DESIGN AND CONSTRUCTION OF PEDESTRIANS CROSSING LIGHT CONTROLLER

BY

HUSSEIN SULEIMAN

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DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE

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A THEISIS SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE

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DEDICATION

I dedicated this project to Almighty Allah for His favour and blessings on me, making me to be alive till today.

I also dedicate this project to my parent Mallam and Mrs. R.T Hussein for their parental and financial support.

DECLARATION

I Hussein Suleiman declare that this work was done by me and has never been presented elsewhere for the award of a degree. I also hereby relinquish the copyright to Federal university of technology, Minna

HUSSEIN SULEIMAN
....
Name of Student

MR P.O ABRAHAM ATTAH
....
Name of Supervisor

10/11/2008
....
Signature and Date

/10/11/2008
....
Signature and Date

ENGR. DR. YA. ADEDIRAN
....
Name of HOD

....
Name of external examiner

....
Signature and Date

....
Signature and Date

ACKNOWLEDGEMENT

My profound goes to His Supremacy Allah (S.W.T) who is my provider and sustenance. He has kept me in good health and overcome challenges to complete their enormous task my sincere gratitude goes to my parent Mr. and Mrs. R.T Hussein for their parental and financial support. I also appreciate the supportive and prayers render by my junior ones Khadijat, Rahamat, Ridwan and Habib.

My gratitude goes to my supervisor Mr. Paul Attah for his advice, correction and contribution which enables me to face the various challenges that come my way. I also appreciate the good work and also the entire staff of the department of electrical computer engineering.

ABSTARCT

The project is a model of pedestrian crossing light controller. A pelican crossing is a type of pedestrian crossing featuring a standard set of traffic lights with a push button and two coloured lamp for pedestrian using the crossing. In this life-like model the signals are normally set at go for traffic and stop for pedestrian. By pushing a switch you can stop the traffic and produce the cycle of changes, including bleeps and flashes. This is achieved using different types of CMOS IC such as decade counter, 555 timer D-flop and or gates, amplifier, transistors and LEDs. The objective of this design is to develop and identify innovative strategies and aids for enhancing pedestrian safety and mobility.

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CHAPTER ONE

1.0 INTRODUCTION

The project is about pedestrian crossing light controller which is normally set at 'go' for traffic and 'stop' for pedestrian. By pushing a switch you can 'stop' the traffic and the cycle of changes, including 'bleeps' and flashes.

A pedestrian crossing or crosswalk is a designated point on a road at which some means are employed to assist pedestrian's wishing to cross [1]. They are designed to keep pedestrians together where they can be seen by the motorists and where they can cross most safely with the flow of vehicular traffic [2]. Pedestrian crossings are often installed at intersection, but may also be at other points on busy roads that would otherwise be perilous to attempt to cross. They are common near schools or in other areas where there are a large number of children [3]. Pedestrian crossing can be considering a traffic calming technique. Road markings are usually present at the site of installation. These markings are easily visible continental strips popularly known as Zebra-Crossing.

Pressing the button is required to trigger the signal. These signals may be integrated into a regular traffic light arrangement or may be on there own. If the crossing is not at intersection. Audible or tactile signals are also included to assist people who have poor sight [4]. Pelican (pedestrians light controlled crossing) have red/yellow/green signals facing drivers and red/green signal on the opposite of the road to the pedestrian waiting to cross [4]. When the red man is lit pedestrian should not cross (although it is not against the law to do so). The high way code says that when the steady red signal to traffic is lit, the driver MUST stop. The green man will light for pedestrians and they should have checked that it is safe to do so cross the road [2, 3]. When the green man begin to flash, pedestrians should not start to cross although there is still enough time for those on the cross to finish to indicate to the visibility impaired when the steady green man is lit.

1.1 PEDESTRIAN WALKING SPEED

A minimum walking speed for most fair-able ambulatory older people is between 210 and 240 feet per minute (Average of 215 feet per minute for a 75 year old) versus 254 to 270 feet per minute for average pedestrian

A minimum walking speed for most handicapped and less agile seniors is approximately 150 feet per minute. This speed is similar to that of a crowd existing in a stadium. Speed below 124 speed per minute represent restricted shutting. However, some disabled people may walk a short distance at a rate of 90 feet per minute (on level terrain) and at a rate 100 feet every minute for distance.

1.2 WAYS TO MAKE STREET CROSSING EASIER

To reduce the distances (and exposure time) for pedestrians across the lanes.

Increasing the time provided at crossing signals

Reduce or mark potential barriers (e.g. curbs)

Increasing visibility.

Limit traffic or modify traffic flow along major pedestrian access routes.

1.3 AIMS AND OBJECTIVES

This project is aimed at the design and construction of a model pedestrian crossing light controller to achieve the following objectives:-

- Reduced speed of motor vehicles in densely populated areas.
- Improve sight distance and visibility for motorist and pedestrians.
- Improve pedestrian access and mobility.
- Encourage walking by improving aesthetics.
- Improve compliance with traffic laws.
- Eliminate behaviours that lead to crashes.

1.4 METHODOLOGY

The circuit holds a dual IC(556),a dual D flip-flop IC(4013B) ,decade counter IC(4017B),Quad 2-input NAND gate IC (4047B),two dual 2-input NOR gate ICs(4001B),astable IC (4047B) npn transistors and LEDS.The D-flip-flop consist of logic gate which output reset the decade counter, the first astable multi vibrator also clock the decade counter. The state of the decade counter output determines counting of the clock pulses. This goes to the respective OR-gates and AND-gates which are connected to the set of light emitting diodes (LEDS) via the transistors or to the speaker via the amplifier. The use of this devices allow for an overall reliability and low cost of the project.

1.5 SCOPE OF THE PROJECT

The project is a model for demonstrating the electronic pedestrian crossing light controller usually installed at road intersections. The involved lighting is light emitting diodes and the bleeps from a loudspeaker. The circuit is built mainly using integrated circuits which are CMOS (complementary metal oxide semi conductor).

CHAPTER TWO

LITRATURE REVIEW

2.1 HISTORICAL BACKGROUND

The creation of pedestrian crossing start in 1950s with the Zebra crossing. By 1965 the term 'pelican' an abbreviation of pedestrian light controlled crossing was used by the UK ministry of transport when the panda's replacement was first being discussed[13]. But when it was relunched in 1967 , a more snappy name was required, and the white cross on the traffic signal led to the X-ways. When it came to the 1969 relunch,a white cross light and the on the road surface had been ditched, and in April 1968,JP Morris astutely noted that "the name X-ways seems a bit odd now that the X has gone from lights....No zoological names;"

In response, his colleague J Meller agreed that animal names were out. He suggested making up a new term, and gave a list of ideas that were all equally terrible, including 'lightways','conways','sigways','safelanes','pedlights','pedways',and 'cross light'[12,13].

By July 1968 the decision has been deferred again and again, and the recipient of the above memo, a Mr Jamieson, tried to hurry things along because the minister was about to announce the scheme to the press and nobody knew what the infernal thing was called. The minister's press release went along with the disliked shorthand term almost by default, and pelican was born [12].

The pelican had been intended to use the new-style Mellor signal heads, designed to provide a sleek, new design for controller across the country and due to launch in 1969.Unfortunately they weren't ready until late 1970 due to launch in 1970 due to problems with new design and so the very first pelicans some 700 of them, according to some reports were installed using older SGE signal heads and X-way style rectangular pedestrian signals. They were converted, at enormous cost, in 1973.The irony, of course, is that the pelican had taken several stages of lengthy and expensive development and well-published launch to create something that has existed thirty years before .after just a few years of refinement, Forest city's 1930s crossings had quickly established that the best way to do things was a conventional set of signals for traffic and a two-light signal for pedestrians[1]. The pelican crossing was the result of more than quarter of a century of meddling, in which time the pedestrian controller changed to a red and green man and the flashing yellow phase was perfected. In the end the government heralded the pelican established as something new and innovative. With pelican established, the history of the pedestrian crossing's development is mostly finished.

The greater London council (GLC) was looking for ways to get more efficient performance from its signalized junctions, meaning more time to get green lights and less time where the chaotic London traffic was held up[12,13]. By 1985 the concept was finalised by the lights showing pedestrians the safest part of the traffic light cycle to cross the road, during which time traffic would be required to give them priority. It did this by showing a red man to pedestrians and at quietest time, this changed to a flashing yellow man. Motorists turning into that arm of the junction would be faced with a flashing yellow light quite reminiscent of a Zebra crossing.

2.2 PEDESTRIAN TIMING REQUIREMENT

Pedestrian movement across signalized intersections are typically accommodated by one of the following operational options:

- Pedestrians cross street with the parallel vehicular green indication (no pedestrian controller display).
- Pedestrian movements are controlled by a concurrent separate pedestrian controller display.
- Pedestrian move on an exclusive phase while vehicular traffic is stopped [5].

The essential factor in any of these options is to provide adequate time for the pedestrians to enter the intersection (walk interval) and to safely cross the Street (pedestrian clearance interval). In cases where there are no separate pedestrian displays and the pedestrians' moves concurrently with vehicular flow on the parallel street, the time allocated to vehicular traffic must consider the time required for pedestrians to react to the vehicular green indication and move across the street [4, 5].

