DESIGN AND CONSTRUCTION OF ELECTRONICS SEQUENTIAL FLASHING DISPLAY

BY

Achem Sylvester Akoji

Department Of Electrical And Electronics Engineering Technology,
Nuhu Bamalli Polytechnic Zaria,

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ACHEM SYLVESTER AKOJI N/EET/09/10299

SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING TECHNOLOGY, NUHU BAMALLI POLYTECHNIC ZARIA, KADUNA STATE. IN PARTIAL FULFILMENT OF THE AWARD OF NATIONAL DIPLOMA IN ELECTRICAL ELECTRONIC ENGINEERING.

DECEMBER, 2011.

DEDICATION

I dedicate this project to God almighty, for His inspiration He grant me throughout this project, I reference His name forever.

DECLARATION

I declare that the project was the result of my hard work under the guidance of my supervisor Mal. D. Gambo of the Department Of Electrical Electronic Engineering Technology Nuhu Bamalli Polytechnic Zaria. I neither copied nor has somebody else done it for me. All efforts and work used that led to the successful completion of the project have surely been acknowledged.

ACHEM SYLVESTER AKOJI
N/EET/09/10299

19/01/012
SIGN/DATE

APPROVAL

I certify that the project titled "Design and construction of electronic sequential flashing display" met the requirement and the regulation governing the award ND (National Diploma) in Electrical Electronic Engineering Technology Nuhu Bamalli Polytechnic, Zaria.

MAL D. GAMBO — SIGN/DATE 19/01/2012
PROJECT SUPERVISOR

ENGR. MAHMUD .A. PANTI — SIGN/DATE_____
PROJECT COORDINATOR

MUHAMMAD GARBA — SIGN/DATE_____
HEAD OF DEPARTMENT EET

ACKNOWLEDGMENT

I hereby centre my profound gratitude to Almighty God for long-life He grant me and for the opportunity, strength and capability to reach this extent in my educational carrier.

My gratitude goes to my Project Supervisor Mal .D. Gambo, who endeavored time to go through the manuscript to see it produce a good work, my Project co-Coordinator Mal. Mahmud Panti and all staff of the Department of Electrical Electronics Engineering Technology, Nuhu Bamalli Polytechnic Zaria.

My special splendid goes to my parent Mr./Mrs. Achem for their financial, moral and spiritual support. I pray thee that God Almighty will continue His glorious deed in their life.

Hi! To my entire course mate for making I feel great in their miss

ABSTRACT

The existing conventional ways in which public are informed about things and places location like signboard and signpost sometimes are problematic. Not be seen at night, the means in which they are presented is unattractive and hence they are hardly noticed by public is unveil in this project.

This project come up with possible means of attracting the attention of the public to be able to read what is placed due to the attractive manner in which LEDs were arranged to display information. The design basically utilized pulse generator, (NE555 timer IC) which act as an oscillator (monostable multivibrator) to the LEDs, decade counter (CD4017BC), rectifiers (IN5400) (series arrangement of diodes) to control the voltage, (voltage regulator) transistor which act as a switch to the Light Emitting Diode (LEDs) (Tip41).

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CHAPTER ONE

1.1 INTRODUCTION

The need to show a visitor the way to the faculty of engineering cannot be overemphasized. This is information age, and there is no any other better way of entertaining the public especially the confused visitors and strangers than welcoming them to the department, in an interesting and fascinating way within a short period of time, using electronic flashing display. This has been the compelling force behind this project.

Display system is one of the means of advertisement and location indication nowadays and a means of noticing the public important things to be read as it is designed to display the messages in a fashionable and attractive manner. Its main objective is to display the location of places (faculty of engineering precisely), addressing a visitor, advertising company/organization names and displaying information to public. The project is to display WELCOME TO ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT. About thousands of LEDs were used in the project. For each LED to light visibly well, a current of about 4mA is needed. The power supply therefore is of fundamental importance. The voltage of the power supply must remain the

same as the LED flashes sequentially and then display the whole information at once by the help of an IC555 timer and decade counter (pulse generator).

1.2 MOTIVATION

Majority of people nowadays watching and appreciating flashing things that can easily calls the attention of the public. With the wide spread of literacy, this has given room for the use of flashing display to show a person the direction he is moving. For instance in this project, *"Electronic Flashing Display"* if the board is placed at the entrance of Electrical Engineering Department NBPZ any visitor to the polytechnic entering the department at anytime (day or night) will see the display very attractive unlike sign post and sign board which is difficult to define during the night, Which ease question of asking which department am I?

