PROJECT TITLE

DESIGN AND CONSTRUCTION OF A T-JUNCTION TRAFFIC CONTROL

BY

EZEA GERALD E. O

98/6965EE

DEPARTMENT OF ELECTRICAL / COMPUTER ENGINEERING SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA NIGER STATE, NIGERIA.

A PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE BACHELOR OF ENGINEERING (B. ENG.) DEGREE IN THE DEPARTMENT OF ELECTRICAL / COMPUTER ENGINEERING.

NOVEMBER, 2004.

CERTIFICATION

This is to certify that this project "DESIGN AND CONSTRUCTION OF A T-JUNCTION TRAFFIC CONTROL was designed and constructed by EZEA GERALD E.O for the award of Bachelor of ENG. In Electrical / Computer Engineering of Federal University Of Technology Minna. Niger State, Nigeria.

----------------------------- -----------------------

Engr. M.S Ahmed Date

Project supervisor

-------------------------------- -----------------------

Engr.MUSA.D. ABDULLAHI

Head of Department Date

-------------------------------- -----------------------

External Examiner Date

CERTIFICATION

This is to certify that this project "DESIGN AND CONSTRUCTION OF A T-JUNCTION TRAFFIC CONTROL was designed and constructed by EZEA GERALD E.O for the award of Bachelor of ENG. In Electrical / Computer Engineering of Federal University Of Technology Minna. Niger State, Nigeria.

------------------------------ ------------------------

Engr. M.S Ahmed

Project supervisor

Date

-------------------------------- ------------------------

Engr.MUSA.D. ABDULLAHI

Head of Department

Date

-------------------------------- ------------------------

External Examiner

Date

DEDICATION

With sincere gratitude, I dedicate this project to my lovely would-be wife. Also I dedicate this work to all my well- wishers around.

ACKNOWLEDGEMENTS

With lowliness of heart, my immense and sincere gratitude goes to the Almighty and Immortal God- El-Shaddai, who through his Son and my Saviour Jesus Christ bestowed me with his divine provisions, protection, and guidance throughout the course of my degree pursuit.

Thanks to my able supervisor, Engineer M.S Ahmed, for his wonderful assistance, constructive advice, encouragement and guidance. I extend my gratitude also to the HOD of Electrical/Computer Engineering Department, Engr. Musa D. Abdullahi and the rest of the departmental lecturers for their assistance directly or indirectly to me.

My immeasurable gratitude goes to my loving, caring and wonderful parents, Mr. And Mrs. Francis Ezea O. for their moral, financial, amongst lots of innumerable responsibilities towards me. My brothers and sisters are not left out. I am obliged to you all.

To share in this banquet of thanks are my only family on campus, the Nigeria Federation of Catholic Students (NFCS), particularly the secured heart of Jesus and immaculate heart of Mary group for their moral encouragement, my former and present room mates, host of friends and course mates. You all are wonderful people, thank you all.

ABSTRACT

It is only the inhabitants of a city without traffic that would not understand the need for traffic control.

It is in the bid for achieving proper traffic control that traffic signs and signals come into being. Traffic light stands conspicuous among the traffic signs and signals and, it is the heart of this project.

The circuit works as: the mains supply from NEPA, which is ≤ 220V is supplied to the 12V step down transformer whose secondary terminals was connected to the full-wave bridge rectifier. The rectifier circuit converts the 12V output from the mains to 12V d.c. the 12V d.c is then smoothened or filtered by the 2200:f capacitor. LM317 IC which is adjustable regulator could variably regulate the filtered d.c voltage. The output was supplied to the Vcc supply of 555 timer IC which generates pulses. An LED in series with 320Ω resistor to drain excess current from burning the LED serves as an indicator of the pulses been generated by the 555 timer. The pin 3 of 555 timer is connected to pin 14 of the Decade Counter 4017IC which then counts sequentially.

The diodes IN 4001 that was connected to the pins of 4017IC was connected in such a way that there is a delay as one diode conducts the other(s) blocks. Hence, six stage outputs is used to drive the LED lamps.

TABLE OF CONTENTS

3

CHAPTER ONE

GENERAL INTRODUCTION

1.1 INTRODUCTION

Recent experience shows that because of unregulated flow of traffic in urban cities, a lot of time is wasted to travel from one urban city to another. Today, in almost every big city of the whole world, the streets and urban motor ways are congested by heavy traffic.

The roundabouts and grade separations used as intersection control have not yielded any good result, likewise the current practice of using human controllers utilizing hand signals to direct traffic.

Thus, there is a non-uniform time standard which results in long queue being formed at the various junctions. This in turn leads to traffic hold-up.

As a result of these problems mentioned above, the need for an automatic traffic control system was enunciated thus, with this new device of automated traffic control system, vehicles can now pass safely. So, the control of vehicles at the various road signals at the junction are RED, YELLOW (AMBER) AND GREEN.

In this project, it is intended to design automatic traffic controller for T-junction road. Normal traffic light control signals follow the same pattern of light sequence for traffic movement.The sequence is

RED ⟶ YELLOW ⟶ GREEN light.

That is, R ⟶ Y ⟶ G

RED ⟶ YELLOW ⟶ GREEN light.

That is, R ⟶ Y ⟶ G

The table below shows what happens at various road sides for T-Junction to allow vehicles to pass through and stop passing.

RED (R)	AMBER (A)	GREEN (G)	COMMENT
ON	OF	OFF	No passing of vehicles
ON	ON	OFF	Get ready to pass vehicles
OFF	OFF	ON	Passing of vehicles

Table 1.0

To understand fully the circuit design criterion of traffic light controller systems, the above table has been used to make the design clear using an arbitrary T-Junction or Y-Junction road.

1.2 LITERATURE REVIEW

TRAFFIC CONTROL – THE STATE-OF- THE- ART

There are many different forms of traffic control developed to reduce the number of conflicts and improve signal controls in roads. While traffic control signals prevent continuous flow by allowing the right way in some set sequence to conflicting traffic streams in forms of intersection control in that they occupy less space. The main types of traffic signal control are designed to operate at isolated junction or in some interactive way in an area control of a road network.

The design and construction of a traffic controller is intended to accomplish traffic sequencing, controlling three road junctions in form of T-Junction or Y-junction. The diagram is shown in fig 1.0.