When separate pedestrian displays (WALK, DON'T WALK) are used, the minimum WALK interval generally ranges from 4 to 7 seconds (as recommend by MUTCD 4D-7).This allows the pedestrian ample opportunity to leave the curb before the pedestrian clearance interval commences. Various research studies have indicated that when there are fewer than 10 pedestrians per cycle, the lower 4 second WALK interval is usually adequate [6].

The MUTCD (manual of traffic signal design) mandates that pedestrian indications are used. During this interval a flashing DON'TWALK indication is display long enough to allow the pedestrian to cross the curb to the centre of the farthest travel lane before opposing vehicles receive a green indication. Some agencies terminate the flashing DON'T WALK and display a steady DON'T WALK on the onset of the yellow vehicular change interval. This encourages those pedestrians still in the crosswalk to complete the crossing without delay. The calculation of the pedestrian clearance time therefore includes the yellow change interval. That is, the pedestrian time clearance time equals the flashing DON'T WALK plus the yellow change interval.

The typical walking speed of 4 fts cited in the MUTCD, is assumed to represent the "normal" pedestrian. There are however, various categories within the general population that walk at a slow rate. For example, some female pedestrian walk slower than some male pedestrians; very young children, the elderly, and the handicapped also walk at a slower rate. Researches on pedestrian characteristics verify that over 60% of all pedestrians move slower than 4fts and 15% walk at or below 3.5fts[6,8].

2.3 DESIGN GUIDANCE

At accessible pedestrian signal locations, push button clearly indicate which crosswalk signal is actuated by each push button. Push buttons and tactile arrows should have high visible contrast as described in the "Americans with Disability Act Accessibility Guidelines for Buildings and Facilities (ADAAG)".Tactile arrows should point in the same direction as the associated crosswalk. At corners of signalized locations with accessible pedestrian signals where two pedestrian push buttons are provided, the push buttons should be separated by a distance of at least 3m (10fts).This enables pedestrian that have visual disabilities to distinguish and locate the appropriate pushbutton[7,8].

Push buttons for accessible pedestrian signals should be located as follows:-

- Adjacent to a level all weather surface to provide access from a wheelchair.
- Within 1.5m (5ft) of the crosswalk extended.
- Within 3m(10ft) of the edge of the curb, shoulder, or pavement.

2.4 OTHER TYPES OF PEDESTRIANS CROSSING CONTROLLER

ZEBRA: Marked by black and white painted strips across the road and flashing amber beacons. The law says motorist must give way when a person has moved onto a crossing. Zebra crossing are cheaper to build, although their use on roads where traffic speeds are higher than 35mph is not recommended.

TOUCAN: Crossing is designed for both pedestrians cyclist and are typically used adjacent to a cycle-path. There is a given cycle symbol alongside the green man. At the latest Toucan crossing time is establish each time by on-crossing detectors in the same way as puffin. The cost of a Toucan is similar to that of a puffin.

PUFFIN (Pedestrian User Friendly Intelligent) crossing differ from pelican crossing as they do not have a flashing green man/ flashing yellow signal. The overall crossing time is established each time by on-crossing pedestrian detectors. The demand for crossing is triggered by push button unit.

PEGASUS: Crossing are similar to Toucan crossing s but have a red/green house symbol and higher mounted push buttons to allow horses riders to cross. This Type of crossing is only used when many crossing movements are made across a bush main road.

2.5 PEDESTRAIN TRAFFIC LAW.

1. A pedestrian crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection shall yield the right of way to all vehicles on the roadway.
2. A pedestrian crossing a roadway at a point where there is a pedestrian tunnel or overhead pedestrian crossing shall yield the right of way to all vehicles upon the roadway.
3. Between adjacent intersections at which traffic control signals are in operation, pedestrians may not cross at any place except in a marked crosswalk.
4. A pedestrian may not cross roadway intersection diagonally unless authorized by official traffic control devices, and if authorized to access diagonally, shall only as directed by the appropriate official traffic control devices [3].

2.6 ADVANTAGES / DISADVANTAGE OF PEDESTRIAN CROSSING SIGNALS

2.6.1 SIGNAL ADVANTAGES

Pedestrian crossing signals that are properly designed located, operated and maintain will have one or more of the following:

1. They avoid potential danger to motorist from people dropping, objects and oncoming vehicle.
2. Ensures less visually intrusive.

3. They provide for orderly movement of traffic.
4. They reduces accident an causalities to both pedestrians and motorist.
5. They are used to interrupt heavy traffic at intervals to permit other traffic and pedestrian to cross.

2.6.2 DISADVANTAGES.

1. They cause delay of traffic while pedestrian cross.
2. Pedestrian could want a whilst waiting for pedestrian phase to be called before crossing.
3. The average walking speeds between the young, the disable and the old are different from the other pedestrians.
4. The signal cannot work without poor supply.
5. Failure of signal can cause traffic jam.

CHAPTER THREE

3.0 DESIGN AND CONSTRUCTION

3.1 INTRODUCTION

The basic electronics components used in the design of this project work (pedestrian crossing light controller system) are dual D-flip flop IC (4013B); dual astable IC (556); decade counter IC (4001B); astable IC (4047B); four npn transistors (ZTX 300); five LEDS (two red, two green, one yellow); resistors -100Ω, 680Ω (5), 4.7kΩ, 47kΩ, 100kΩ, 1mΩ, 2.2mΩ, ceramic capacitors 0.01μf (2), electrolytic capacitors 1μf (2), buzzer, push button switch, PVC-covered tinned copper wire. The D flip-flop and the 556 clock the decade counter which is responsible for the cycle of the changes and via the amplifier and the gates the desired LED and bleep are produced.

Fig 3.1 shown below is the block diagram representing the pedestrian crossing light controller.