Also in business environment, fully displays are used to call the attention of customers more especially women and children when they go out for shopping.

1.3 AIM

The aim of this project is to design and construct public address system that can display sequentially and also flash the message **WELCOME TO ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT.**

1.3.1 OBJECTIVES

. To design and construct a befitting school of engineering digital electronic sequential display which beautifully welcome to electrical electronics engineering department.

. To provide a design that is affordable compared to similar types of the device.

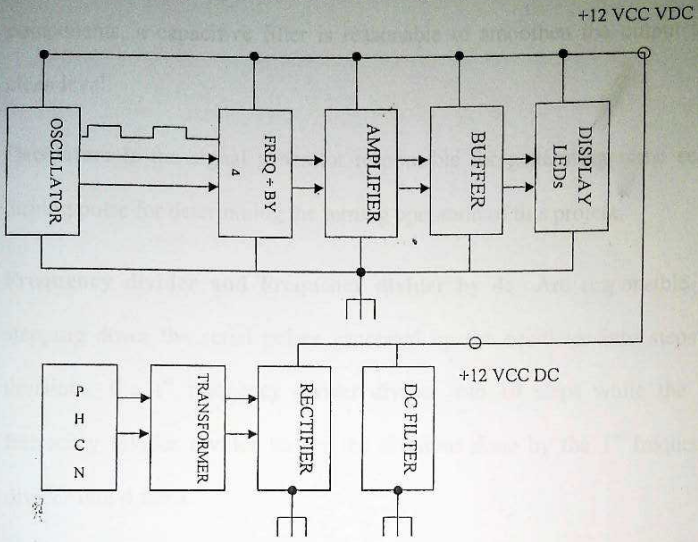
. To improve on the work of others who have done similar work

. Testing the circuit

.4 METHODOLOGY

The method employed in designing and constructing this project is constructing the various unit of the circuit, that is; the power supply unit, oscillator unit (i.e. 555 timer and decade counter) and the display unit where the outputs are obtained.

Fig. 1: Block diagram of electronic flashing display with output voice



EXPLANATION OF THE BLOCK DIAGRAM

1. **PHCN:** Is the AC input power supply, 220_{vac}

2. **Transformer:** The AC input is fed into a step-down transformer to slow down the input voltage, to a level suitable for the circuit consumption.

3. **Rectifier:** The rectifier converts the input voltage to DC good for the operation of the circuit.

4. **DC Filter:** Because the rectified AC to DC has some noise and AC components, a capacitive filter is reasonable to smoothen the output to a clean level.

5. **Oscillator:** Is the signal generator responsible for generating some serial turning pulse for determining the turning operation of this project.

6. **Frequency divider and Frequency divider by 4:** Are responsible for stepping down the serial pulses generated by the oscillator into steps or divisions, the 1st frequency divider divides into 10 steps while the 2nd frequency divider divides further the divisions done by the 1st frequency divider into 4 steps.

7. **DC Amplifier:** The divided signals from the frequency dividers are used for operating the LED arrays. Therefore, the amplifier section amplifies the signals into a level that can operate the relay.

8. **Buffers:** In reality the relays were used as the buffer to separate or isolate the LEDs from the control circuit but amplifying control signals from the control.

1.5 SCOPE AND LIMITATION

This project is concerned with the design and construction of several gadgets. It finds application in where the mode of operation is not to be known by everybody. Hence,

- A very heavy rain can stop the circuit from working (component like choke resistor as used in the construction when getting hot during operation, a drop of water on it will break the resistor).
- Care should be taken to ensure that each turned pulse is positioned neatly before any soldering take place.
- Components and materials used should be considerable factors for the project such factors as manufacturing factors, service factors, availability factors and economic factors.

1.6 PROJECT ORGANIZATION

This project was arranged into five chapters, chapter one as an introduction to the project. Chapter two deals with relevant literature review of the project. Chapter three deals with design procedures/circuit analysis, and component selection. Chapter four is construction, testing and enclosure and

chapter five gives the conclusion and recommendation for upgrading the project.

CHAPTER TWO

2.0 LITERATURE REVIEW

In this chapter, the work done by other writers that are relevant to the research work is presented; the basic theories behind the working principles of the important components are also discussed. It also highlights the limitation and lapses that had been undertaken on projects concerning electrical sequential flashing display.