In the diagram consideration, it is assumed equal traffic density flow on all sides of the roads.

Alternatively, the signal timing of the roads can be varied by a control system logic incorporated in the actual design construction.

Thus, to explain fully the function of the various signals in the controller, the following T-Junction traffic signals must be obeyed by vehicles and road user for the system to work perfectly well. See fig 1.1

Vehicles passing from ROAD A to ROAD B do so without problem by traveling at the right side of the road.

Vehicles passing from ROAD B to ROAD C do so without problem also by traveling at the right side of the split road side. Likewise vehicles passing from ROAD C to ROAD A do so without problem by travelling at the right side of the split road as shown in fig. 1.1. Thus, under this condition it is assumed that the roads considered are all split into two at any

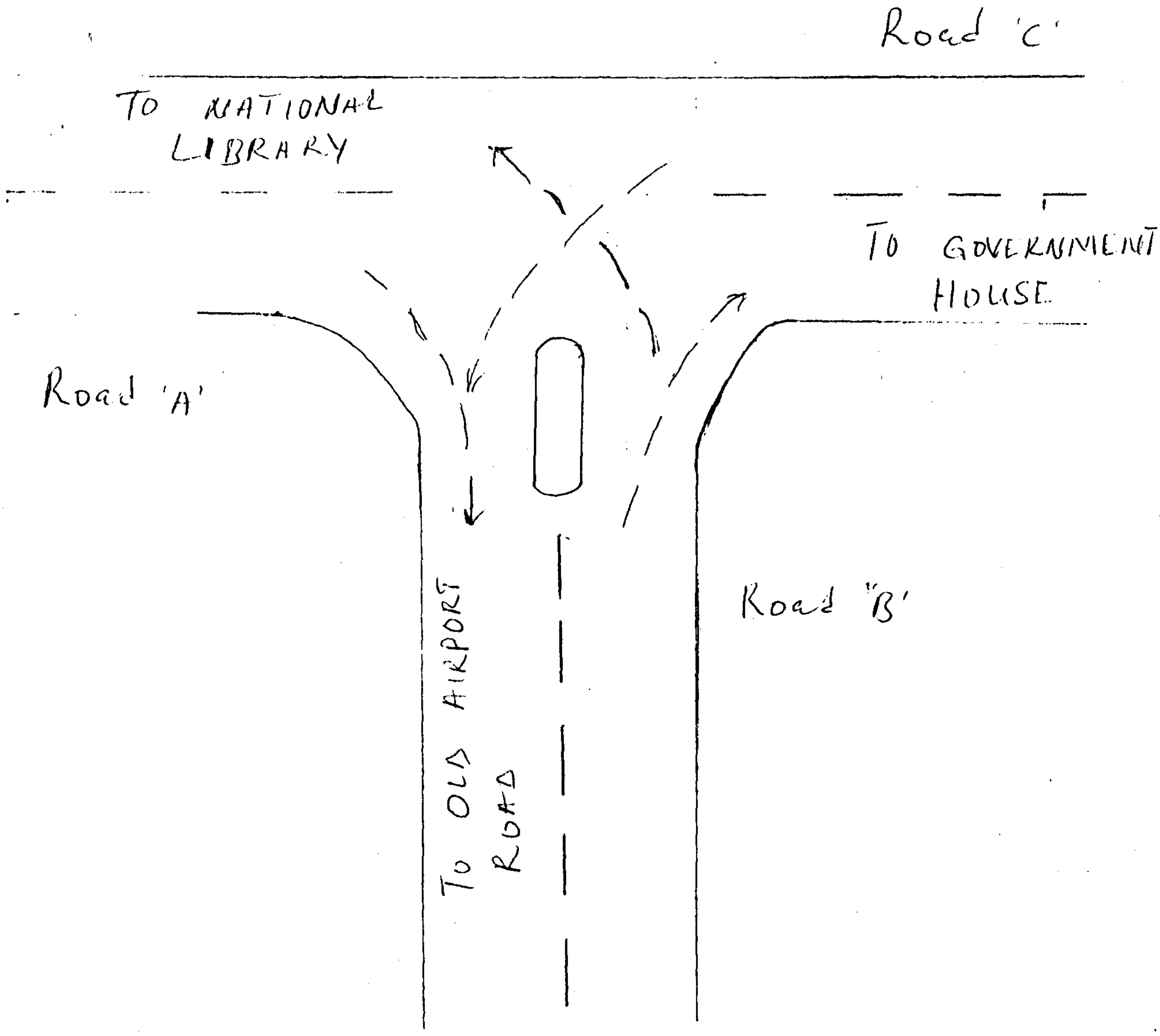


Fig 1.0 A Typical T- Junction Road

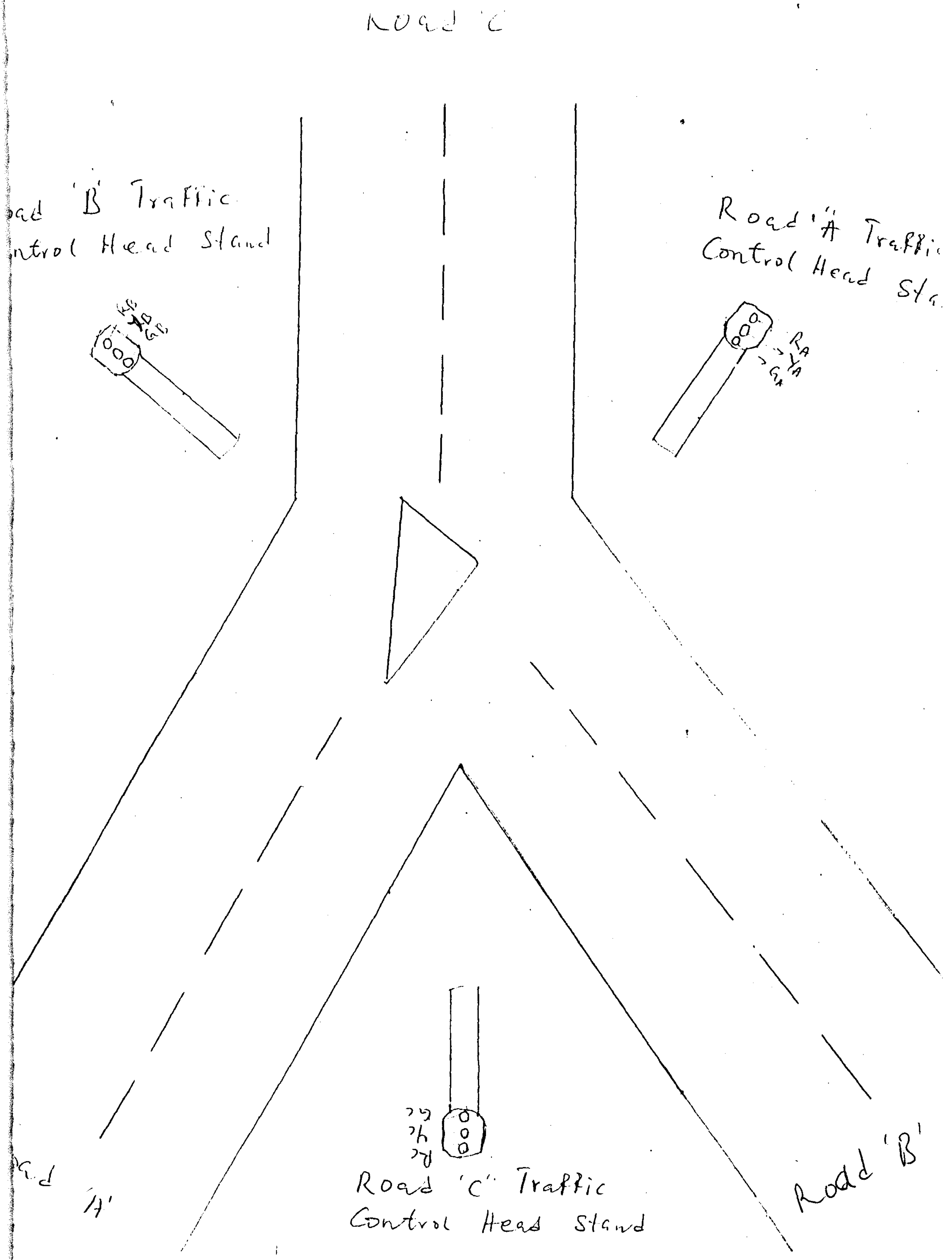


Fig 1.1 T(Y)-JUNCTION WITH TRAFFIC HEAD

road side having considered. It is also assumed that there is no left passage of vehicles without observing the various traffic light signals for control.

In general, the various traffic sequences without problem are as shown below.

SEQUENCE WITHOUT PROBLEM	COMMENT
ROAD A TO ROAD B	Direct passage (no problem)
ROAD B TO ROAD C	Direct passage (no problem)
ROAD C TO ROAD A	Direct passage (no problem)

Table 1.1

Conversely, for a vehicle to pass from ROAD A to ROAD C, the vehicle need to observe the signal shown in the traffic head mounted directly opposite the road in this case, ROAD A. So also, vehicle passing form ROAD B to ROAD A have to observe the traffic control signals mounted directly opposite the ROAD B.

Finally, vehicle passing from ROAD C to ROAD B will also observe the traffic signal controller mounted directly opposite road C.

The traffic sequence table for vehicles to pass while observing the traffic light control signals is as shown in table 1.2 below.

ROAD A	ROAD B	ROAD C	
R_A A_A G_A	R_B A_B G_B	R_C A_C G_C	COMMENT
ON OFF OFF	ON OFF OFF	OFF OFF ON	Vehicle passing ROAD C
ON ON OFF	ON OFF OFF	OFF ON ON	ROAD C getting ready to stop
ON OFF OFF	OFF OFF ON	ON OFF OFF	Vehicle passing ROAD B
ON OFF OFF	OFF ON ON	ON ON OFF	ROAD B getting ready to stop
OFF OFF ON	ON OFF OFF	ON OFF OFF	ROAD A passing vehicles
OFF ON ON	ON OFF OFF	ON OFF OFF	ROAD A getting ready to stop

TABLE 1.2 TRAFFIC LIGHT SEQUENCE TABLE

R_A =	RED LIGHT	FOR ROAD A
A_A =	AMBER LIGT	
G_A =	GREEN LIGHT	

R_B =	RED LIGHT	FOR ROAD B