3.2 BLOCK DIAGRAM

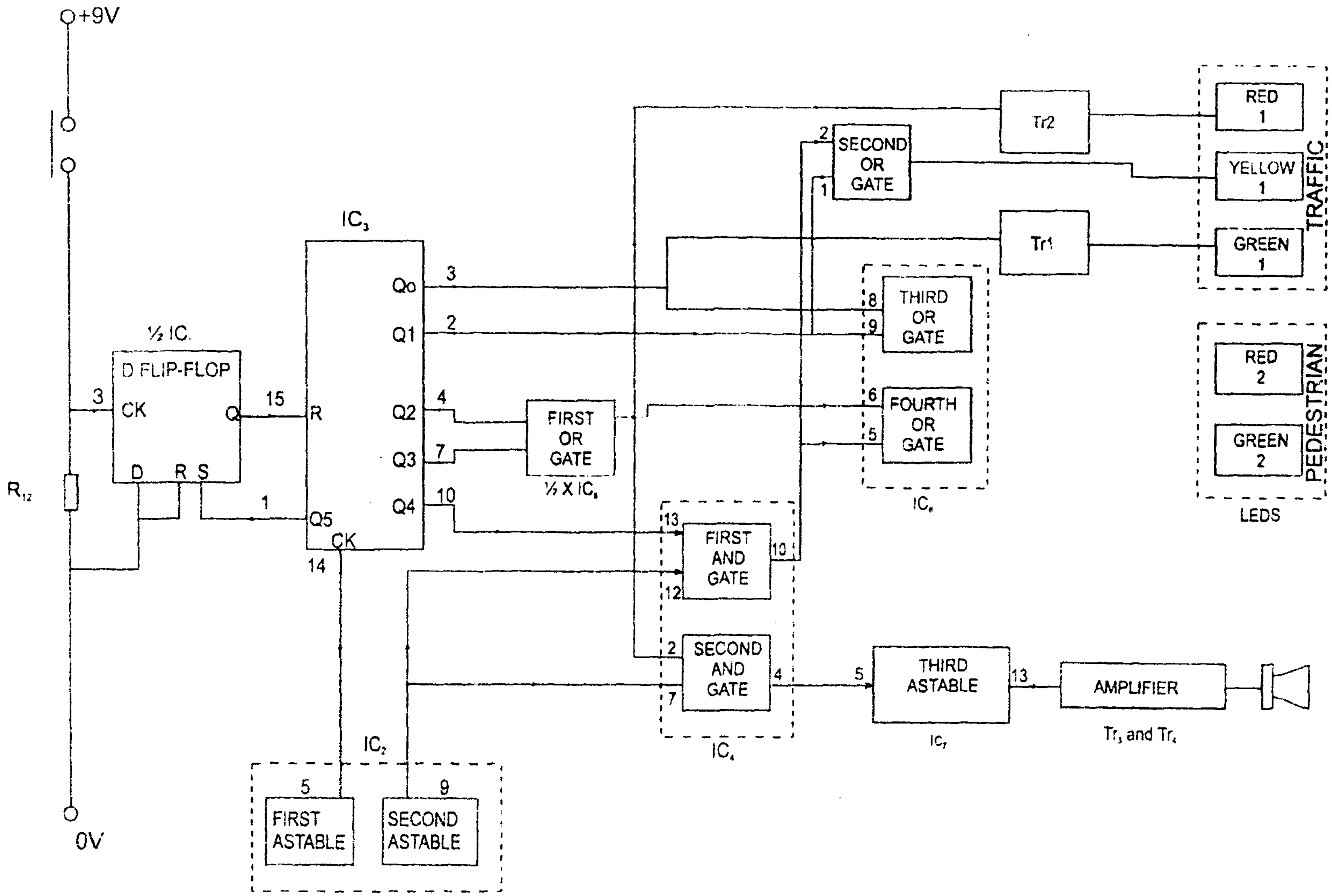


FIG 3.1 BLOCK DIAGRAM OF PEDESTRIAN CROSSING LIGHT CONTROLLER

3.3 POWER SUPPLY UNIT

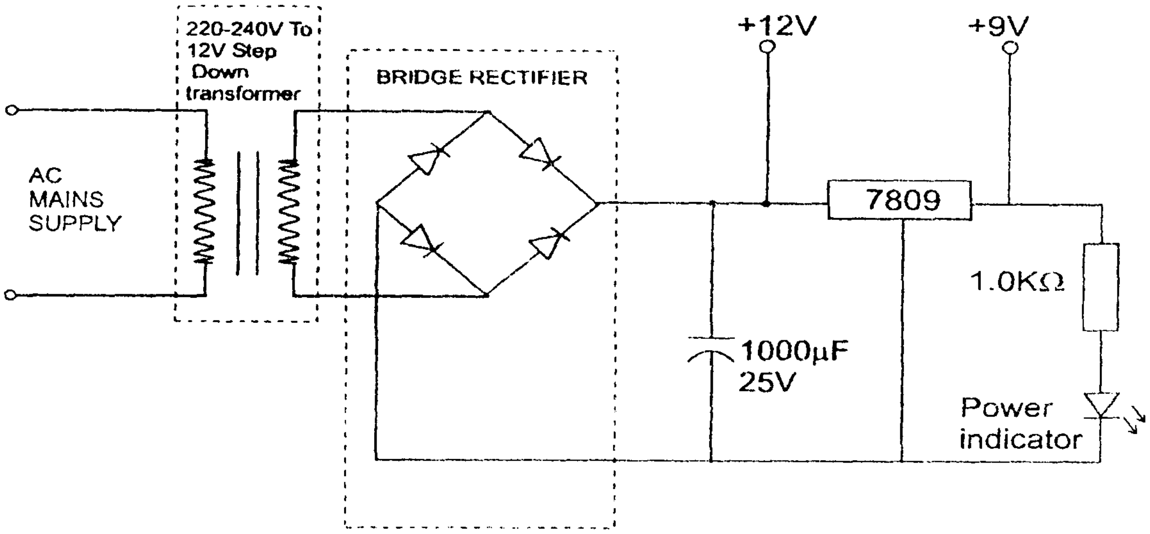


Fig 3.2 Power Supply unit

Most electronic devices and circuit require DC for source for their operation which is not an exception for this project.

The power supply functions basically to provide the necessary DC voltage that is ripple free with good stability and regulation [9].

Since the most convenient and economical source of power is the domestic AC supply, it is advantageous to convert this altemating voltage (usually 220-240V) to DC (smaller voltage). This conversion from altemating voltage to DC voltage is achieved with the construction of a powers supply unit which consists of 4 stages as shown in the fig 3.3 below.

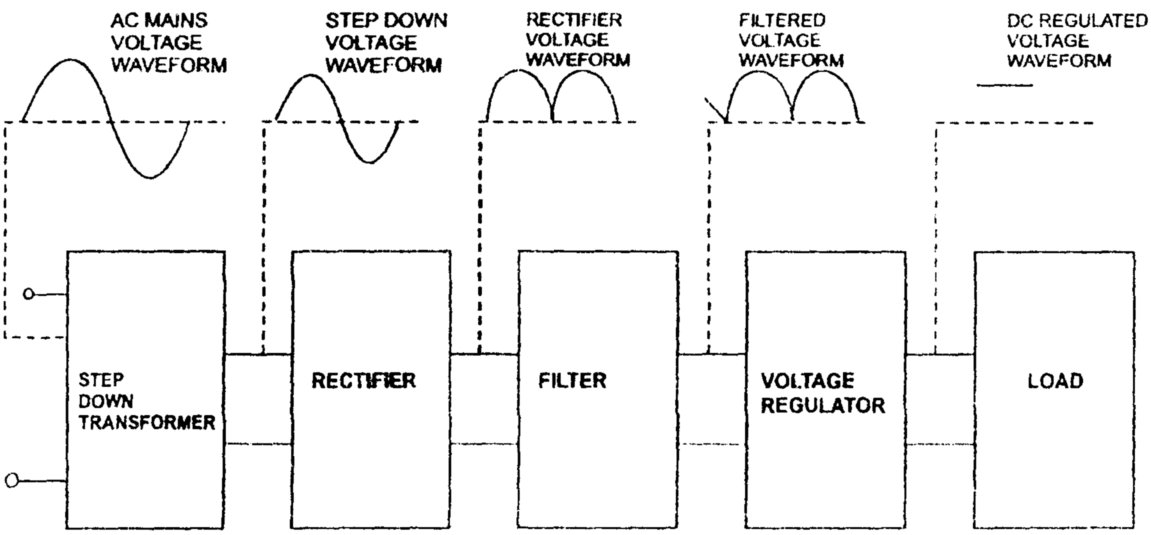


FIG. 3.3, Block Diagram of stages in power unit

3.3.1 TRANSFORMERS

A transformer is a static (or stationery) piece of apparatus by means of which electric power in one circuit is transformed into electric power of the same frequency in another circuit. It can raise or lower the voltage in a circuit but with a corresponding decrease or increase in current. It accomplishes this by electromagnetic induction. The physical basis of a transformer is mutual induction between two circuits linked by a common magnetic flux. The induced voltage is a function of the numbers of turns of the winding. A step down transformer is used from 220V to 12V.The relationship between the numbers of turns voltage and the current both at the primary and secondary are related by this equation 3.1

$$\frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_s} \quad \text{.......................... (3.1)}$$

Where

V = Voltage

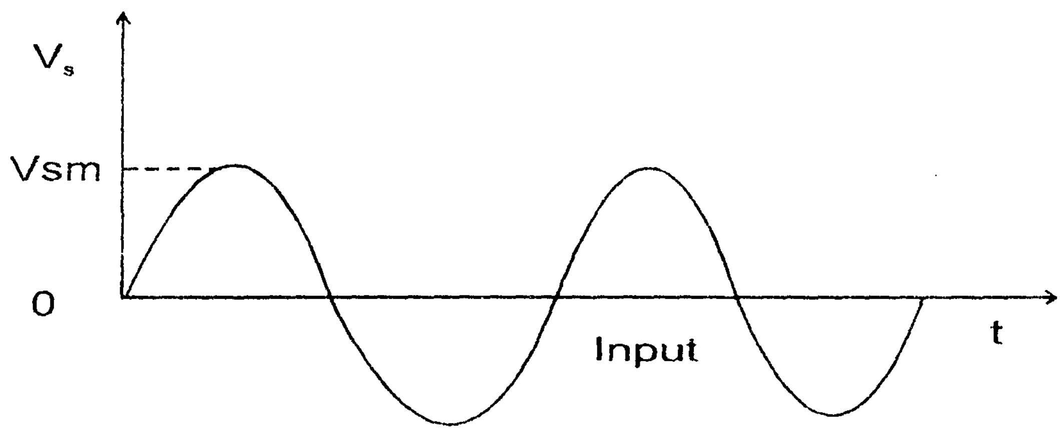
N = Number of turns

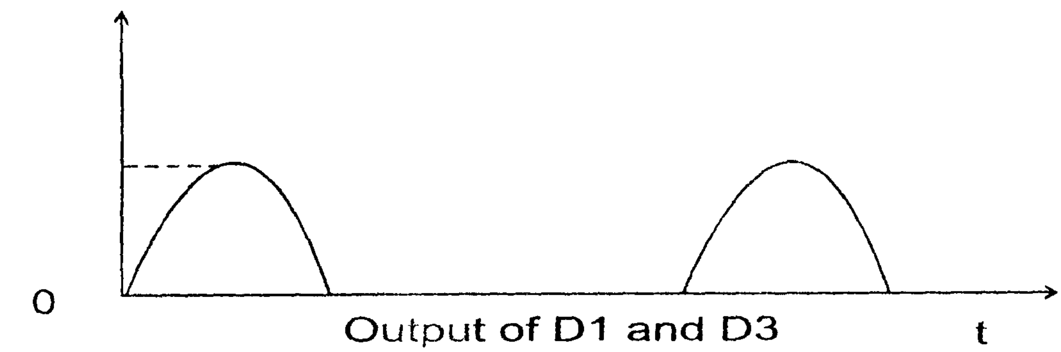
s = Secondary

p = Primary

3.3.2 BRIDGE RECTIFIER

A bridge rectifier is a circuit which employs four diodes to convert the stepped down AC voltage into a pulsating DC voltage. It provides a full wave rectification. The rectifier gives the following output wave form [9, 12].