2.1 HISTORICAL BACKGROUND

The dominant display technologies today are Light Emitting Diode (LEDs) and Light Crystal Display (LCDs). LEDs emerged in the early 1960s by using semiconductor light emitting theory. As an Engineer at Bell labs, Dr. Stibitz used surplus relays, tin constrip, flash light bulbs and other canonical items to construct his model "K" (for Kitches table) which display the results.

More also, another attempt was made (2007) titled "Design and construction of decorative lamp control system", which was successfully carried out. The project was designed in such a way that the astable multivibrator generate

continuous square waveform clock pulse, by the use of 555 timers connected in the astable mode (which operate like an oscillator).

The astable modes in its conduction stage enable the lamps to light sequentially. The power supply to the circuit is provided by a $12V\ DC$ regulated power circuit.

However, the design and construction of fan remote control is carried out so as to control the speed of fan using remote control without using the permanent rotary switch regulator.

In this project, the astable multivibrator behaves as an oscillator is used to generate the pulses which is fed to the buffer as a result switch on the transistor which allows current to flow thereby lighting the LEDs.

2.2 COMPONENTS REVIEW

To construct this circuit, it is necessary to briefly discuss some major components used in the construction of the project.

2.2.1 Transformer: Its function is either to step up of (mostly) step down the AC supply voltage to suit the requirement of the solid-state electronic devices

and circuit fed by the DC power supply. It also provides isolation from the supply line, an important safety consideration.

*See appendix **g** for circuit diagram.*

2.2.2 **Rectifier:** It is a circuit which employs one or more diode to convert AC voltage into pulsating DC voltage.

*See appendix **f** for circuit diagram.*

2.2.3 **Voltage Regulator:** Its main function is to keep the terminal voltage of the DC supply constant even when:

i. AC input voltage to the transformer varies (deviation from 220v are common) or

ii. The load varies.

Usually, Zener diodes and transistors are used for voltage regulation purposes. Again, it is impossible to get 100% constant voltage but minor variations are acceptable for most of the appliances.

Strictly speaking, all that is really required for conversion from AC to DC is a transformer and a rectifier (in fact even the transformer could be eliminated if no voltage transformation is required).

$$\%regulation = \frac{V_{max} - V_{min}}{V_{max}} \times 100$$

$$= \frac{V_{in} - V_{out}}{V_{in}} \times 100$$

V_{max} = The maximum dc output

V_{min} = The dc output voltage

See appendix ***h*** *for circuit diagram.*

2.2.4 **Resistor:** Oppose, restrict or limit the flow of electricity. According to ohm's law the voltage depend on the current and the resistance.

$$V = IR$$

$$And\ R = \frac{V}{I}(\Omega)$$

Therefore, resistance is voltage flow V (V) per unit current$I$ (A).

A property of a substance due to which it opposes, restricts or limit the flow of electricity is called resistance, measure in ohms (Ω).

See appendix ***a and b*** *for circuit diagram.*

2.2.5 **Capacitor:** The purpose of a capacitor is to store electric charge or energy by electrostatic stress in the dielectric. The ability of a capacitor to store charge or electricity may be called its capacitance, measured in$farad$ (F).

$$C = \frac{Q}{V}(F)$$

$$Where\ Q = Charge\ measure\ in\ coulombs\ (C)$$

$$V = potential\ difference\ measure\ in\ volts\ (V)$$

One farad is actually too large for practical purposes. Hence, much smaller units like *micro farad* (μf), *nanofarad* (nF) *and micro microfarad* ($\mu\mu f$) *or picofarad* (pF) are generally employed.

Generally, capacitance is that property of a capacitor which delays and change voltage across it.

See appendix ***i, j and k*** *for circuit diagram.*

2.2.6 LED: As the name indicates is a forward bias PN-junction which emits visible light when energized. Charge carrier (i.e. electrons) recombination takes place when the negative from the N side cross the junction and re-combine the holes on the P side.

See appendix ***e*** *for circuit diagram.*

2.2.7 Transistor: Transistor is essential to apply voltage of correct polarity across the two junctions. It is worthwhile to remember that for normal operation

i. Emitter base junction is always forward bias and

ii. Collector base junction is always reverse bias. This type of biasing is called FR biasing (i.e. Forward – Reverse biasing).