A_B =	AMBER LIGT	
G_B =	GREEN LIGHT	

R_C =	RED LIGHT	FOR ROAD C
A_C =	AMBER LIGHT	
G_C =	GREEN LIGHT	

Thus, the above control signal for traffic on a T-junction road works well in reducing or totally eliminating accidents on the T-junction when vehicles fully observe the signals at the various traffic heads.

TRAFFIC CONTROL SYSTEMS

Traffic control systems are power operated traffic control devices which alternatively direct traffic to stop and to proceed. The main function of traffic control signals is to permit crossing streams of traffic to share the same intersection by means of time separation to minimize delays to traffic, increase safety etc.

Hence. the need for a traffic control signals to any junction must be carefully evaluated in relation to the following:

(a) Where traffic on major Street is so heavy that traffic on a minor street suffers excessive delay or hazards in entering or crossing the major street.

(b) Where inadequate gaps exist for people to cross at established school crossing.

(c) Where the traffic volume on a major street and pedestrian volumes crossing the street exceed specified levels.

(d) Where the number of reported cases of accidents exceeds a specified value.

STRUCTURE OF A TRAFFIC CONTROL SYSTEM

Traffic control signals are usually implemented in a number of ways ranging from electro-mechanical devices using cams to computers based traffic network controller.

Modern traffic controllers operate by electricity. This method is better than others in that they are cheaper, occupy less space, safer and more efficient.

Certain basic parts like the controller, signals heads, detectors, inter-connecting cables and associated hardware are required in any installation. However, equipment requirement for any installation depends on the degree of sophistication desired, and the particular application of the control device. The function is to switch the signal indicators ON and OFF according to a fixed or alterable plan to correctly and safely assign the right of way at a given location.

Traffic control system at an intersection consists of signal head units mounted in each leg of the intersection. Individual units must have separate RED, AMBER AND GREN indicators.

Each signal consists of a lamp, reflector and lens. Plastic lenses are preferred to glass ones because of their shatter proof characteristic and polycarbonate plastics are preferred to hyalite plastics because of their higher temperature characteristic. Availability of power and an unobstructed view to approaching traffic are other very important factors.

