003/15371EE

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A Thesis Submitted to the Department of Electrical and Computer Engineering, Federal University of Technology, Minna.

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Dedication

To my sister, Mrs. Kate Sadoh

Declaration

I, Omijie Haruna Ben, declare that this work was done by me and has never been presented elsewhere for the award of degree. I also hereby relinquish the copyright to the Federal University of Technology, Minna.

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Acknowledgement.

I sincerely acknowledge God Almighty for making this day come to pass and for the success of this project work.

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To my Brother Mr. Julius Osetohamen thanks for being around. Many thanks to Mr. Irving Sadoh Akhidnor, you have been wonderful and I love you, Mr. Otaifo Akhidenor, many thanks and my brothers and sisters: OmijieVictor, Raphael, Jimon, Theresa, Noel, Benor Otulugbu, Suleman Alhassan and my baby girls: Cynthia and Ekpen.

Finally, I acknowledge everyone who in one way or the other contributed towards the completion of this project work. God bless you all.

Abstract

The essence of this project is to solve the problem of voting "for" or "against" a motion in state and national assemble. To solve this problem each senators should have buttons for "no" vote and "yes" vote, a display unit place at a strategic position in the hall, the display unit help to display the number of "yes" votes and "no" votes. As a prototype, the project was design for 6 senators; however, it could be expanded to accommodate any number of senators. Logically since the project worked for 6 senators one can conclude that it will work for as many as possible. Therefore, the project can be said to be successful.

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CHAPTER ONE

1.0 GENERAL INTRODUCTION

The essence of democracy is that everyone airs his/her view independently [1]. In places like the national assemble: upper and lower house, where crucial issues are deliberately upon often end up in deadlock which result to fighting . A better way to decide who carries the day might be through voting "for" or "against" the motion. The manner in which voting "for" or "against" motion is being done is not encouraging, if we continue like this I doubt if Nigeria will ever get to the promise land. Sometime last year I was privilege to witness one of such it actually ended up in deadlock. To decide who carries the day those "for" the motion moved to the extreme end of the building, those "against" the motion moved to the other end. Counting was done and results announce while these processes where going on I observed three (3) things:

- The voting was not a fair one
- People voted dependently (godfather)
- Time wasting

To avoid future occurrences of such. This project is aim at designing and construction of a voting machine or system. With this system in place distinguish senators and members of house of representative can vote electronically and independently.

1.1 Electronic Voting System

The electronic voting system is a system that can be used to simultaneously provide the number of "yes" votes and the number of "no" votes for example

This type of system can be used where a group of people are assembled and there is a need for immediately determining opinions (for or against) making decisions, or voting on certain issues or other matters.

In its simplest form, the system includes a switch for "yes" or "no" selection at each position in the assembly and a digital display for the number of "yes" votes and "no" votes [15]

1.1.1 Microcontroller

The microcontroller (AT89C52) is the central processing unit of the electronic voting machine. Its function is to accept inputs signal from the switches placed at each position in the assembly and to make sure no double voting is allow, once a switch has being pushed it automatically disable the other switch at the same position in the hall. The microcontrollers also sum-up the "no" and "yes" vote and displays the numbers separately [17].

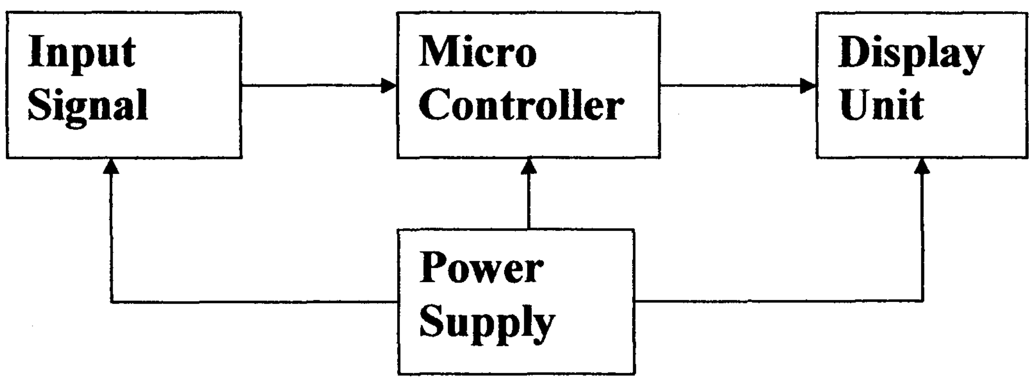

Fig.1.1 Block diagram of electronic voting system.

1.2 AIMS\OBJECTIVE

The design and construction of Electronic Voting system and Digital Display is aim at: -

- Introduction of automation in voting process to meet the challenges of the ever-increasing population.
- Reducing fraudulent acts such as rigging and other electoral vices.
- Eliminating errors due to counting since the votes will be display digitally
- It will help to ensure prompt and timely release of election results.

1.3 Methodology

The construction was carried out in three modules. The first module was the construction of the power unit on the bread board and then tested the second module was the construction of the logic unit using microcontroller on the bread board and then tested While the third module was the construction of the display circuit.

1.4 Scope of Work

This project write-up is a report on the design, construction and testing of an Electronic Voting system with Digital Display.

Chapter one gives the general introduction of the project, objectives and the methodology of the project. Chapter two gives the literature review and the theoretical background of the project work. Chapter three gives the design and implementation, calculation and choice of components used. Chapter four gives the series of the test carried out, the result obtained and the discussion of the result, and the short coming or limitations of the project work.