*See appendix **m** for circuit diagram.*

2.2.8 **Switch:** Electronics switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. An ideal switch describes a switch that:

- Has no current limit during it ON state
- Has infinite resistance during it OFF state
- Has no voltage drop across the switch during it ON state
- Has no voltage limit during its OFF state
- Has zero rise time and fall time during states changes
- Switches without "bouncing" between ON and OFF positions.

The ideal switch is often used in circuit analysis as it greatly simplifies the system of equations to be solved, however this can lead to a less accurate solution.

*See appendix **i** for circuit diagram.*

2.2.9 **NE 555 Timer:** The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation and oscillator applications. The 555 can be used to provide time delays, as an oscillator and as a flip-flop element. Derivatives provide up to four timing circuits in one package.

*See appendix **n** for circuit diagram.*

2.2.10 Decade counter: In electronics, counter is a device which stores (and sometimes displays) the number of times a particular event or process has occurred. Often in relationship to a clock signal. Decade counter counts through ten states per stage. Decade counter is one that counts in decimal digits, rather than binary. A decade counter may have each digit binary encoded. Alternatively, it may have a "fully decoded" or one-hot output code in which each output goes high in turn such a circuit is control by CD4017BC.

*See appendix **o** for circuit diagram.*

CHAPTER THREE

3.0 DESIGN ANALYSIS

The general mathematical theory and methodology used to achieve this project is described in this chapter. The mathematical parameters of this project were designed to correspond with practical design.

3.1 DESIGN OF THE POWER SUPPLY

Theoretically the power supply consists of a step-down transformer, a bridge rectifier, and a capacitor filter circuits.

3.1.0 THE STEP DOWN TRANSFORMER

Theoretically a step down transformer was used for this project of 200Watt. Ratting the essential factors of parameters as shown below: -

$E.m.f_{pri} = 220VAC$

$E.m.f_{sec} = 15Vac$

$Number\ of\ turns\ in\ the\ primary = 500T$

$Number\ of\ turns\ in\ the\ secondary = ?$

$$Transformer\ turaz\ ratio\ K = \frac{E_S}{E_P} = \frac{N_S}{N_P} = \frac{I_P}{I_S}$$

Considering the parameter above, we used;

$$\frac{E_S}{E_P} = \frac{N_S}{N_P}$$

$$N_S = \frac{E_S N_P}{E_P}$$

$$= \frac{15 \times 500}{220}$$

$$= 34 turns.$$

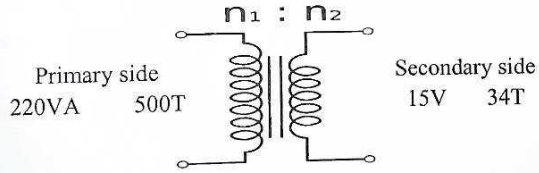


Figure 2 circuit symbols of a step down transformer

The current (Amps) consumption of the primary turns of the transformer

$$P = IV \times pf$$

$$I = \frac{P}{V \cos\theta}$$

$At\ P_{max}, \cos\theta = 1$

$$Thus;\ I = \frac{P}{V}$$

$$I_1 = \frac{200}{220}$$

$$I_1 = 0.9Amps.$$

The winding ratio of the transformer is

$$K = \frac{primary\ turns}{secondary\ turns} = \frac{500T}{34T} = 14.7\ ratio$$

Then the secondary current supply of the transformer is

$= winding\ ratio\ x\ primary\ current$

$$\frac{I_2}{I_1} = K$$

$$I_2 = I_1 K$$

$$I_2 = 14.7 \times 0.9$$

$$I_2 = 13.23Amps.$$

3.1.1 THE RECTIFIER STAGE

The A C rectification stage was build with 2 diodes as a full-wave centre taped rectifier as shown below.

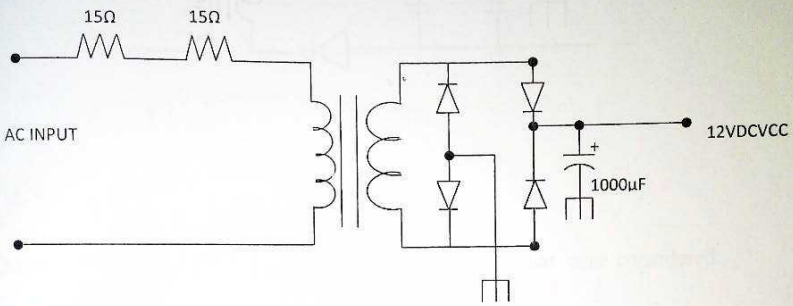


Fig. 3 full-wave centre taped rectifier

The peak value of the AC input at the 220V input is 339.4V peak (Vin) is applied to the output of the transformer. Then the average output voltage from the full wave centre tapped rectifier is 15V.