SIGNAL TIMING

A major parameter in traffic sequencing is the CYCLE-LENGTH. Cycle – length is the time required for a complete sequence of indications and lies between 30 seconds and 12 second, although it depends on the intersection.

Short cycle lengths are preferred to long ones because of short delay experienced by vehicles. However, because of starting time delays and the time required to clear the intersection, short cycles are more likely to incur more lost time and accommodate fewer vehicles per hour.

The sequence of signal is:-

(a) RED

(b) RED and AMBER

(c) GREEN

(d) GREEN and AMBER

(e) REPEAT

The green time depends on the volume, speed of traffic flow and the importance of each street is increased further if 'left', 'right' and pedestrian phases are included. The objective of signals timing is to alternate the right of way between traffic streams so that the average delay to all vehicles, pedestrians and the total delay to only single group of vehicles can be minimized.

Cycle-length is determined such that the capacity to volume ratio on each approach will during the peak periods accommodate all the traffic that has accumulated during the proceeding RED interval and all that has arrived during GREEN phase.

TYPES OF CONTROLLERS

There are two types of controller in traffic viz:-

FIXED TIME CONTROLLERS and VEHICLE ACTUATED CONTROLLERS

(i) FIXED TIME CONTROLLER

In fixed time controller, pre-timed traffic signals are set to repeat regularly at fixed sequences of indication. The advantage is the relatively low cost and with a series of interconnected signals; vehicles can move through an intersection with a minimum of stop and other delays. The operation is not affected by condition brought about by unusual vehicles behavior such as forced stops.

The disadvantage is that it cannot adjust to short term variations in traffic flow and often hold vehicles from one direction when there is no traffic to the other direction.

The fixed time controller is frequently used where there are predictable and stable traffic volumes. Expansion of timing program is often limited because of timing and logic circuitry required. However, with modern control equipment, it is possible to change the cycle division at intervals during the day to fit the traffic pattern better.

(ii) **TRAFFIC ACTUATED**

Traffic signals operate on the bases of traffic demand registered by the actuation of vehicle and or pedestrian detectors. The advantage is that it can continuously adjust the cycle-length and the phase intervals to give a maximum response to short-term changes in traffic. With modern control equipment, signal operations can be adopted to many situations. Pass operations are offered to various movements in rotation with those without traffic demand.

Thus, traffic light controllers have the disadvantage that it can cause traffic jam in case of unusual vehicle behavior such as forced stops.

1.3 OBJECTIVE AND MOTIVATION

The goal of this project is to design and construct a traffic controller for any T-junction road.

The system is intended to:

(1) Regulate and control the traffic flow at a T-junction road.

(2) Provide for orderly flow of traffic

(3) Increase efficiency of traffic handling capacity at various danger zones and T-junction roads

(4) Reduce the frequent occurrence of certain types of accidents at the various T-junction

(5) Interrupt heavy traffic to allow crossing by other road users.

1.4 PROJECT LAYOUT

This project was written in four chapters viz: chapter one deals with the general introduction which discusses in brief the knowledge of the history of traffic light control system. In addition, the objective and motivation embarked upon this project was stated. Chapter two; the system design analysis of basic components was discussed.

Chapter three discusses about construction, testing and packaging.

Finally; chapter four deals about conclusion and recommendation on this project.

CHAPTER TWO

SYSTEM DESIGN AND ANALYSIS

2.1 INTRODUCTION

In the design of traffic controller, the generation of pulses in the circuit is achieved with the help of a popular analog-to-digital integrated circuit NE 555 timer IC configured as an astable multivibrator.

The model designed is based on the pulse counting and balancing technique. The design is aimed at realizing the following function:-

To select sequentially the motorway traffic heads and signals light.

To auto – initialize the controller in the event of OFF – ON NEPA POWER SUPPLY.

2.2 SIGNALS CODING

Generally, the traffic lights are color coded. The significance of the colors is as follows:

RED signifies stop; no traffic flow

RED YELLOW Combination implies get ready to move

GREEN demands traffic to flow

GREEN YELLOW combination signifies get ready to stop.

For simplicity, the following abbreviation have been adopted

(a) denotes road 'a',

(b) denotes road 'b'

And c denotes road 'c', each road, that is, road 'a' see traffic sign from traffic head A and vice-versa. A traffic head contains traffic light each of Red, Yellow and Green denotes as R, Y and G respectively

SPECIFICATION AND REQUIREMENT

In the case studied and designed, it is assumed that any traffic turning to right at the junction should have a free pass hence, movement from road (a) to road (c) need not wait for any sign.

The signal time diagram as shown in table below indicates the sequence of signal lamp illumination of each selected traffic head in time. Hence, the process starts with road (a) meaning that R_A, Y_A, G_A, is sequentially illuminated. The same applies to other heads B and C

A	B	C	FUNCTION
1	0	0	Road (a) to pass
0	1	0	Road (b) to pass
0	0	1	Road © to pass
1	0	0	Road (a) to pass

a

R	Y	G	FUNCTION
1	1	0	Ready to go
0	0	1	Go
0	1	1	Ready to stop
1	0	0	Stop

b

Table 2.0(a &b)

The output sequence of the traffic light is drawn in the table below

State	Traffic head A	Traffic head B	Traffic head C	Function
	R_A Y_A G_A	R_B Y_B G_B	R_C Y_C G_C	
0	OFF OFF ON	ON OFF OFF	ON OFF OFF	Road (a) passing
1	OFF ON ON	ON ON OFF	ON OFF OFF	Road (a) get ready to stop , road b to get ready to go
2	ON OFF OFF	OFF OFF ON	ON OFF OFF	Road (b) passing
3	ON OFF OFF	OFF ON ON	ON ON OFF	Road (b) get ready to stop Road (c) get ready to go
4	ON OFF OFF	ON OFF OFF	OFF OFF ON	Road (c) passing
5	ON ON OFF	ON OFF OFF	OFF ON ON	Road (c) get ready to stop Road (a) get ready to go
6	OFF OFF ON	ON OFF OFF	ON OFF OFF	Road (a) passing

Table 2.1

The three road junction require nine coded light for actual realization of the traffic light controller as shown above and the sequence of light illumination is also shown. State '0' is the initialization condition that is; the state is maintained even in the event of OFF – ON of NEPA. But, If the interruption of power occur while the sequence of light are at state order than state '0', the controller transfers back unconditionally to states '0'.