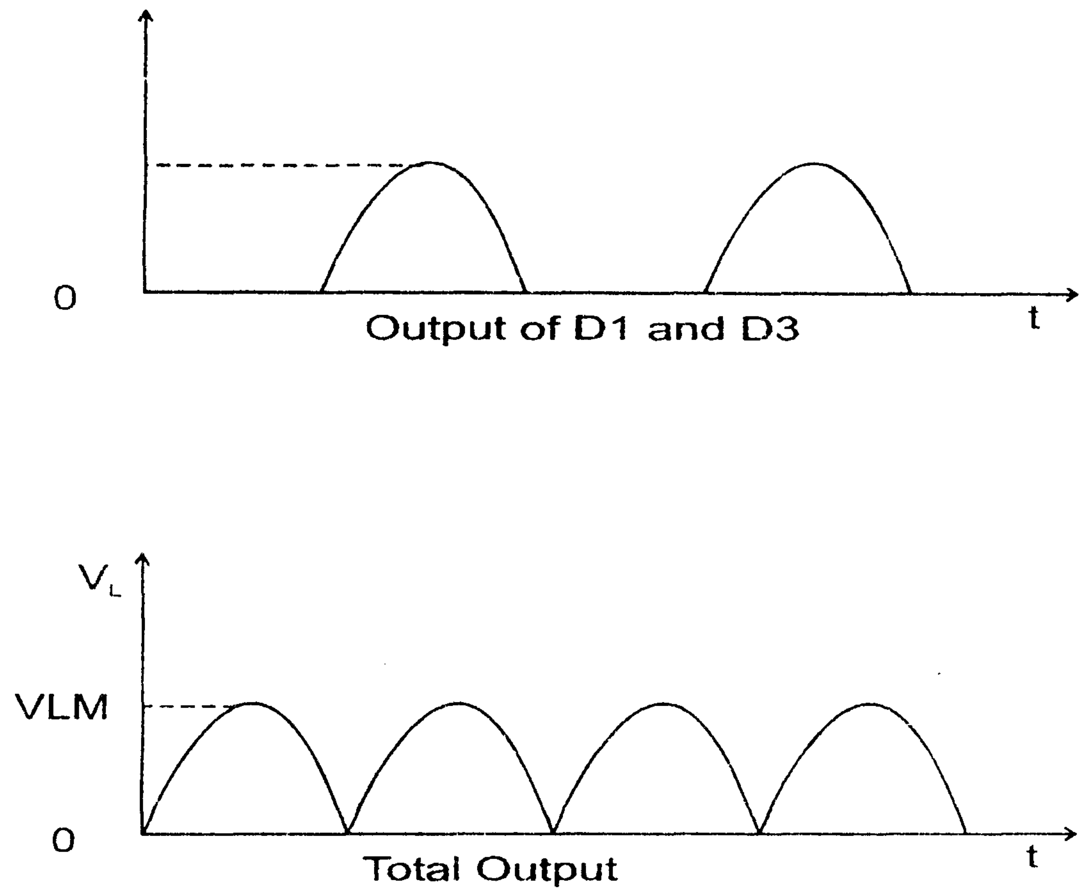


Fig 3.4 Output rectifier wave forms

3.3.3 FILTER

The function of this circuit element is to remove the fluctuations or pulsations (called ripples) present in the output voltage supplied by the rectifier. Though it does not give ripple free output voltage like DC battery but approaches it so closely. A capacitor filter is used in this project.

3.3.4 VOLTAGE REGULATION

Its main function is to keep the terminal voltage of the DC supply constant even when:|

a. AC input voltage to the transformer varies (deviation from 220V are common), or

b. The load varies.

It is impossible to get 100% constant voltage due to minor variation. A 7809 regulator is used for this project. It is supplied with +12V input and gives output of +9V.

3.3.5 POWER INDICATOR

It is a light emitting diode which is fixed basically to know when the power supply unit is functioning or not. The current flowing into the LED can be calculated. Thus:

Calculation

$V_{out} = V_{in} - IR$

$I = \frac{(V_{in} - V_{out})}{R}$ regulator

$V_{in} = 12V$

$V_{out} = 9V$

$R = 1k\Omega$

$I = \frac{12V - 9V}{1k\Omega} = \frac{3V}{1k\Omega}$

$I = 3mA$

3.4 556 TIMER

The 556 is dual version of the 555 housed in a 14-pin package, the two types (555 and 556) share the same power supply pins. The circuit symbol for a 556 is a box with the pins arranged to suit the circuit diagram; for example 556 pin 14 at the top for the +VS $_{supply}$, 556 pin 6 and 9 output on the left and right. Usually, just the pins numbers are used and they are not labeled with their functions.

The 556 can be used with a supply voltage (V_s) in the range of 4.5 to 15V (18V absolute maximum). Standard 556 ICs create a significant 'glitch' on the supply when their output changes state [10].

Pin connection is shown on Appendix 1.

3.4.1 556 ASTABLE

As used in the project, an astable circuit produces a 'square wave'. This is a digital wave form with sharp transistor between low (0V) and high ($+V_s$). Note that the durations of the low and high states may be different. The circuit is called an astable because it is not stable in any stable, the output is continually charging between 'low' and 'high' [10, 11].

The time period (T) of the square is the time for one complete cycle, but it is usually better to consider frequency (f) which is the number of cycle per second.

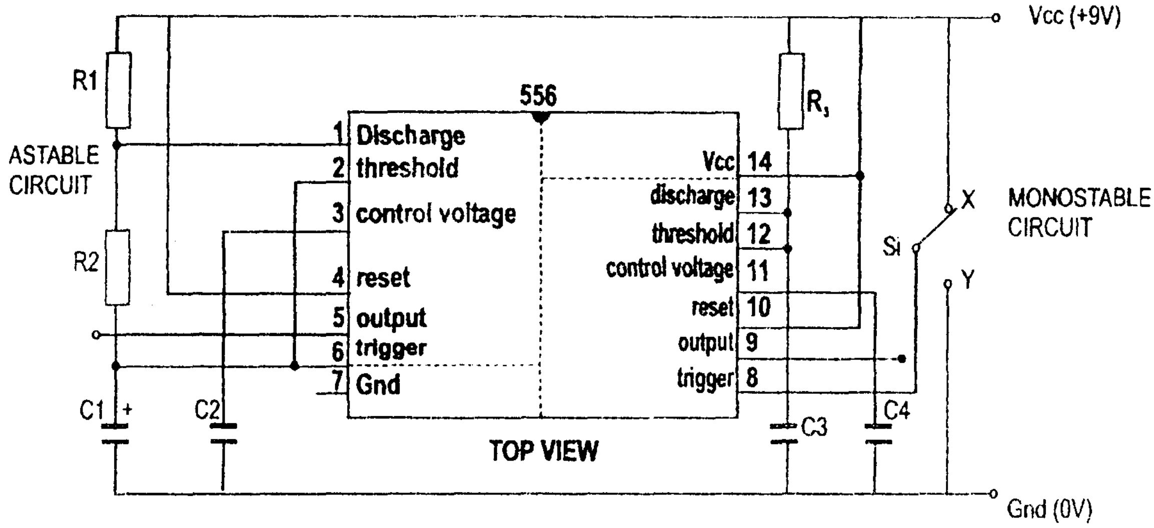


Fig 3.5 556 Connection as an astable and operation as monostable

3.4.2 **FORMULAs**

$T = 0.7 \times (R_1 + 2R_2) \times C_1$ .... (1)

And $f = \dfrac{1.4}{(R_1 + 2R_2) \times C_1}$ .... (2).

T = Time period in second (s)

F = Frequency in Hertz (Hz)

R_1 = Resistance in ohm (Ω).

R2= Resistance in ohm (Ω).

C1 =Capacitance in Farad (F)

The time period can be split into two parts:

T = Tm + Ts .... (3)

Mark time (output high): Tm = 0.7 x (R1 + R2) x C1 .... (4)

Space time (Output low): Ts = 0.7 x R2 x C1 .... (5)

3.4.3 CHOOSING R1, R2 AND C1

R1 and R2 should be in the range 1k Ω to 1MΩ.

It is best to choose C1 first because capacitors are available in just a few values.

To choose C1 and R2 table of guide is required

$$R_2 = \frac{0.7}{F \times C_1} \quad \ldots\ldots (6)$$

- Choose R1 to be about a tenth of R2 (1kΩ min), unless you want to mark time Tm to be significantly longer than the space time is.
- If is a variable resistor, it is best to use R2.
- If R1 is variable, it must have a fixed resistor of at least 1 kΩ in series.

Table 3.1 Table Guide for Choosing C_1 and R_2

556 ASTABLE FREQUENCIES			
C1	$R_2 = 10k\Omega$ $R_1 = 1k\Omega$	$R_2 = 100\ k\Omega$ $R_1 = 10\ k\Omega$	$R_2 = 1M\Omega$ $R_1 = 100\ k\Omega$
0.00μf	68KHz	6.8KHz	680Hz
0.01μf	6.8KHz	680Hz	68Hz
0.1μf	680Hz	68Hz	6.8Hz
1μf	68Hz	6.8Hz	0.68Hz
10μf	6.8Hz	0.68Hz (Per min)	0.068Hz (4 per min)

$R_1 = 1M\Omega = 1 \times 10^6\Omega$

$R_2 = 2.2M\Omega = 2.2 \times 10^6\Omega$

$C1 = 1\mu f = a \times 10^{-6}f$

Therefore, from the equation .... (6)

$$f = \frac{0.7}{R_2 \times C_1}$$

$$f = \frac{0.7}{2.2 \times 10^6 \times 1 \times 10^{-6}}$$

$$f = \frac{0.7}{2.2}$$

$f = 0.32Hz$

If the voltage on 'reset is less than 0.7V or so, it stop working and f can be changed independently of R_1, R_2, and C_1 by applying a voltage of 9V to 'control voltage' (which normally goes to 0V via a 0.01μf capacitor (2) i.e. frequency induction occurs.