3.1.2 THE CAPACITIVE FILTER

The capacitive filters were used as a clean up for the rectifier. They were used to suppress ripples current after rectification while not affecting the direct current as shown below.

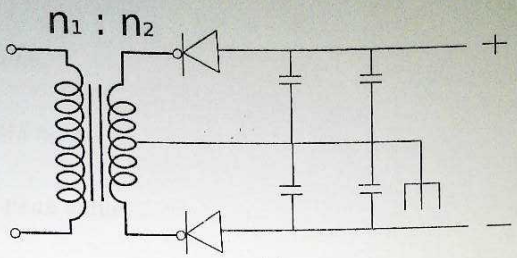


Fig. 4 the capacitive filter circuit

Other important parameter of the DC filter circuit that was considered includes;

The peak-to-peak ripple.

Actually the filter output used in this power supply is fluctuating between +20V and +30V and therefore the ripple peak to peak value is

$= 15 - 25V$

$= 10V\ peak - peak\ difference.$

$Peak\ of\ the\ ripple = ½\ of\ peak - peak\ value$

$= ½ of\ 10V$

$= 5V peak\ value.$

$The\ ripple\ RMS\ is$

$= 0.0707 \times peak\ value$

$= 0.707 \times 5V$

$= 3.54V.$

$$Then\ the\ ripple\ percent = \frac{Vrms\ of\ ripple}{V_{AVRa}\ of\ ripple}\ X\ 100\%$$

$$\% = \frac{3.5V}{15V} \times 100\%$$

$$\% = 23\%$$

3.2 DESIGN OF THE OSCILLATOR

The oscillator was built using the world most populous IC (NE555). With it pin out configurations shown below.

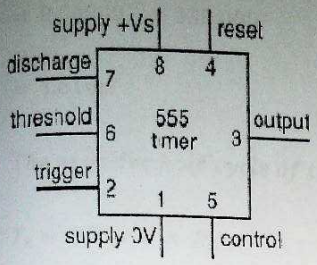


Fig 5 circuit diagram of an IC 555 timer

The circuit diagram of the oscillator is show below.

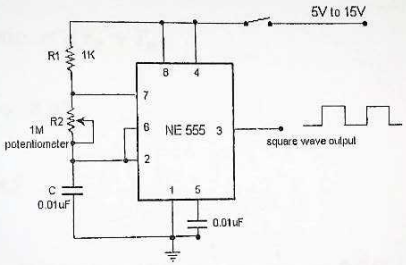


Fig 6 The circuit diagram of the oscillator

In the circuit above R1, R2 and C determine the frequency of the oscillator.

The positive half cycle time of the oscillator be calculated as

$$T_p = 0.7 \times C \times (R_1 + R_2)$$

$$= 0.7 \times 10 \times 10^{-6} \times (220000 + 10000)$$

$= 0.000007 \times 230{,}000$

$= 1.61mS$

The negative half cycle of the oscillator can also be calculated as

$T_n = 0.7 \times C \times R_B$

$= 0.7 \times 10 \times 10^{-6} \times 10000$

$= 0.07$

$Total\ time = (T_P + T_n)$

$= 1.61 + 0.07$

$= 1.68mS$

Then the frequency is $F = \frac{1}{T} = \frac{1}{1.68} = 0.6H_Z$

$F = 0.6H_Z$

3.3 THE FREQUENCY DIVIDERS

The frequency dividers were built using CD4017 as shown below:

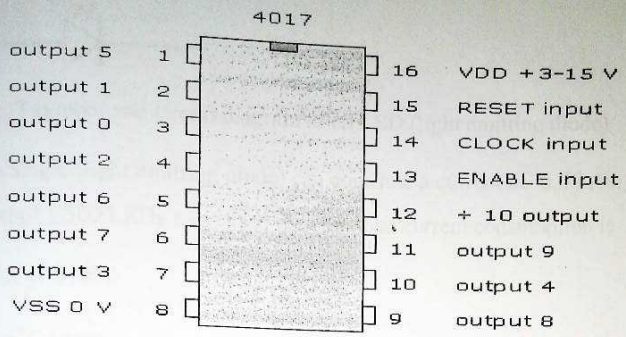


Fig. 7 symbol of a decade counter CD4170BC

The CD4017 was used as a Johnson counter. Its counting steps can be determined as: $\frac{Frequency\ in\ Hz}{Number\ of\ output\ used}$

In this project, if the frequency is roughly 4Hz then, the output frequency would be $\frac{4Hz}{10} = 0.4Hz$

3.4 LED ANALYSES

The symbol and physical appearance of an LED is shown below.