The last chapter gives the conclusion and the recommendation for future improvement of the work done with references to all the theoretical work.

1.5 Sources of Materials

All the materials (components) used for the construction of this project were sourced locally from electronic vendors at the correct specifications and rating of the components.

CHAPTER TWO

Literature Review\Theoretical Background

2.1 Literature Review

At the very beginning of ancient democratic government, we find Athens coming out to their open market square to cast votes by counting the numbers of people that raise up their hands in favor of a particular candidates. The Ancient Greece citizens also adopted another method by using pieces of broken pottery to scratch in the name of the candidate in the procedures of ostracism; this was done because while parliament was expensive and had to be imported from Egypt broken pottery was abundant and virtually free [6].

These processes continue until the population of people grows and becomes so large to handle. The open market square practice and broken pottery practice became insufficient due to lack of space to accommodate or gather together all the people at a time and the task of counting which is bulky and tedious, leading to errors and some other fraudulent acts.

As a result of the insufficient of these practices the ancient democracy paved way to the contemporary institutions of democracy through open and secret balloting by the use of ballot box and papers. The first use of paper ballots to conduct an election appears to have been in Rome in 139 BCE [6] and the first use of paper ballots in North America was in 1629 within the Massachusetts Bay colony to select a pastor for the Salem church. Also the secret ballot was first introduced in Australia in the 1850s [6].

The secret ballot system is one of the most used in this part of the world. Although, is a highly adopted system, it has limitation in the area of sorting out and counting of total number of votes cast which is manually done, time wasting and late release of results.

The limitation of this balloting system coupled with the technological advancement led to the use of electronic devices as voting system\machine

In advance countries such as America, some part of Europe e.t.c. Different system\machine has been in use. The system\machine ranges from punch card, direct recording electronics (DRE) system, and optical scan voting system [1] etc.

The electronic voting systems have been in use since the 1960s when punch card systems debuted. The newer optical scan voting systems allow a computer to count a voter's mark on a ballot. DRE voting machines which collect and tabulate votes in a single machines, are used by all voters in all elections in Brazil and also on a large scale in India, the Netherlands, Venezuela and the united sates, Internet voting systems have gained popularity and have been used for government electrons and referendums in the United Kingdom, Estonia and Switzerland as well as municipal elections in Canada and party primary elections in the United states and France [8].

This technological advancement has helped in automating and computerizing of voting process. So, many people have taken advantage of this development to come up with their own ideas and worked upon this topic. Different people with the combination of different circuitry have produced different voting systems\machines. For instance; the electronic ballot counter box, the unanimous vote counter machines [5] etc

2.2 Paper Ballot

The paper ballot system employs uniform official ballots of various stocks Weights on which the names of all candidates and issues are printed. Voters record their choices, in private, by making the boxes next to the candidate or issue choice they select and drop the ballot in a sealed ballot box.

This paper ballot system was first adopted in Australian state of Victoria in 1856 and in the remaining Australian states over the next several years. The paper ballot system thereafter became known as "Australian ballot." New York became the first American state to adopt the paper ballot for statewide elections in 1889 [7].

2.3 Mechanical Lever machines

On mechanical lever voting machines, the name of each candidate or Ballot issue choice is assigned a particular lever in a rectangular array of levers on the front of the machine. A set of printed strips visible to the voters identifies the lever assignment for each candidate and issue choice. The levers are horizontal in their unvoted positions. The voter enables the machine with a lever that also closes a privacy curtain. The voter pulls down selected levers to indicate choices. When the voter exits the booth by opening the privacy curtain with handle the voted levers are automatically returned to their original horizontal position. As each lever returns, it causes a connected counter wheel within the machine to turn one-tenth of a full rotation. The counter wheel, serving as the "ones " position of the numerical count for the associated lever, drives a " tens" counter one-tenth of a rotation for each of its full rotation. The "tens" counter similarly drives a "hundreds". If all mechanical connections are fully operational during the voting period, and the counters are initially set to zero, the position of each counter at the close of the polls indicates the number of votes cast on the leer that drives it. Interlocks in the machine prevent the voter from voting for more choices than permitted.

The first official use of a lever type voting machine, known as the "Meyer Automatic Boot" occurred in Lockport, New York, in 1892. Four years late, they were employed on large scale in the city of Rochester, New York, and soon were adopted statewide. By 1930, lever machines had been installed in virtually every major city in the United States, and by the 1960s well over half the Nations votes were being cast on these machines. Mechanical lever machines were used by 20.7% of registered voters in the United States as of the 1996 presidential election. Because these machines are no longer made, the trend is to replace them with computer-based mark sense or direct recording electronics systems [7].

2.4 Punch cards

Punch card systems employ a card [or cards] and a small clipboard-sized. Device for recording votes. Voters punch holes in the cards (with a supplied punch device) opposite their candidate or ballot issue choice. After voting, the voter may place the ballot in a ballot box, or the ballot may be fed into a computer vote-tabulating device at the precinct. Two common types of punch cards are the "votamatic" card and the "datavote" card. With the votomatic, the locations at which holes may be punched to indicate votes are each assigned numbers. The number of the hole is the only information printed on the card. The list of candidates or ballot issue choices and directions for punching the corresponding holes are printed in a separate booklet. Votamatic cards are direct descendents of the original punch card developed from a concept introduced by political scientist and former government administrator Dr. Joseph P. Harris with datavote, the name of candidate or description of issue choice is printed on the ballot next to the location of the hole to be punched.