The time T of the pulse from the monostable is given by

$T = 1.1 \times R_3 \times C_3$ .... (7)

$R_3 = 47k\Omega = 47 \times 10^3\Omega$

$C_3 = 1\mu f = 1 \times 10^{-6}f$

Therefore, $T = 1.1 \times 47 \times 10^3 \times 1 \times 10^{-6}$

$T = 0.05sec$

The monostable is triggered by the falling (negative going) edge of a pulse applied to 'trigger' obtained for example, be rapidly switching S1 from X to Y and back to X again so that the triggering time is less than the output pulse time T.

3.5 4000 SERIES CMOS LOGIC ICS GENERAL CHARACTERISTICS

- Supply: 3 to 15V, small fluctuations are tolerated.
- Input: have very high impedance. This is good because it will not affect the part of the circuit where they are connected. However, unconnected input must be connected to the supply (either positives or 0V) so as to prevent pick up electrical noise.
- Output: Can sink and source only about 1mA. If no input is driven, maximum 10mA with a 9V supply/just enough to light "an LED".
- Fan out: One point can drive up to 50 inputs.
- Gate propagation: typically 30ns for a signal to travel through a gate with 9V supply.
- Frequency: Up to 1MHz
- Power Consumption: Is very low. It is much greater at higher frequencies, a few mW at 1 MHz.

3.5.1 PRECAUTIONS WITH CMOS

Static electric charges can build up on the input pin (due to the very high input impedance of CMOS chips) when, for example, they are touch insulating materials [9, 10]. The following rulers should be followed.

- Keep the IC in their carrier in which supplied until it is inserted in the circuit.
- Connect all unused inputs to either positive or negative terminal of the battery.
- Check very carefully before switching on a circuit that is on correct polarity.

3.5.2 WHY CHOOSE CMOS OVER TTL

- The MOS IC is relatively simple and inexpensive to fabricate.
- The MOS device size is small and it consumes less power because of the small size, it can accommodate a much larger number of circuit's elements on a single chip than TTL. This makes them suitable for complex ICs such as Micro processors, memory chip, e.t.c.
- Most digital ICs normally do not use the IC resistor elements that take up so much of the chip area or bipolar ICs [9, 10].

3.6 DUAL D FLIP FLOP "4013B"

This IC consists of two independent D flip flop with common power supply pins. In this project, it operates in two ways;

i. Direct Mode

ii. Clocked mode

3.6.1 DIRECT MODE of D-Flip Flop

In direct mode, it behaves as an RS type. If R is 'high' and S 'low', it reset with Q 'low' and Q 'high'. If R = 0 and S = 1, it switches to its other stable in which it is set with Q = 1 and Q = 0. If R = 1 and S = 1, it means we are trying to get Q (and Q) to be 1 and O at the same time.

Table 3.2 Direct Mode of D-Flip Flop

INPUTS		OUTPUTS	
R	S	Q	1
1	0	0	1
0	1	1	0
1	1		
0	0		

3.6.2 Clocked Mode of D-Flip Flop

In the clocked (or triggered) mode, R and S must be O. When a rising (Positive going edge) pulse is applied to CK (or T), if D = 0, clocking makes Q = 0 and Q = 1 and both output retains these states until the next clock pulse arrives. When D = 1, clocking makes Q = 1 and Q = 0. To sum up in D type action, the state (1 or 0) of the D input is transferred to the Q output during the rising edge of a clock pulse and not before. The direct inputs r and S override the clock input.

Table 3.3 Clocked mode of D-Flip Flop

INPUT		OUTPUT	
CK	D	Q	$\bar{Q}$
Rising Edge	0	0	1
Falling Edge	0	0	1
Rising Edge	1	1	0
Falling Edge	1	1	0

3.7 DECADE COUNTER "4017B"

This has ten outputs (Q_0 to Q_9) and each goes 'high' in turn on the rising edge of successive clock pulses provided that reset (Pin 15) and clock enable (Pin 13) are both 'low'. When reset is taken 'high' the counter resets to zero and in this condition Q_0 is 'high' the counter reset to zero and in this condition, Q_0 is 'high' and all other outputs are 'low'. Reset must be returned to 'low' for counting to start again. Counting stop if clock enable is made 'high' at any time. Pin connection is shown on appendix 3.

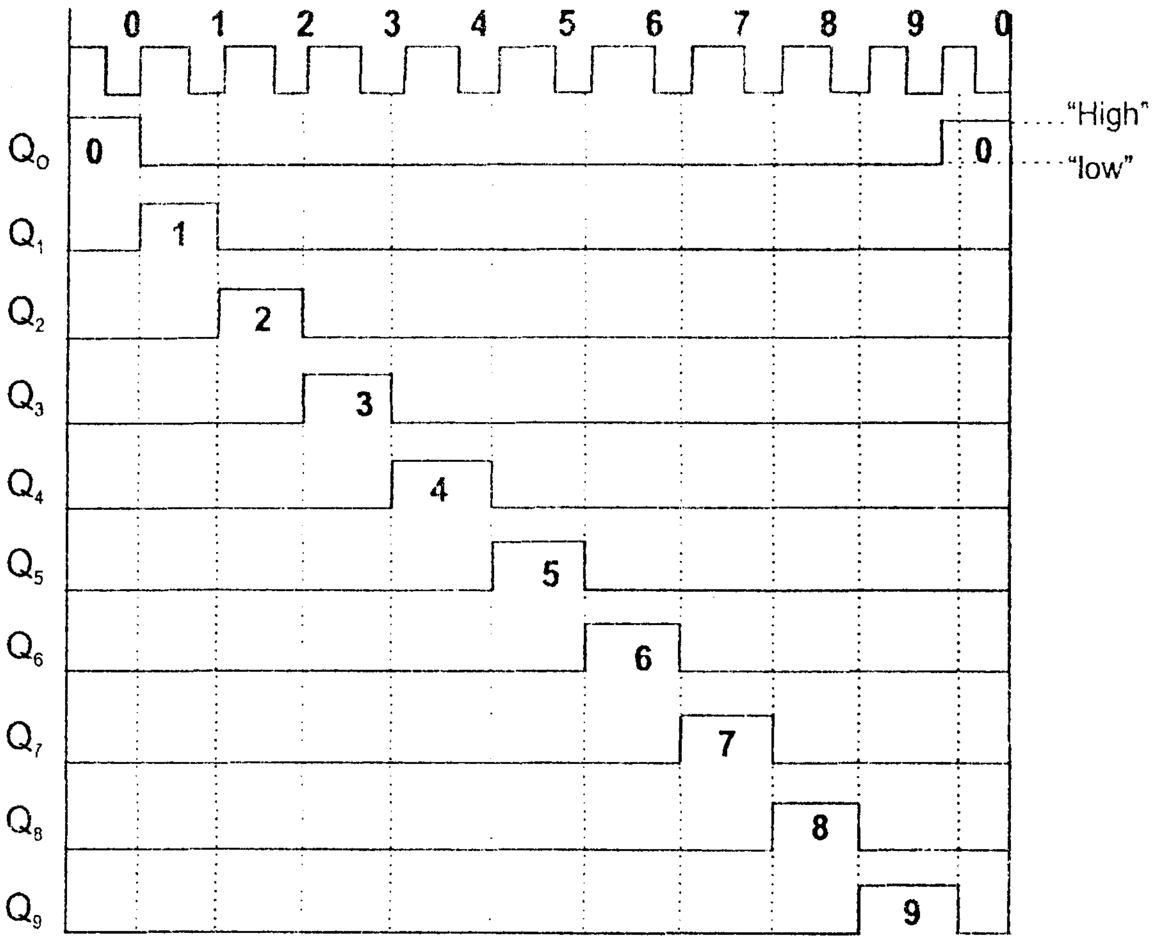


Fig. 3.6 Decade Counter Timing Diagram

3.8 ASTABLE/MONOSTABLE IC "4047B"

This IC has a much lower power output than the 556 but it needs only one external capacitor (C, not an electrolytic) and one resistor (R) and has three astable outputs called Q, Q and 'oscillator'. Q and Q are complements, i.e. one is 'high' when the other is 'low'.

Their frequency F_1 is given by:

3.8.1 FORMULARS

$$F_1 = \frac{0.23\ Hz}{R \times C} \quad \ldots\ldots (8)$$

$$F_2 = 2F_1 \quad \ldots\ldots (9)$$

$T = 2.5RC$

Where

F = frequency

R = Resistor

C = Capacitor

T = Pulse time.