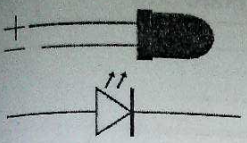
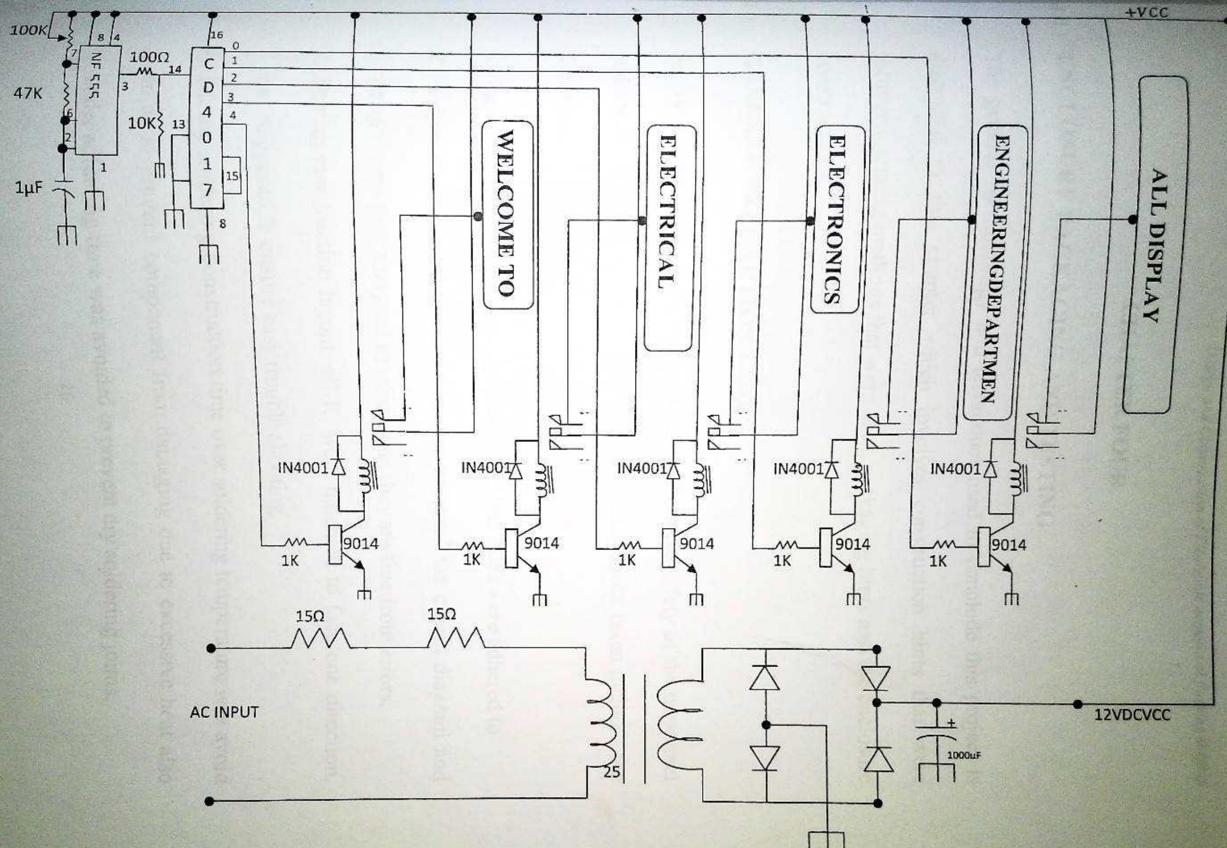


Fig. 7 symbol and circuit diagram of an LED (light emitting diode)

If a single (light emitting diode) can consume a current of 0.03 *Amps* and a total of 1,500 LEDs were used then the total current consumption is

$0.03 \times 1{,}500$

$= 450 Amps.$



+VCC
100K
47K
1µF
NE 555
100Ω
10K
CD4017
WELCOME TO
ELECTRICAL
ELECTRONICS
ENGINEERINGDEPARTMEN
ALL DISPLAY
IN4001
9014
1K
15Ω
15Ω
AC INPUT
25
1000uF
12VDCVCC

CHAPTER FOUR

4.0 ENCLOSURE PACKAGING AND TESTING

The general methodology and techniques used to conclude this project is discussed in this chapter which involves construction hints that were followed, testing methods that were used, packaging hints and the enclosure constructions.