Fulton and De Kalb counties in Georgia were first jurisdictions to use punch cards and computer tally machines when the adopted the system for the 1964 primary election. In November 1964 presidential election, these two jurisdictions were joined by lane county, Oregon, and san Joaquin and Monterey counties in California, who also adopted the punch card system. Although many jurisdictions are now switching from punch card systems to more advanced mark sense or DRE systems, Los Angeles County, the nation's largest election jurisdiction with 3.8 million registered voters, continues to rely on their punch card voting system. In the 1996 presidential election, some variation of the punch card system used by 37.3% of registered voters in the United States [7].

2.5 Mark sense (Optical) scan)

Mark sense systems employ a ballot card on which candidates and issue choices are preprinted next to any empty rectangle, circle, oval or an incomplete arrow. Voters record their choices by filling in the rectangle, circle, or oval, or by completing the arrow. After voting, the voters either place the ballot in a sealed box or feed it into a computer-tabulating device at the precinct. 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 or vote. Mark sense technology has existed for decades and used extensively in such areas as standardized testing and statewide lotteries. Although mark sense systems are often referred to as optical scan systems, mark sense technology is only one of several methods for recognizing marks on paper through optical reading techniques [7].

2.5 Direct Recording Electronics (DRE)

The most recent configuration in the evolution of voting systems are known as direct recording electronic, or DRE They are electronic implementation of the old mechanical lever systems. As with the lever machines, there is no ballot; the possible choices are visible to the voter on the front of the machine. The voter directly enters choices into electronic storage with the use of a touch screen, push buttons, or similar device. An alphabetic keyboard is often provided with the entry device to allow for the possibility of write-in votes. The voter are stored in these machines via a memory cartridge, diskette or smart card and added to the choices of all other voters. In 1996, 7.7% of the registered voters in United States used some type of direct recording electronic voting system.

Therefore, it is on these bases that I opted to harmonize the use of microcontroller and display unites to synthesize an electronic system known as electronic voting system with digital display as an introduction to the automation of the voting process [7].

2.6 Theoretical Background

Theoretical, the Electronic voting system with Digital Display In its simplest form, it includes a switch for "yes" or "no" selection at each position in the assembly and a digital display for the number of "yes" votes and for "no" votes [15].

Structurally, the system is a simple but highly efficient and reliable device; it makes use of low cost components which are locally sourced from vendors, in-fact, the choice of the design and construction of this particular voting system is due to the efficiency, reliability, availability and low cost of the components used.

The system is aimed at preventing electoral vices such as rigging, the bulky task of counting the total number of votes cast and the late release of election results and so on.

2.7 Constraints

Several difficulties were encountered in the cause of this project work. Sourcing of materials "on" and 'before' the commencement of this project work was an uphill task because a lot of finance was spent on transportation to get the materials ready for the construction also a lot of money was spent sourcing for materials used in the write up of this project work.

Other problems were encountered during the construction process; some of the components used got damaged it took time to get them replaced, the work slowed down at this period. Also the constant power failure in the town was a serious problem faced during the construction and typing of this project work.

CHAPTER THREE

DESIGN AND IMPLEMENTATION

3.1 Power Supply Unit

The power supply unit comprises the following

- Power transformer circuit
- Rectifier circuit
- Filtering circuit
- Power regulating circuit

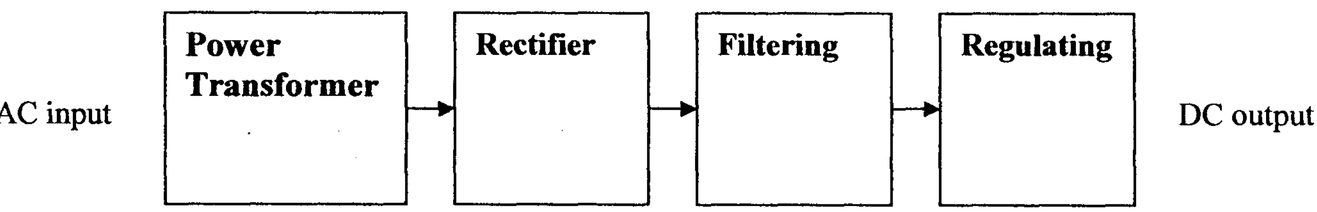

Fig. 3.1 Block Diagram of power Supply Unit

3.1.1 Power Transformer Circiut

The first block consist of the transformer.the primary winding consist of N1 turn is connected to the 220v ac supply,the secondary winding having N2 turns is connected to the rectifier. The ac voltage developed at the secondary of the winding is 220 (N2\N1) volts (rms) by selecting an appropraite turn ratio (N1\N2) for the transformer the input ac voltage can be stepped down to an appropraite ac value required for the dc output voltage [9]

3.1.2 Rectifier Circuit

Rectification is the process of changing AC to DC. Diodes are commonly used as rectifiers in power supplies. there are two (2) major classifiation of Rectifier circuits: half-ware and full-ware, the full wave rectifier is employed in this project.

3.2.1. Full-Wave Rectifier Circuit

Since the half-wave rectifier makes use of only one half of the AC input wave, it's uses is limited to low-power applications.Using full-wave rectifier, a less pulsating and more powerful direct current can be produed by rectifying both half-cycles of the AC input wave.