State 0 implies that the controller has selected road (a) to pass while blocking Road b and Road C respectively. State '2' and state '4' are similar except that Road B and Road C are selected to pass accordingly. State'0', '2' and ‘4’ have long delay while state ‘1’, ‘3’ and ‘5’ have short delay. State ‘6’ is the repetition of state ‘0’.

2.30 ASTABLE MULTIVIBRATOR OPERATION USING 555 IC

One popular application of the 555 timer IC is an astable multivibrator or clock circuit. The following analysis of the operation of the 555 timer as an astable circuit includes details of the different parts of the unit and how the various inputs and outputs are utilized. Figure below shows an astable circuit built using an external resistor and capacitor to set the timing interval of the output signal.

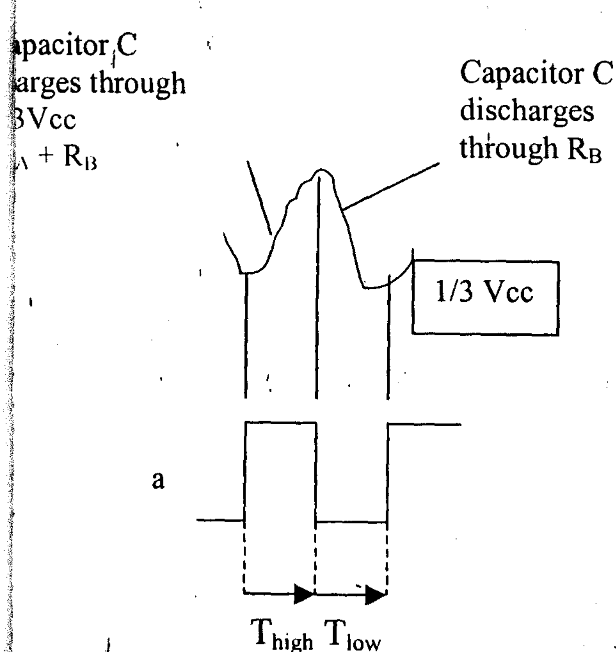
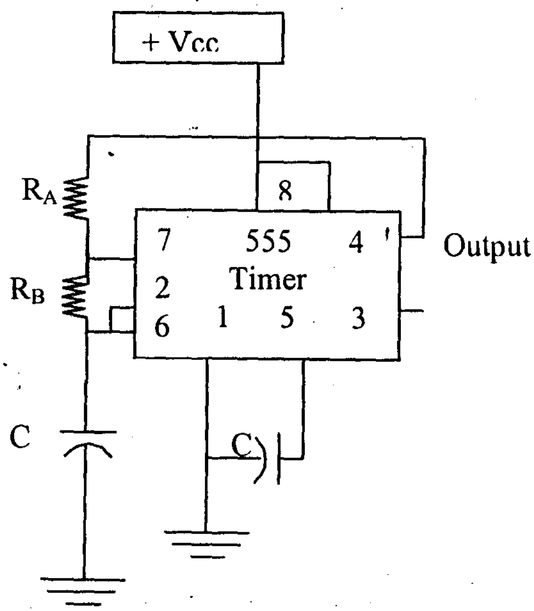
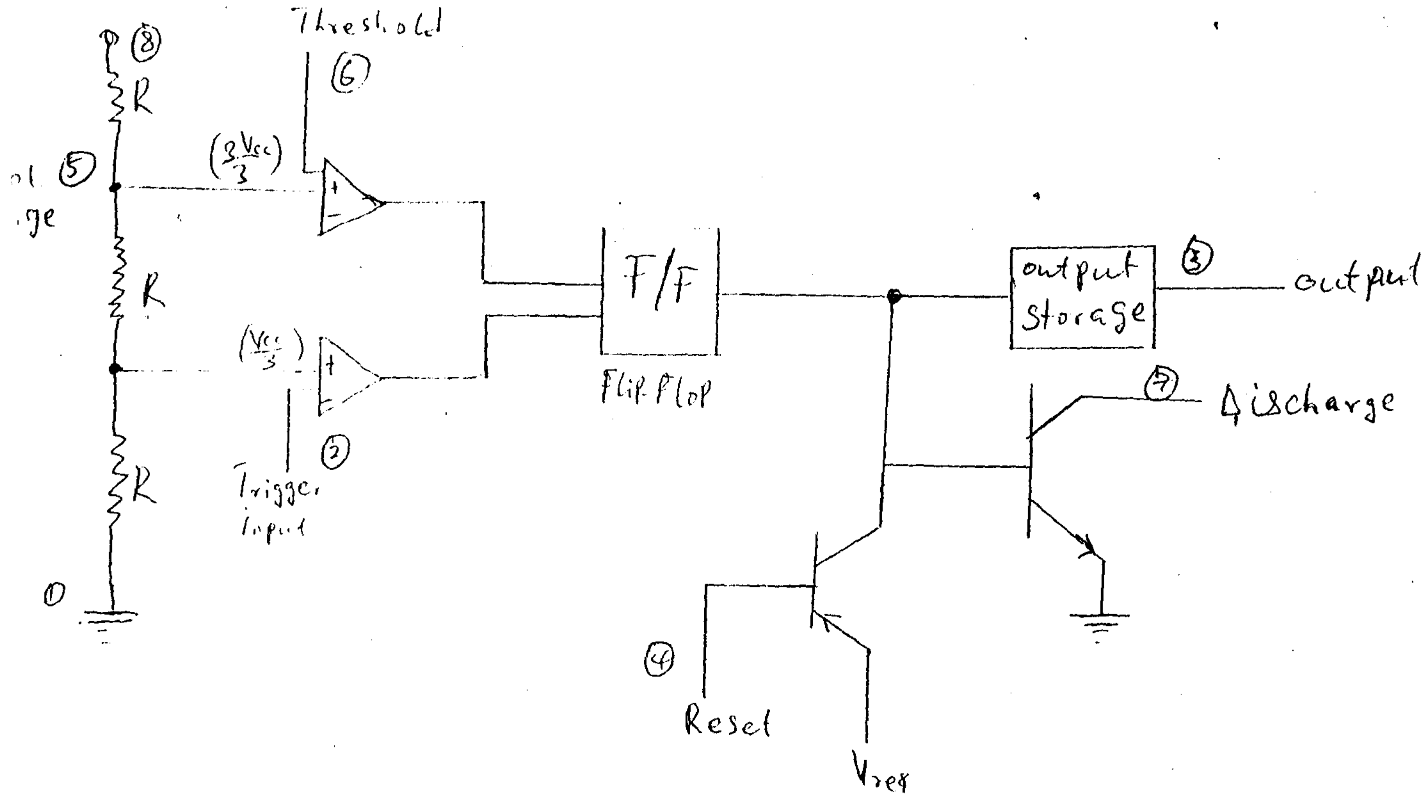