4.1 GENERAL PRECAUTION TAKEN

Safety is everything in any technical design both the safety of the personnel and the device were considered some general precautions taken includes the following.

1. Ensuring that all electrical regulations and IEE rules were adhered to
2. Before the practical construction was executed the circuit diagram and design were first analyzed to ensure that they are free from errors.
3. During construction layout, all IC were mounted to face one direction, not staggered to ensure easy trouble shooting.
4. During soldering construction time over soldering temperature was avoid so as to prevent component from damaging due to excessive heat also under soldering time was avoided to prevent dry soldering joints.

5. After the construction was completed the circuit board was washed with ethanol so as to dissolve conductive mineral contaminators and to remove tiny lead particles that could cause short circuit.
6. IC based devices were used except for power ICs so as to make IC substitutions convenience during any damage or design error.

4.2 TESTING AND TESTING METHODS

There were three testing methods that were employed; prototype testing, qualification testing and production testing.

PROTOTYPE TESTING

The prototype testing may still be refer as the bread-boarding, before the permanent constructions was done.

The prototype testing using bread board was done to thoroughly prove that the circuit design will meet the specifications, also to reveal any inadequacies in either performance or parameter.

As a result of prototype testing two errors were revealed and they were fixed. They are:

1. Design error and
2. Part error

QUALIFICATION TESTING

Qualification testing was carried out to ensure that the constructed projects fulfill the technical requirements such as operational requirements, voltage requirements and frequency requirements etc.

PRODUCTION TESTING

The production testing is simply the construction testing's the construction testing was used to verify the conformity of the finished construction.

4.3 CONSTRUCTION HINTS AND PACKAGING.

In general the front panels of the enclosure were used for indicators, meters, etc. as well as controls and frequently used connectors. It is a common practice to put seldom-used adjustments and connectors that don't require frequent access on the rear or back panel of the enclosure. Along with AC wires, fuses etc.

The most important thing that was remembered during layout packaging is the need for good accessibility to circuit without great pain. This means neat cabling of wiring so that circuit boards can be raised without unsoldering and could be tested while operating.

4.4 GENERAL CAUSES OF FAILURE AND PRECAUTIONS.

The failure of a component in equipment may lead to the failure of that equipment. The general cause of failure and their remedies includes.

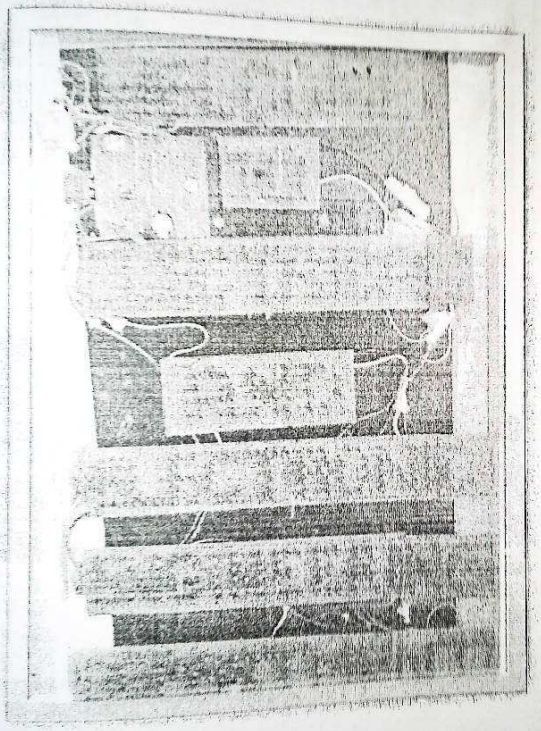
1. The effect of temperature: according to Arrhenius law state's that the failure ratio of a component approximately doubles with every 10^0C rise in temperature for a fixed voltage. Therefore the effect can be reduced through the use of heat sinks, cooling fans and enclosure perforation for cross verification.
2. The effect of humidity: under this condition a thin firm of water known as water vapor can be formed on board and can become consequently ionized and from an undesirable conducting path. The only remedy for this problem is that the enclosure material must not support the absorption of coater.
3. The effect of mechanical vibrations and shocks since all equipments once subjected to mechanical vibrations and shocks which may weaken equipment support loosen wires, bend some components with long leads.