The bridge rectifier circuit was chosen since it an be used in transformer type as well as line-operated power supplies it also required no center-tapped transformer. The bridge rectifier circuit uses four (4) diodes to obtain full-wave rectification. As shownin fig. 3.2. below

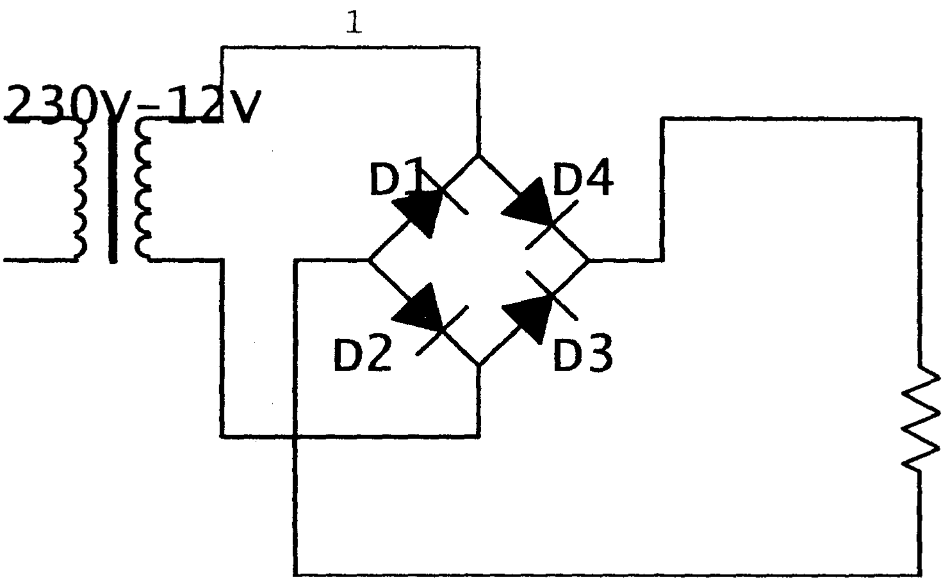

Fig 3.2: The bridge rectification circuit

CALCULATION

It is required to power the system with a 5v constant power supply. The 5v positive regulator IC, LM7805 was used. The a.c mains voltage was step-down by a 240\9v, transformer, Ti and rectified by a full wave bridge rectifier consisting of D1,D2,D3 and D4 as shown in fig 3.2 above the rectified voltage is smoothen by capacitor C1 and the resulting voltage is fed into a constant IC while a constant mains supply is obtained.

Since rms of the transformer secondary winding is 9Vrms

The peak value of the voltage, $V_p=\sqrt{2}*V_{rms}$

$=9*\sqrt{2}=12.7V$

for safe operation, the peak inverse voltage (PIV) rating of the rectifiers must be greater than Vpeak, therefore, the diode IN4001 with PIV of 50v was chosen

3.2 Filtering Circuit

A filter is used to reduce the amount of AC ripple, thus providing a relatively pure form of DC. This is because the pulsating DC output of the rectifier circuit is not smooth enough to properly operate most electronic devices

The main function of filter circuit is to minimize the ripple content in the rectifier output as shown below

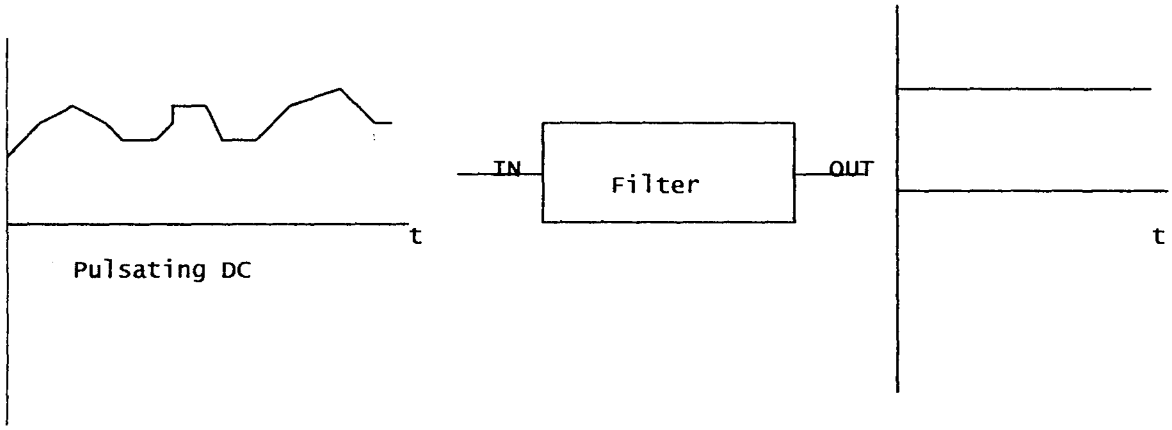

Fig 3.3 AC component in DC power supply

The most common filter device is a capacitor connected in parallel with the output of the rectifier circuit. The filter capacitor is large value electrolytic capacitor. It makes an excellent filter because of its ability to store electric charges.