3.8.2 CALCULATION

Using equation (8) $f_1 = \frac{0.23}{R \times C}$ Hz

From the construction:

$R = R{=}5 = 4.7k\Omega = 4.7 \times 10^{3}\Omega$

$C = C_5 = 0.1\mu f = 0.1 \times 10^{-6}F$

Therefore

$$f_1 = \frac{0.23}{4.7 \times 10^3 \times 1 \times 10^{-7}}$$

$$f_1 = \frac{0.23}{0.00047}$$

$f_1 = 489.4Hz$

Using equation (9)

Therefore frequency f_2 of the oscillator =

$f_2 = 2f_1$

$f_2 = 2 \times 489.4$

$f_2 = 978.7Hz$

The astable circuit is enable, only if the voltage on 'astable' (pin 5) does not fall below about ½ V_{DD} (i.e. 4.5 if V_{DD} = 9V). The connections for triggering the IC as a monostable are given in the table. Both rising and falling edges can be used.

To calculate pulse time T, we can use equation (10) with R and C being connected as in the astable circuit.

$T = 2.5RC$

$R = 4.7k\Omega = 4.7 \times 10^3\Omega$

$C = 0.1\mu f = 0.1 \times 10^{-6}f.$

$T = 2.5 \times (4.7 \times 10^3) \times (0.1 \times 10^{-6})$

$T = 1.2 \times 10^{-3}sec.$

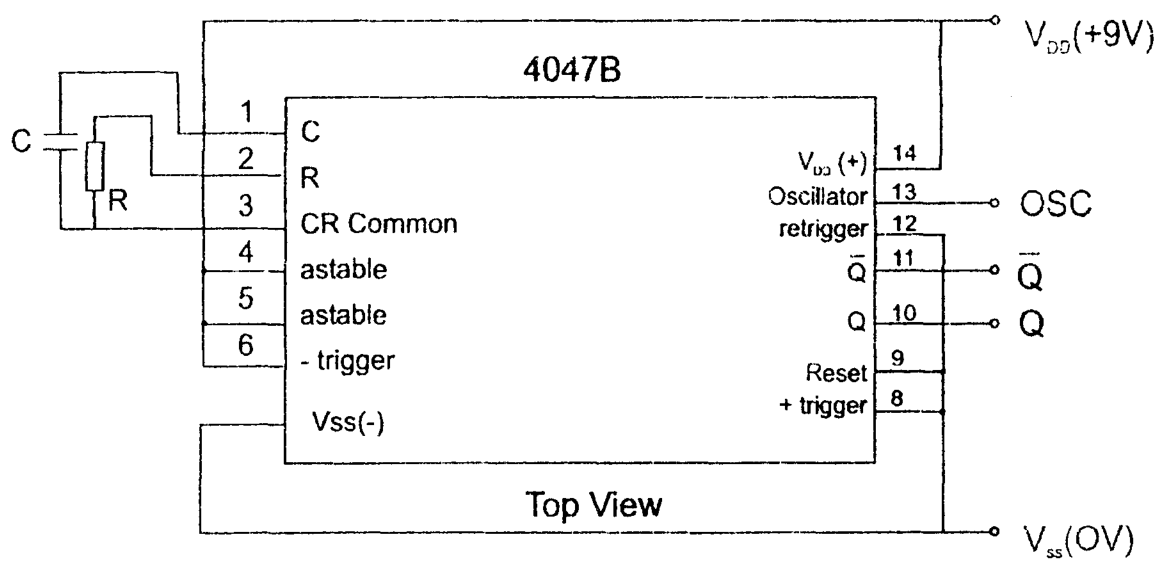


Fig 3.7 Astable circuit

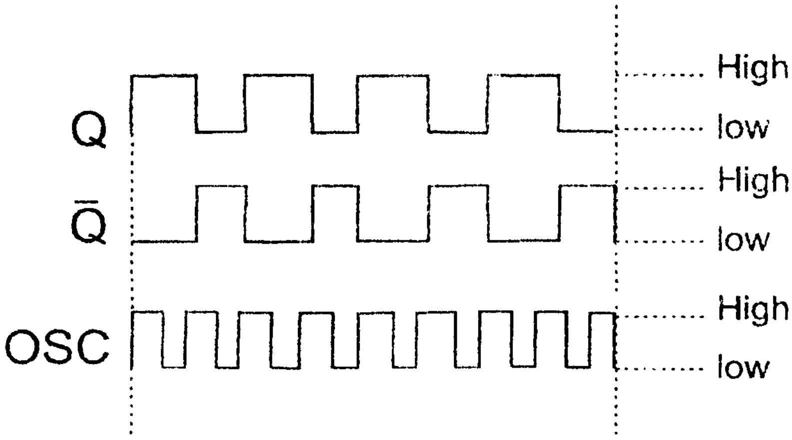


Fig 3.7.1 Astable outputs wave form

TABLE 3.4 Time connection for triggering in monostable

rigger	Pin connection		Input trigger to	Output pulse from
	To V_{DD}	V_{SS}		
ising edge	4, 14	5, 6, 7, 9, 12	8	10, 11
alling edge	4, 8, 14	5, 7, 9, 12	6	10, 11

Facilities not required are provided by 'astable' (pin 4) in astable operation and by 'retrigger' (pin 12) and 'reset' (pin 9) in monostable operation.

3.9 400IB AND 4011B

This logic ICs usually have several gate on the same chip with common power supply connections.

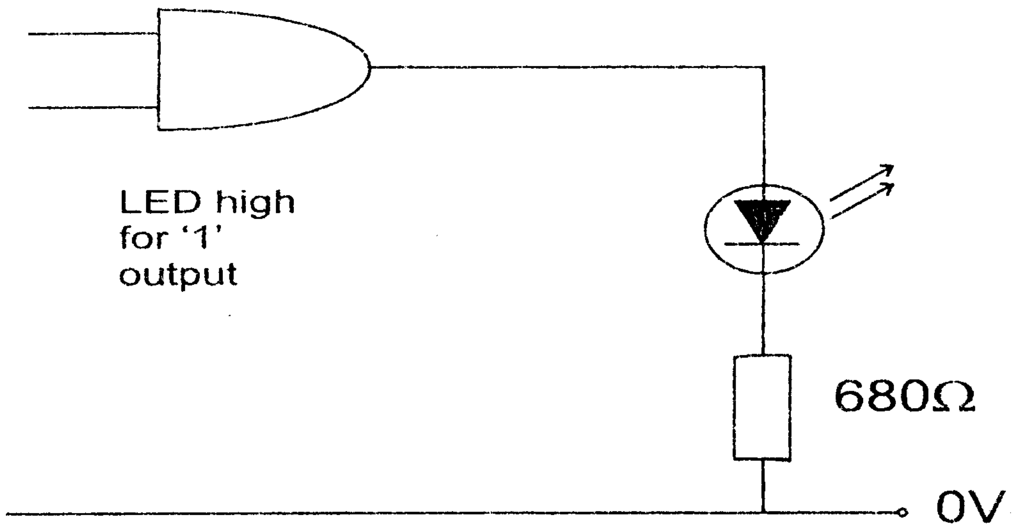
- 4001B is a quad 2 input NOR gate, with four identical two input NOR gate. Its pin connection is shown in Appendix 5

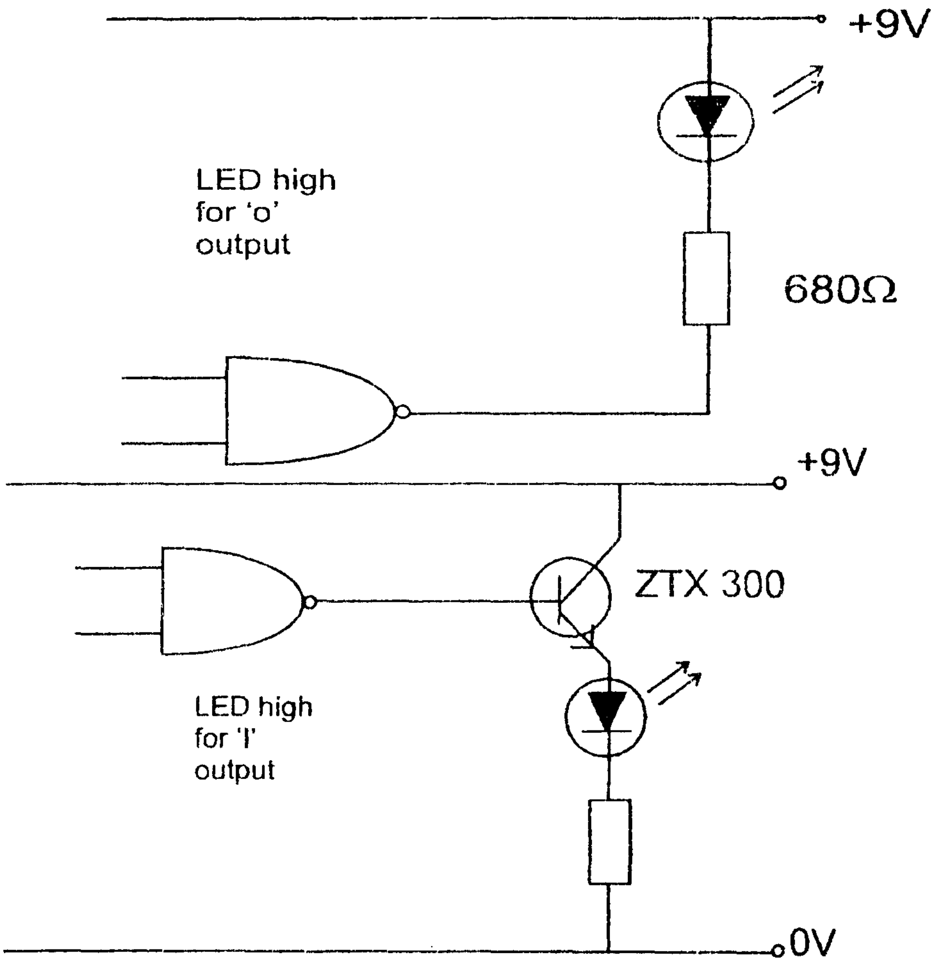
- 4011B is a quad 2 input NAND gate the pin connection is shown in Appendix 6.
- The output from this logic gate goes to the LED (output)