The effect of mechanical vibration and shocks can be resolved by using anti-vibration mountings, shake-proof washers, hooking nuts and by encapsulating sensitive components.

4.5 ENCLOSURE

The dimensions of the enclosure used in this project are 24×15 *inches*.

The various photo views of the enclosure are also shown below.



24 inches

15 inches

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Electronic flashing display is the conventional way in which public are informed about things and places in an outstanding merit or quality to draw ones attention to itself. Unlike signpost and signboard which are unattractive and hardly noticed by the public.

The design basically utilized pulse generator (NE 555 timer), Rectifier (IN5400), voltage regulator, transistors/switch, LED, Buffer etc.

5.2 RECOMMENDATION

It is recommended that the circuit can be modified into another form of design and used in different area of application e.g. an audible alarm can be connected instead of light emitting diode (LED) to give different alarm sound or alternatively can be used in telecommunication system.

However, 12v battery that will serve as a standby can be included, in case of power failure and the circuit can be designed using microcontroller and also the following are recommended: -

- Student should be provided with current journals, manuals and text book which will increase the understanding and challenge in design and construction.
- Government should make electronics components available for students who wish to work for electronics projects.
- Seminar and symposium workshop should be encouraged in the department to enlighten students in the department about design and construction.
- Government and financial institution should be looking into the students project with the view of improving them for the benefit of the society.

REFERENCES

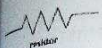
B.L. Theraja (1999): A textbook of Electrical Technology volume 1.

D.C. Green: (1981): Electronics IV fourth edition, Longman group Ltd London.

Weller .F. (1978); Handbook of Electrical system design; (third edition) Reston Publishing Company Inc. Reston Virginia, USA.

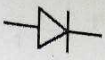
R. Maddock and MD. M. Calcartt: A course for Engineers

APPENDIX A LIST FIGURE



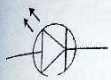
a. Fixed Resistor

b. Variable Resistor

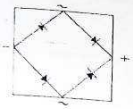


c. Diode

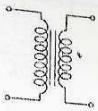
d. Zener Diode



e. LED

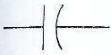


f. Full wave rectifier



g. Transformer

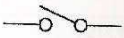
h. Regulator



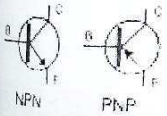
i. Fixed polarized capacitor

j. Fixed capacitor

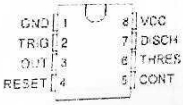
k. Variable capacitor



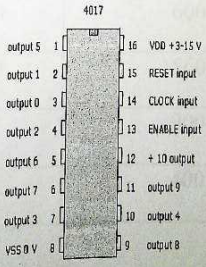
l. Switch



m. NPN and PNP Transistors



n. NE 555 Timer



o. Decade Counter CD4017BC

BILL OF QUANTITY

S/N	ITEM	QTY	UNIT PRICE (₦)	TOTAL PRICE (₦)
1.	Transformer	4	410	1640
2.	Rectifier	2	45	90
3.	DC filter	4	115	460
4.	Vero board	20	100	2000
5.	Leads	2 rolls	1000	2000
6.	AC cord	2	75	150
7.	Jumper wires			1200
8.	LEDs	1200	10	12000
9.	Soldering iron	2	60	120
10.	Bread board	1	600	600
11.	IC sockets	10	30	300
12.	Razor blades	10	10	100
13.	NE555 Timer	6	100	600
14.	CD4017 (Decade counter)	13	120	1560
15.	Transistors	20	45	900
16.	Relays			400

17.	Super glue	8	50	400
18.	Capacitors	4	25	100
19.	Resistor s			300
20.	Choke Resistors			460
21.	Battery	2	100	200
22.	Digital multimeter	1	500	500
23.	Spray paint	1	650	650
24.	Enclosure			6500
25.	Miscellaneous			6500
26.	Screw driver			200
27.	Consultionary services			1500
28.		**Total**		**₦41,430**