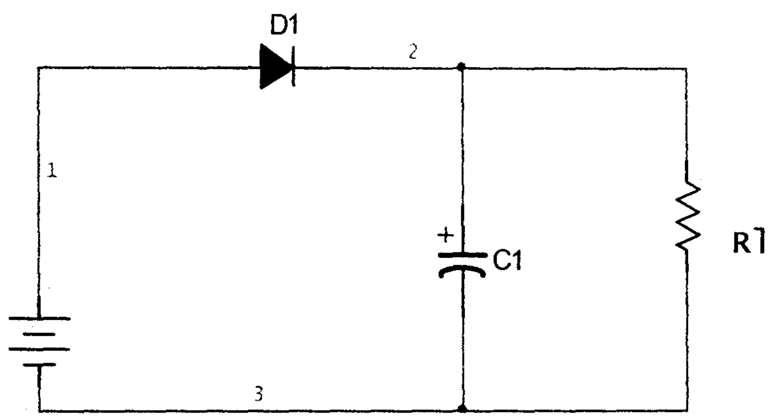

Fig 3.4: Capacitor filter connection

CALCULATIONS

To calculate for the filtering capacitor, C

Recall, $C = \frac{I}{\left(Fr.Vr\right)}$

Where I= the maximum load circuit

Fr= frequency of ripple voltage

Vr =allowable peak to peak value of the ripple voltage

For a full wave rectifier, frequency of ripple voltage =

2* frequency of mains voltage

Fr = 2f = 2*50 =100Hz

I = 0.5A

Vr = 3v

Therefore, $c = \frac{0.5}{100*3} = 1667*10^{-3} f$

$= 1667*10^{-6} = 1667Nf$

This is the minimal value of capacitance required. Its voltage rating must also be greater than Vpeak = 12.7v

The value of 35v, 3300Nf was chosen

LED_7 is a power indicator and Rr is the current limiting resistor.

$Rr = \frac{Vs - Vd}{Id}$

Where Vs = supply voltage

Vd = voltage drop

Id = current across the led

$$Rr = \frac{5-2}{3*10^{-3}} = 1k\pi$$

3.3 Power Regulating Circuit

A voltage regulator is an electrical regulator design to automatically maintain a constant voltage level. It may use an electromechanical mechanism, or passive or active electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages, with the exception of shunt regulators, all modern electronic voltage regulators operate by comparing the actual output voltage to some internal fixed reference voltage. Any difference is amplified and used to control regulation element, this forms a regulative feedback some control loop. If the output voltage is too low, the regulation element is commanded to produce a lower voltage; however many just stop sourcing current and depend on the current draw on what ever it is drawing to pull the voltage back down. in this way, the output voltage is held roughly constant. the control loop must be carefully designed to produce the desired trade off between stability and speed of response [11].

The power regulating circuit enables the power supply to maintain a constant voltage under varying input voltage or varying load current [9]. An Ic voltage regulator was employed to provide the regulated power supply stability output voltages of 5v was regulated using 7805 Ic voltage regulator with a permissible load current of 1A, the Ic voltage regulator was mounted on a heat sink to radiate any excess heat out. In addition, a 1Nf, 160 capacitor was fitted to the output of the regulator to keep the output resistance of the circuit constant of high frequency.