Fig 2.0(a&b)



Astable multivibrator using 555IC

Capacitor C charges toward Vcc through external Resistor R_A and R_B. Referring to the figure above, the capacitor’s voltage rises until it goes above 2Vcc/3. This voltage is the threshold voltage at pin 6, which drives comparator 1 to trigger the flip-flop so that the output at pin 3 goes low. In addition, the discharge transistor is driven on, causing the output at pin 7 to discharge the capacitor through resistor R_B. The capacitor’s voltage then



Details Of 555 timer IC

Fig 2.1

decreases until it drops below the trigger level (Vcc/3). The flip-flop is triggered so that the output goes back high and the discharge transistor is turned off, so that the capacitor can again charge through resistors R_A and R_B toward Vcc.

Calculation of the time intervals during which the output is high and low can be made using the relations

$T_{high} = 0.693 (R_A + R_B) C$ ---------------- (1)

$T_{Low} = 0.693 R_B C$ ---------- (2)

The total period is $T = T_{high} + T_{low}$ ----------- (3)

The output frequency and duty cycle

The frequency, f, of the 55 timers as astable circuit is calculated using

$$f = \frac{1}{0.6963 (R_A + 2R_B) C} \quad \text{-----} \quad 4$$

Let t_1 = mark time = ON time (t_{of})

t_2 = space time = OFF time (t_{of})

$$\text{Duty cycle D} = \frac{t_1}{T} \times 100\% \quad \text{------} \quad 5$$

T = period = $t_1 + t_2$

$t_1 = 0.693(R_A + R_B) C$

$t_2 = 0.693 R_B C$

$$\text{Duty cycle, D} = \frac{0.693 (R_A + R_B) C}{(0.693 (R_A + R_B) C + 0.693 R_B C)} \; \frac{X\ 100\ \%}{1}$$

$$= \frac{R_A + R_B}{R_A + 2 R_B} \times 100\% \quad \text{-- -- --} \quad (6)$$

From the circuit diagram

22

$R_A = 100\ k\ \Omega$, $R_B\ 39k\Omega$, $C = 47\mu f$

Period, $T = 0.693\ (R_A + 2\ R_B)\ C = 0.693\ (100k\Omega + 2 \times 39k\Omega) \times 47\mu f \times 10^{-6}$ seconds.

$= 0.693 \times 178 \times 10^{3} \times 47 \times 10^{-6}$ seconds = 5.79sec≈5.8seconds

Then, the frequency $f = 1/T = 1/5.8 = 0.17$herts

F= 0.17 Hz is generated in the circuit. This frequency can be varied using the variable resistor on the circuit

2.4 PULSE GENERATOR CIRCUIT DESIGN

The circuit is designed by configuring the integrated circuit (NE 555 Timer) to function as an astable multivibrator.

Before choosing 555 timer as the pulse generator, the range frequency expected at the output has already been determined from the time allocation of the green light, that is, the duration of the green light will stay before it changes state.

In the case studied, it was assumed ideal to allow a maximum of thirty five seconds for one road to pass when selected. That is if.

Road (a) is selected to pass for 35 seconds or less, either Road (b) or road © not allowed to pas until thirty five second or less elapses.

Mathematically, it implies that if the duration of the green light G_A for road (a) is 35 seconds, the Red light R_A duration will be 2 x 35 seconds = 70 seconds.

This also means that a clock of period 105 seconds will be required to drive the display as shown is the figure.

Having determined or estimated frequency required of the 555 timers to be 0.172Hz. The value of the capacitor C is determined or chosen using the frequency capacitor characteristics of the 555 timer, then the value of R_A and R_B can be calculated using the equation.

$$t_{ON} / t_{OFF} = R_B / (R_A + R_B) \quad \text{-- -- --- ---} \quad (7)$$

$$f = \frac{1.44}{(R_A + 2R_B)C}$$

It is obvious here that

$$\frac{t_{ON}}{t_{OFF}}$$

Must be imposed a value n greater. With two unknowns, two equations are required, that is OFF to ON ratio

$$t_{ON} / t_{OFF} = R_B / (R_A + R_B) \quad \text{-- -- ---- --} \quad (8) \text{ and since}$$

$$\frac{t_{ON}}{t_{OFF}} = 0.28 \text{ (imposed).}$$

The equation becomes

$$0.28 = \frac{R_B}{R_A + R_B}$$

$$0.28 R_A + 0.28 R_B = R_B \quad \text{---------------- --} (9) \text{ re-arranging}$$

$0.28 R_A - 0.72 R_B = 0$ and

24

$$F = \frac{1.44}{(R_A + 2R_B)\,C}$$

since $C = 47\mu f$ and $f = 0.172$ Hz the equation becomes

$$0.172 = \frac{1.44}{(R_A + 2R_B)\,47 \times 10^{-6}} \quad = R_A + R_B = \frac{1.44}{0.17 \times 47 \times 10^{-6}} = 178129.64$$