3.9.1 LED (LIGHT EMITTING DIODE)

When forward bias, an LED conducts and emits red, yellow, or green light depending on the composition from which is made from on +9V supply,680 ohms is suitable. The voltage drop across a conducting LED is 1.7V.Reverse voltages of more than 5V may cause damage. The lead nearest the flat is the cathode. The output from the CMOS IC will drive the LED directly. Transistor ZTX 300 is used to avoid 'overloading which might stop switching.

Fig 3.8 LED Connections





All these gives the complete circuit diagram of the project

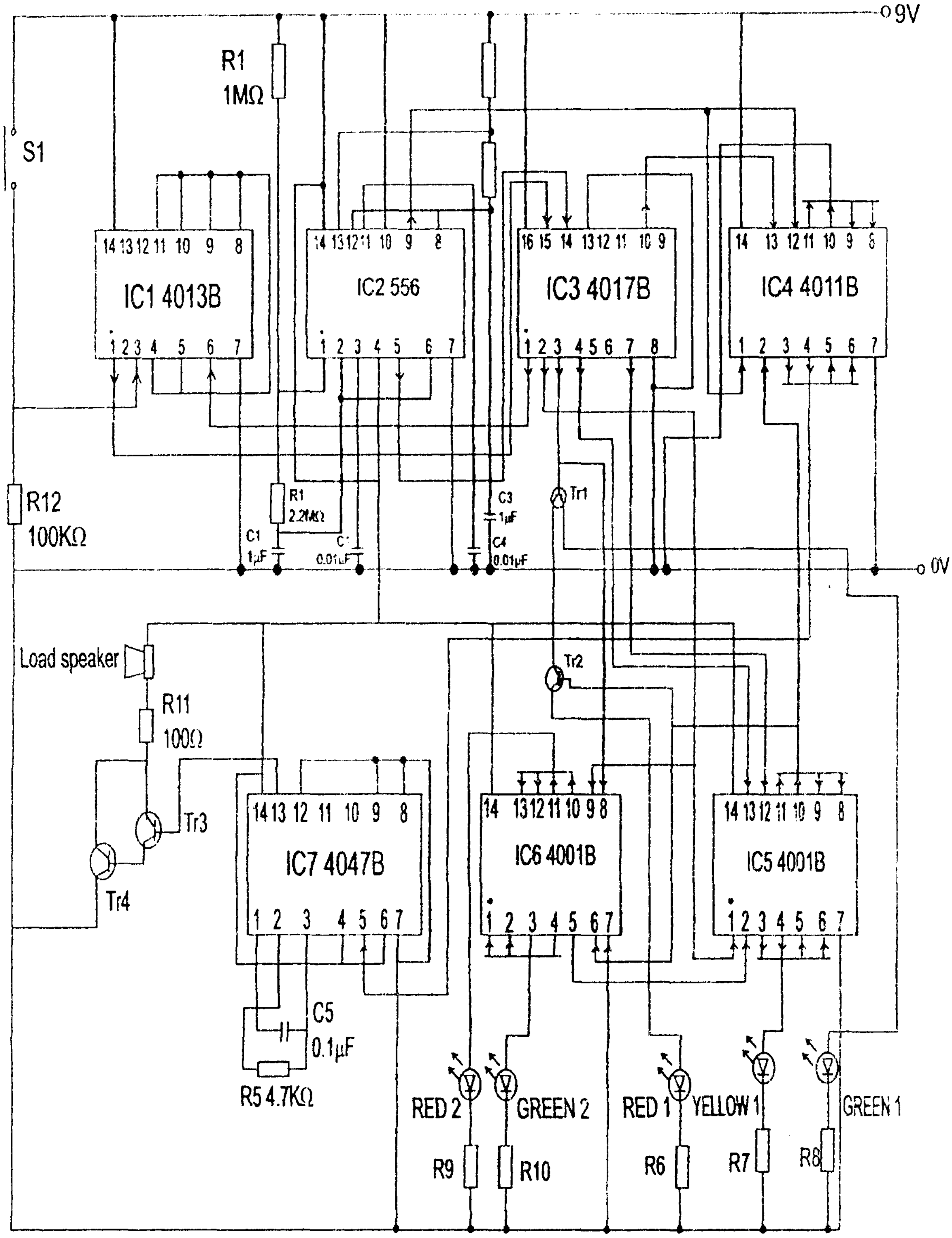


Fig 3.9 Complete circuit diagram of Pedestrian crossing light controller

CHAPTER FOUR

4.0 TESTS, RESULTS, AND DISCUSSION

4.1 TESTS

Before testing the work, it was first constructed on a breadboard to determine if it will work or not. After the testing on bread board, it was then transferred onto the Vero board. The following precaution was taken before testing the finished work:-

- Pin 1 from the ICs were identify from the small dot or notch at one end of the case.
- Links wires were inserted from each IC to the positive and negative rails and between other sockets.
- R_1 to R_{12}, C_1 to C_5 and S_1 where inserted ensuring that C_1 and C_3 are connected to the correct way round, the positive end has a groove and the negative end a black band.
- The collector (c), base (b) and the emitter (e) of the transistor are identify and ensure that they are not touching each other.
- In inserting the LED, the cathode is next to the flat at the bottom of the plastic case.
- Tight connection was ensured and the circuit is checked carefully before testing.

To test the construction, the correct terminals of the transformer are connected to the mains. The LED light and the bleeps sounds as discussed in the result obtained.

4.2 RESULTS OBTAINED

The result obtained is tabulated below with 1 representing a lit LED and 0 an unlit one. The pulse outputs from each stage are also shown below;

Table 4.1 **Truth Table**

	STAGES →	1	2	3	4
TRAFFIC LEDS	RED 1	0	0	1 + Bleeps	0
	YELLOW 1	0	1	0	Flashes
	GREEN 1	1	0	0	0
PEDESTRIAN	RED 2	1	1	0	0
LEDS	GREEN 2	0	0	1 + Bleeps	Flashes

4.3 DISCUSSION OF RESULT

The block diagram on Fig 3.2 shows that the output from the first astable (Pin 5) is applied to the 'clock' input CK (Pin 14) of the decade counters and drives it at a slow rate determined by R_1, R_2 and C_1. If 'reset' R (Pin) on the counter is 'low', counting of the clock pulses from the astable occurs, i.e. outputs Q_0, Q_1 e.t.c. goes high in turn. When Q_5 (Pin 1) is 'high', it makes the 'set' input S (Pin 6) on the D flip flop go 'high' and so puts the Q output (Pin 1) 'high'(i.e the flip flop operates in the direct mode). This makes 'reset' R (Pin 15) on the counter go 'high' causing it to reset, i.e Q_0 becomes 'high' and all other outputs go 'low', including Q_5. LED green 1 is therefore alight (via Tr1) as is Red 2 because one of the inputs (Pin 8) is 'high' to the third or gate which drives it. This is the normal state of the system, i.e 'go' for the traffic and 'stop' for pedestrians.

Since Q_5 is now 'low' both R and on the flip flop are 'low' allowing it to operate in the clocked mode. Consequently, when S1 is closed, the 'clock' input CK (Pin 3) rise from OV (due to the connection via R12 to OV) to 9V, and on the resulting rising edge the 'low' state of the D input (Pin 5) is transferred to the Q output, i.e Q now goes 'low', counting can then start again. Q1 (Pin 2) goes 'high' after Q_0 therefore Red2 is kept 'high' by the third or gate (Pin 8) and the second or gate (Pin 1) drives yellow 1 'high'. The other LED are unlit since the other outputs are 'low'. This is stage 2 in the sequence.