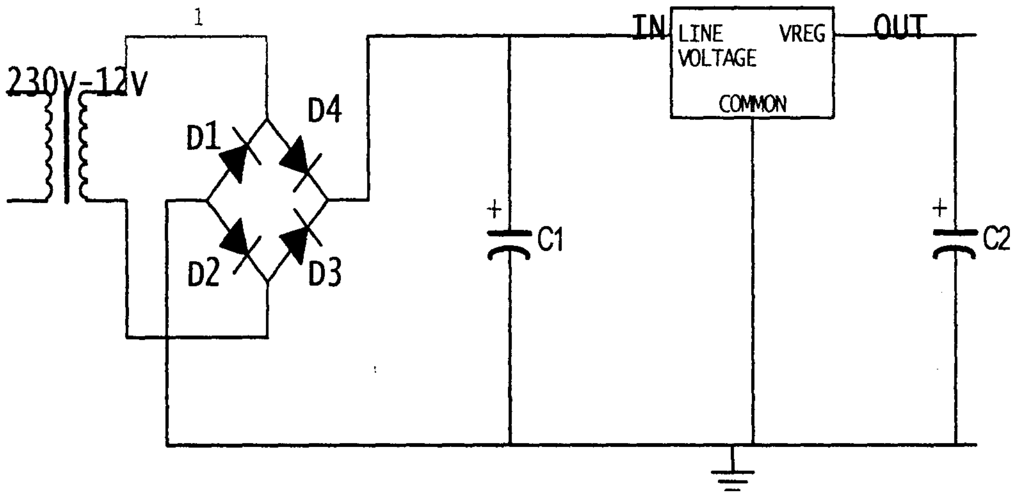

Fig 3.5 power supply circuit

3:2 AT89C52 MICROCONTROLLER PIN DIAGRAM AND PIN FUNCTIONS

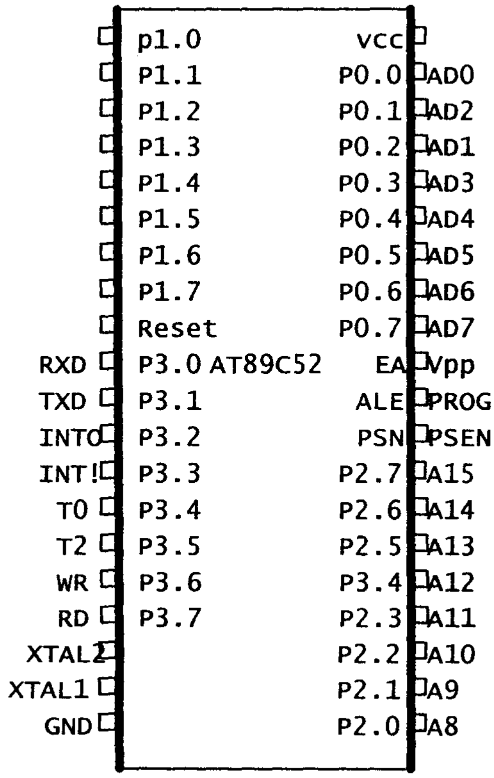

Fig 3.6 AT89C52 Microcontroller Pin Diagram and Pin Functions

ALE\PROG: Address latch enable output pulse for latching the low byte of the address during access to external memory. ALE is emitted at a constant of $\frac{1}{6}$ of the external memory. (However, one ALE pulse is skipped during each access to external data memory).This pin is also the program pulse input (PROG) during EPROM programming

PSEN; program store enable is the read strobe to external program memory. When the device is executing out of external memory, PSEN is activated twice each machine cycle (except that PSEN activation are skipped during access to external data memory). PSEN is not activated when the device is executing out of internal program memory.

EA|Vpp: When EA is held high the CPU executes out of internal program memory (unless the program counter exceeds OFFH in the 80C51). Holding EA low forces the CPU to execute out of external memory regardless of the program counter value. In the 80C51 EA must be externally wired low. In EPROM deices, this pin also receives the programming supply voltage (Vpp) during EPROM programming.

XTAL1: input to the inverting oscillator amplifier.

XTAL 2: Output from the inverting oscillator amplifier.

Port 0: port o is an 8-bit open drain bi-directional port. As an open drain output port, it can sink eight LSTTLloads. Port 0 pins that have are written to them float, and in that state will function as high impedance inputs. Port 0 is also multiplexed low-order address and data bus during accesses to external memory. In this application it uses strong internal pull-ups when emitting it. Port 0 emits code bytes during program verification. In this application external pull-ups are required.

Portl: Port 1 is an 8-bit bi-directional port with internal pull-ups. Port 1 pins that have 1 written to them are pulled high by the internal pull-ups, and in that state can used as inputs. As inputs, port 1 pins that are externally being pulled low will source current because of the internal pull-ups.

Port 2. Port 2 is an 8-bit bi-directional I/O port with internal pull-ups. Port2 emits the high order address byte during access to external memory that uses 16-bit addresses. In this application, it uses the strong internal pull-ups when emitting 1s, Port 3: Port 3 is an 8 bit bi-directional I/O port with internal pull-ups [17]. It also serves the function of various special features of the 80C51 family as follows:

Port pin alternate function

P3.0 RXD (serial input port)

P3.1 TXD (serial output port)

P3.2 INTO (external interrupt 0)

P3.3 INT! (External interrupts 1)

P3.4 TO (timer 0 external input)

P3.5 T1 (timer1 external input)

P3.6 WR (external data memory write strobe)

P3.7 RD (external data memory read strobe)

Vcc: supply voltage.

Vss: Circuit ground potential.

3.3 THE 7-SEGMENT DISPLAY UNIT

The figure below shows a common display format composed of seven elements or segments energizing certain combinations of these segments can cause each of the ten decimal digits to be displayed. To produce a 1, segments b and c are energized; to produce a 2, segments a, b, g, e and d are used, and so on.

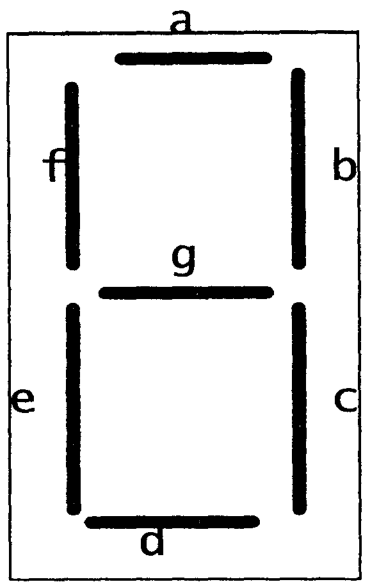

Fig 3.8. 7 Seven Segment Display.

LED Displays: One common type of 7-segment display consists of light emitting diodes (LED) arranged as shown below fig……Each segment is an LED that emits light when there is current through it. Because of the external source of current attached to the common anode the common anode will be use for this project [15].