$R_A + 2\,RB = 178129.64$ -- -- ---------------- (10) but,

$$R_A = \frac{0.72R_B}{0.28} = 2.57R_2$$

substituting $R_A = 2.57R\,B$ into the equation (10) above we have

$2.57R_B + 2R_B = 178129.64$

$$\frac{4.57R_B}{4.57} = \frac{178129.64\Omega}{4.57}$$

dividing both sides by 4.57

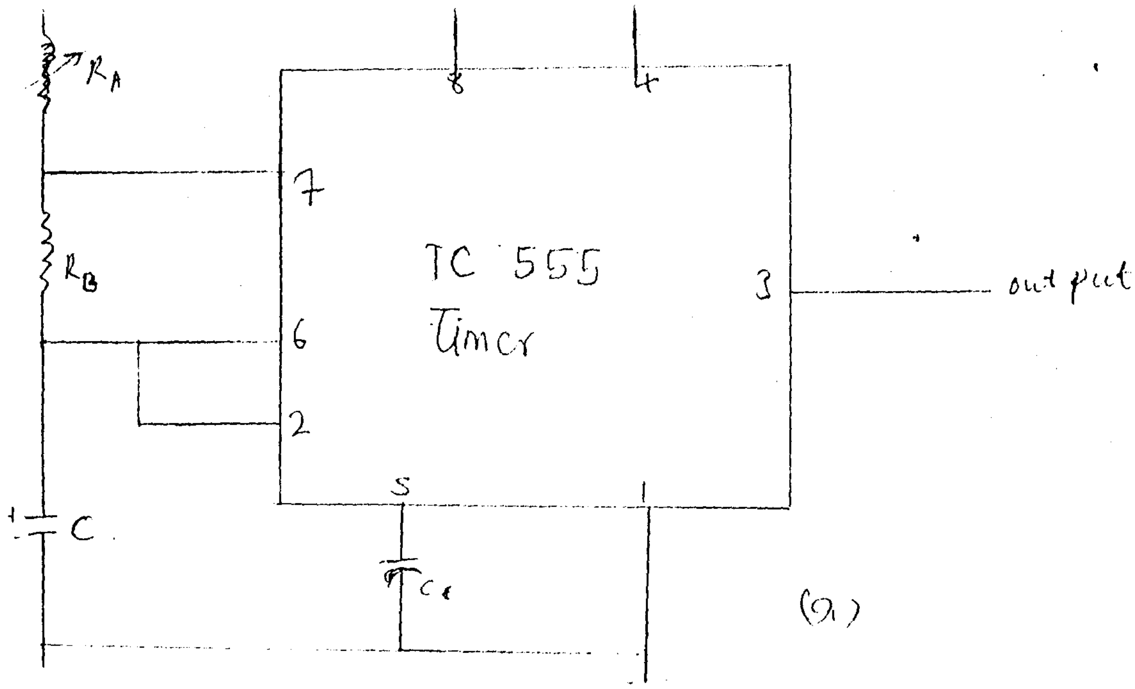
$R_B = 38978\Omega = 38.98k\Omega \approx 39k\Omega$

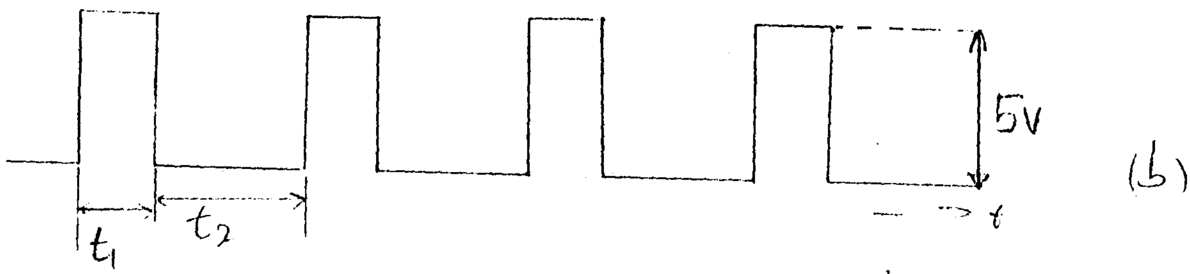
Substituting $R_B = 39k\Omega$ into $R_A = 2.57R_B$ we have

$R_A = 2.57 \times 39k\Omega = 100.23k\Omega$

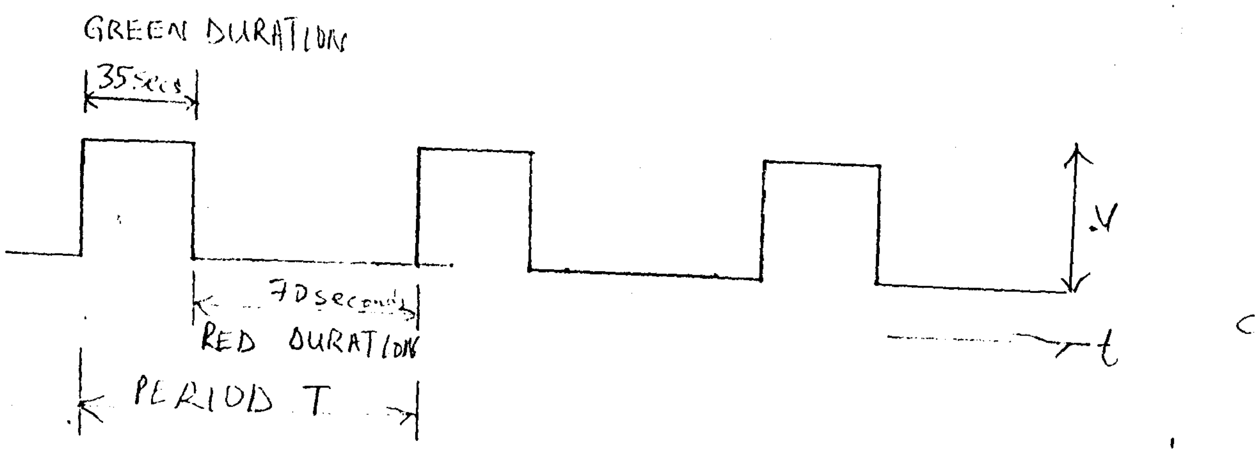
$R_A \approx$ (approximately) $100k\Omega$

Thus, the preferred values for both R_A and R_B are $R_A = 100k\Omega$ and $R_B = 39k\Omega$. The capacitor C was chosen to be 47µf 10V because, it is a decoupling capacitor.





THE WAVEFORM OF THE ASTABLE MULTIVIBRATOR



THE WAVEFORM OF THE CLOCK

FIG 2.2 (a, b & c)

2.5 **SEQUENTIAL CONTROL LOGIC**

Registers, counters, flip-flops are sequential circuits used in designing traffic light controller. These sequential circuits have memories and remember pest inputs or outputs to perform the present one. See the figure below.