Q_2 (Pin 4) and Q_3 (Pin 7) provide the inputs to the first or gate so that when either is 'high', the output (Pin 10) from the gate is 'high' thereby making stage 3 last twice as any other (giving pedestrians time to cross the road). Red 1 is now alight (via Tr2), as is green 2 because one of the inputs (Pin 6) to the fourth or gate is 'high'. To obtain the bleeps for this stage the output from the first gate is also supplied to one input of the second astable which produces faster pulses (due to R3, R4, and C3) than those from the fist astable. The first or gate provides a long pulse (when Q2 or Q3 is high) which opens the second and gate to allow about twenty shorter pulses from the astable to pass into the third astable. The latter fills each pulse in with even shorter pulses (Determined by R5 and C5) because the third astable is only enabled (Pin 5) when the output from the second and gate is high. The 'fast' pulses from the third astable are amplified by Tr3 and Tr4 to give audible note in the loudspeaker.

In stage 4, Q4 (Pin 10) goes 'high' and opens the first and gate to the second astable, thereby causing the output from the gate (Pin 10) to switch several times a second between 'high' and 'low' 'flashing' of green 2 occurs via the second or gate.

When Q_5 goes 'high', the counter resets to lie the 'normal' state until S1 is pressed again. The whole sequence takes 15 seconds.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The aim and objective of this project work; the design and construction of a pedestrian crossing light controller, which is to display different light display combination and audible sound at intervals to control traffic and pedestrians crossing at road intersection and highly densely populated areas has been achieved.

The work of a traffic officer standing inside the sun to control traffic can be replaced with this design by simply pressing a button.

5.2 LIMITATION AND MERITS OF THE PROJECT

The limitation of this work is that the walking time between pedestrians are different, the walking speed of the old, young and the disable cannot be the same but they have the same time given to cross. Also the design only includes provision for the blind but no provision for a pedestrian that is both blind and deaf.

The major merit of this project is the simplicity of the involved circuit and its low cost to implement. It is quite flexible; the output sequence can be expanded or modified for numerous tasks. The use of Light Emitting Diodes (LEDs) display for controlling traffic is quite an improvement.

5.3 PROBLEM ENCOUNTERED

In the course of designing and constructing this project, the problem encountered includes;

(a) Getting materials needed especially the CMOS ICs. Casing material is also non available around.

(b)Aground fault was encountered and it takes a lot of time to trouble shoot before the fault was rectified.

5.4 POSSIBLE IMPROVEMENT ON PROJECT

This work can be improved on by designing the same type but being powered with solar cells since public power supply is not constant in this country.

It can also be modify to include a motor tracking technology that sense traffic flow and numbers of pedestrian willing to cross so that the design can automatically operate without pushing of a button.

5.5 RECOMMENDATION

Adoption and use of this circuit is recommended in all schools intersection and crosswalk. It should also be installed in any densely populated area in this country.

Also the Department should make available ICs testing equipment needed by students for their project in the laboratory.

REFRENCES

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APPENDIX

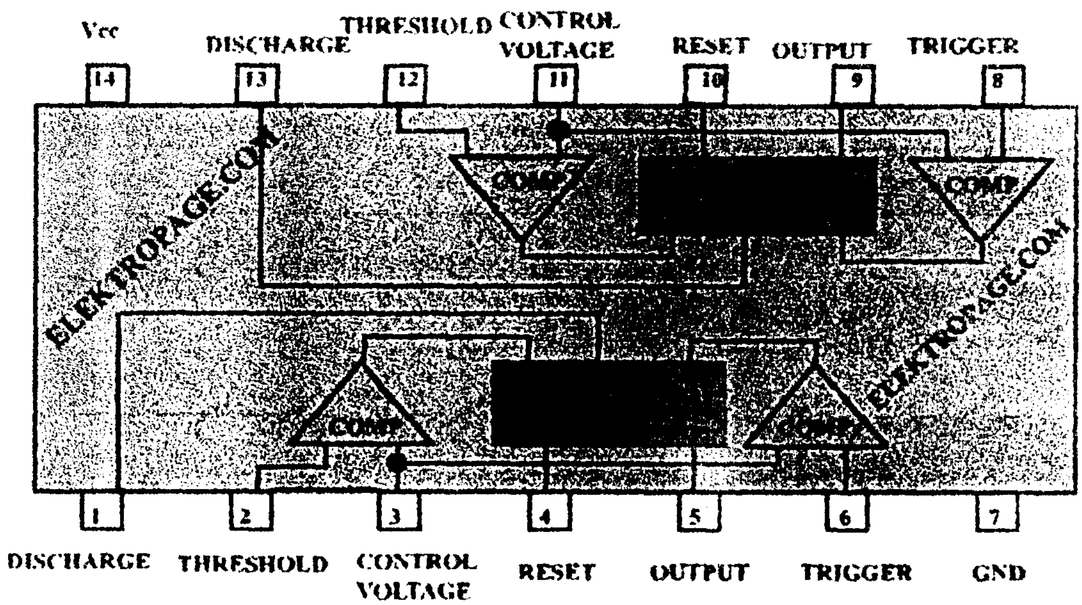
S/NO	Quantity	Name of Component	Unit price (N)	Amount (N)
1	1	240V-12V step down transformer	N200	N200
2	1	IC 4013B	N200	N200
3	1	IC 556 Timer	N250	N250
4	1	IC 4017B	N200	N200
5	1	IC 4047B	N200	N200
6	2	IC 4001B	N200	N400
7	4	ZTX 300 transistor	N30	N120
8	12	Resistors	N10	N120
9	5	Capacitors	N20	N100
10	5	LEDs	N20	N100
11	1	Push button switch	N30	N30
12	1	Buzzer	N150	N150
13	1	Big Vero Board	N130	N130
14	1	Soldering Iron	N300	N300
15	10	Soldering Lead	N30	N300

16	1	Lead Sucker	N120	N120
17	5	Tinned Copper Wire	N30	N150
18	1	Power Cord	N50	N50
19	1	Digital Meter	N1000	N1000
20		Casing	N1000	N1000

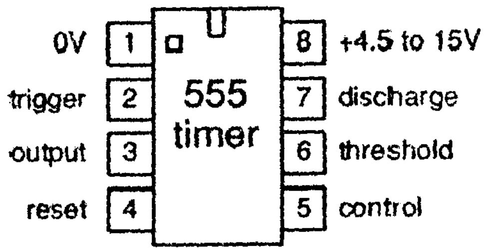
COST ANALYSIS

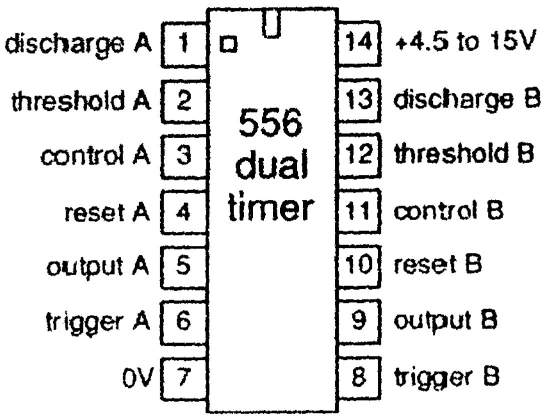
APPENDIX 1

556 Connection Diagram



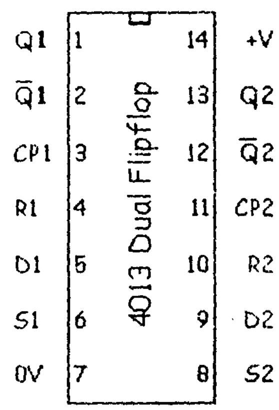
556 pin connection



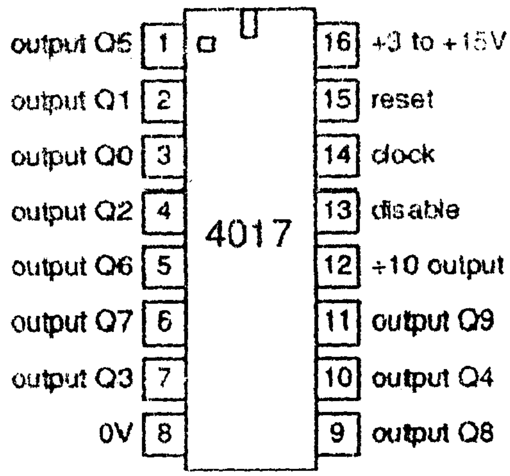


Appendix 2

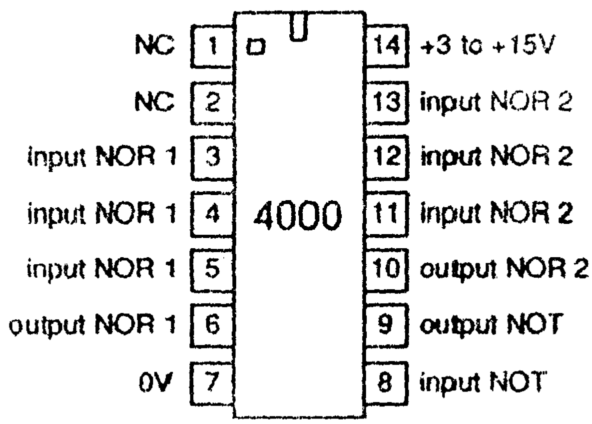
DUAL D PLIPFLOP 4013B PIN CONNECTION



APPENDIX 3 DECADE COUNTER 4017B PIN CONNECTION



APPENDIX 4047 PIN CONNECTION



APPEDDIX 6 4001B AND 4011B PIN CONNECTION