Complete circuit diagram

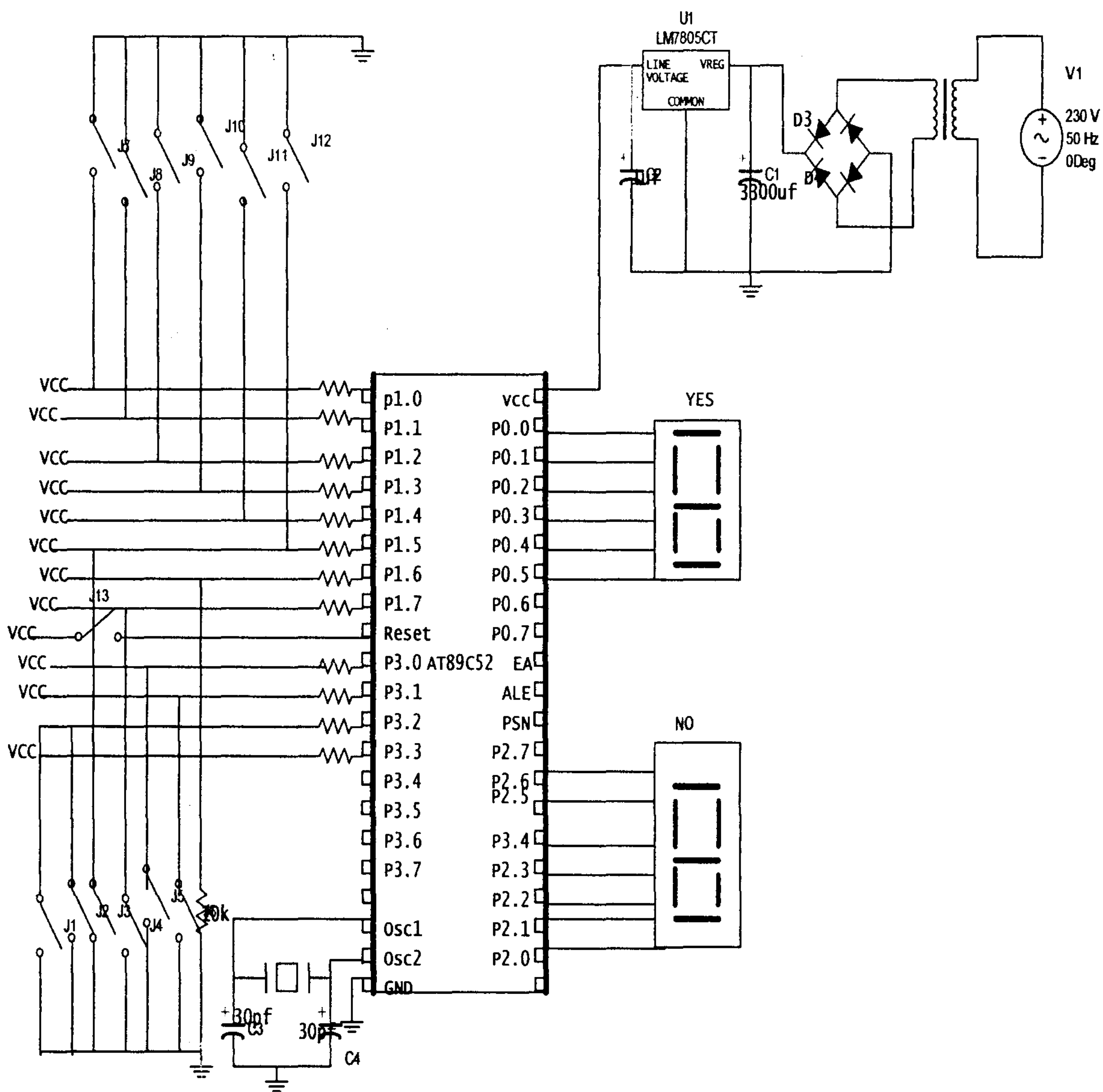

Fig 3.7 complete circuit diagram

CHAPTER FOUR

Tests, Results and Discussion

4.1 Tests

Each of the constituting units of the device being constructed were simulated one after the other before being tested on project board (bread board) and then finally soldered to the main board.

The microcontroller based voting system was tested to make sure that each pulse generated is being incremented and display by the 7-segment display unit.

Finally, the preset button was tested to ensure that it starts up the program and display zero in both 7- segment displays.

4.2 Results.

The results obtained during testing are tabulated as follows,

Table 4.1 gives the results of the test carried out.

		7-segment Display	
Yes vote	No vote	Yes vote	No vote
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6

4.3 Discussion of result

The design of this project was aimed at casting of vote(s) with an equally display of such vote(s) as soon as it cast.

When either the "yes" or "no" switch is pressed they will be a corresponding increment on the Yes or No display screen. The project was design for 6 man committee that implies that when 4 people are "for" the motion 2 people will be "against" the motion. In a democratic setting like Nigeria majority carries the vote. "For" the motion have the highest votes.

CHAPTER FIVE

5.0 Conclusions and recommendation

The target of this project which is design and construction of an Electronic voting system with digital display was achieved as demonstrated by the results obtained from the test carried out as explained in chapter four.

The aim, which was to use an electronic system rather than the normal raising up of hands " for " or " against" the motion in our national and state assemble was achieved. This is an improvement in the electoral process of Nigeria and other parts of the world.

Though, a number of difficulties were encountered at the design and construction stage of this project, due consultation and constant research helped to get through.

5.1 Recommendation

1. Voice-out for "yes" and "no" votes.
2. The system can be made wireless.

REFERENCES

[1] Tadagoshi K.Adams, Aviel. DR, S.W "Analysis of an electronic voting System" February 2004.

[2] Lawal Lasisi S., Design and construction of Digital Electronic Ballot Counter Box, Unpublished Thesis (2001 session) pp1, pp7

[3] Eyinere D. O., Government made easy. Doc-sun publishers, Nig 1996. Pp7.

[4] Abdullahi M. D, Analogue electronics lecture Notes, Unpublished

[5] Alli Babatunde Suleiman, Unanimous vote counter machine, unpublished Thesis (2004 session).

[6] Jones Douglas W." A brief illustrated history of voting" The University of IOWA dept of computer science.

[7] Bellis Mary, "The history of voting machines". about.com.

[8] Chris Backett," Remote voting technology". E-government consulting.

[9] Frank D Petruzella, Essentials of electronics, a surey Glencoe McGraw-Hill New York pp440-441, p444, p448.

[10] B.L theraja and K Theraja, Electrical technology, S Chaud and company Limited pp1938.

[11] Voltage regulator, www.en.wikipedia.org|wiki|voltage regulator

[12] John Hewes 2007, the electronic club, www.kpsec.freuk.com.

[13] Digital Electronics, http://en.wikipedia.org\wiki\digital-eletronics.

[14] Briophy .J.J, Basic Electronics for scientist McGraw Hill inc 1983 pp327.

[15] Ronald J Tocci, Neal s. Widmer, Digital systems principles and application, prentice-Hall international, in.

[16] Paul Horowitz, Winfield Hill, The art of electronics Cambridge University press. P44-52, pp673-738

[17] Microcontroller, www.8051 forum project.com

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Show_yes EQU P0
Show_no  EQU P2
Time_up      EQU P3.4
RB0      EQU     000H
RB1      EQU     008H


DSEG
ORG      20H
Syes:    Ds       1
SNo:     Ds       1
STACK    DATA     3FH
CSEG      AT       0
ORG      00H
MOV PSW,#RB0
Mov Show_yes, #040H
Mov Show_no, #040H
Mov Syes, #00H
Mov SNo,  #00H
Mov p1, #0FFH
Mov p3, #0FFH
SETB Time_up
Mov R0, #00H
Mov R1, #00H
Mov R2, #00H
Mov R3, #00H
Mov R4, #00H
Mov R5, #00H
Mov R6, #00H
Mov R7, #00H
Start:   MOV A, #1AH
REP3:    MOV R6,#4FH
REP2:    MOV R7,#0FFH
REP1:    CJNE R0, #00H, SECOND
         JB P1.0, NO1
         MOV R0, #01H
         INC Syes
         LCALL DISP_YES
         SJMP SECOND
NO1:     JB P1.1, SECOND
         MOV R0, #01H
         INC SNo
         LCALL DISP_NO
SECOND: CJNE R1, #00H, THIRD
         JB P1.2, NO2
         MOV R1, #01H
         INC Syes
         LCALL DISP_YES
         SJMP THIRD
NO2:     JB P1.3, THIRD
         MOV R1, #01H
         INC SNo
         LCALL DISP_NO
THIRD:   CJNE R2, #00H, FOURTH
         JB P1.4, NO3
         MOV R2, #01H
         INC Syes
         LCALL DISP_YES
         SJMP FOURTH
NO3:     JB P1.5, FOURTH
         MOV R2, #01H
         INC SNo
         LCALL DISP_NO
FOURTH: CJNE R3, #00H, FIFTH
         JB P1.6, NO4
         MOV R3, #01H
         INC Syes
         LCALL DISP_YES
```

```
        SJMP FIFTH
NO4:    JB P1.7, FIFTH
        MOV R3, #01H
        INC SNo
        LCALL DISP_NO
FIFTH:  CJNE R4, #00H, SIXTH
        JB P3.0, NO5
        MOV R4, #01H
        INC Syes
        LCALL DISP_YES
        SJMP SIXTH
NO5:    JB P3.1, SIXTH
        MOV R4, #01H
        INC SNo
        LCALL DISP_NO
SIXTH:  CJNE R5, #00H, DOWN11
        JB P3.2, NO6
        MOV R4, #01H
        INC Syes
        LCALL DISP_YES
        SJMP DOWN11
NO6:    JB P3.3, SIXTH
        MOV R5, #01H
        INC SNo
        LCALL DISP_NO
DOWN11: DJNZ R7,RE1
        DJNZ R6,RE2
        DEC A
        CJNE A,#00H, RE3
        CLR Time_up
        JNB Time_up, $
        LJMP Start
RE1:    LJMP REP1
RE2:    LJMP REP2
RE3:    LJMP REP3
DISP_YES:PUSH   PSW
        MOV     PSW,#RB1
        Mov R1, SYes
        CJNE R1, #00H, Ben1
        Mov Show_yes, #040H
        AJMP    DOWN
Ben1:   CJNE R1, #01H, Ben2
        Mov Show_yes, #079H
        AJMP    DOWN
Ben2:   CJNE R1, #02H, Ben3
        Mov Show_yes, #024H
        AJMP    DOWN
Ben3:   CJNE R1, #03H, Ben4
        Mov Show_yes, #030H
        AJMP    DOWN
Ben4:   CJNE R1, #04H, Ben5
        Mov Show_yes, #019H
        AJMP    DOWN
Ben5:   CJNE R1, #05H, Ben6
        Mov Show_yes, #012H
        AJMP    DOWN
Ben6:   CJNE R1, #06H, Ben7
        Mov Show_yes, #02H
        AJMP    DOWN
Ben7:   CJNE R1, #07H, Stop
Stop:   Mov R1, #00H
DOWN:   POP PSW
        RET
DISP_NO:PUSH    PSW
        MOV     PSW,#RB1
        CJNE R2, #00H, Ben11
        Mov Show_no , #040H
        AJMP    DOWN1
```