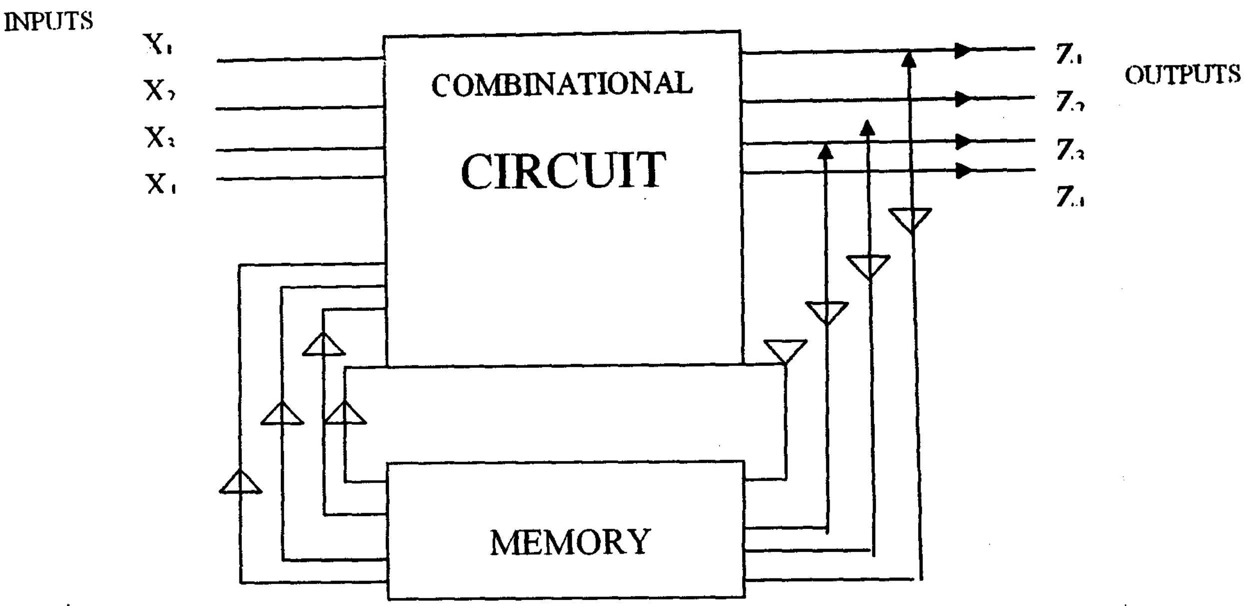


Fig 2.3

Sequential circuit are classified into two types- Synchronous and Asynchronous sequential. For synchronous sequential circuits the signals only change their values at discrete times, that is, they all change in synchronism.

Pulses are generated by a device called a master clock (555 timer IC), the master clock pulses synchronizes the operation of all the devices within the digital device. In general different types of digital circuits respond at different rates.

In an asynchronous sequential circuit, each device responds at its own rate. Therefore in general, asynchronous circuits are considerably faster than sequential ones.

On this project we shall discuss about counter more especially 4017IC decade counter.

2.6 ELECTRONIC COUNTER

Electronic counters are used to count pulses at regular time intervals. Counters used in the design of traffic light control function mainly to count pulses and as frequency division.

There are two type of counters used in electronic-Viz Asynchronous and synchronous counters. Counters returns to its original state on reaching the last number to repeat yet another cycle in response to applied count pulse. The number of states through which the counter cycles is called the modulo of the counter. In general, the maximum modulo of an n-bit counter is 2^n.

Asynchronous (Ripple) counters

These are formed by cascading a number of flip-flops (FF). In Ripple counter, each flip-flop does not trigger exactly in step with the clock pulse. Its rippling action brings about accumulated delays for a long number of bits.

Synchronous counters

When a counter is designed for a long numbers of bits, the accumulated delays caused by the rippling action can be serious. This problem can be resolved by rearranging the circuit configuration so that the device operates as a synchronous counter rather than asynchronous (or ripple) counter. They are used to increase the speed of the counter at the expense of circuit complexity. Here all the flip-flops are clocked simultaneously.

2.7 **POWER SUPPLY CONFIGURATION**

In general all electronics equipment requires a d.c power source before they can operate. The source could be a battery, but usually the power is obtained form a unit that converts the normal single phase main supply 220V at 50Hz to some different value of d.c voltage.

The power supply provides the required d.c voltage and current with low levels of a.c ripple and with good stability and regulation. It must provide a stable d.c output voltage irrespective of changes in the mains input voltage and of changes in the load current.

It is also important that the power unit should be able to limit the available output current in the event of an overload (current limiting) and also limit the maximum output voltage. This requirement is necessary for the protection of sensitive component such as ICS, in the equipment if excessive voltage appears on the power supply lines.

There are various methods for achieving a stable d.c power supply from the mains, but for this project a linear stabilized power unit method was adopted despite its own limitations.

D.C SUPPLY

A typical d.c power supply consists of the following transformer, rectifier, filter and voltage regulator.

TRANSFORMER

Its job is either to step up or (mostly) step down the a.c supply voltage to suit the requirement of the solid-state electronics devices and circuits fed by the d.c power supply. It also provides isolation from the supply line – an important safely consideration.

RECTIFIER

It is a circuit which employs one or more diodes to convert a.c voltage into pulsating d.c voltage.

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.

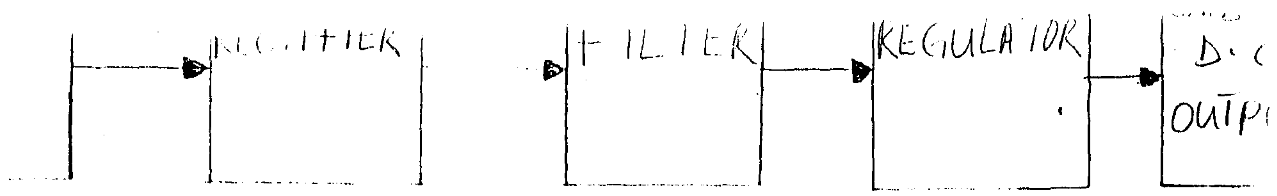
VOLATGE REGULATOR.

Its main function is to keep the terminals voltage of the d.c supply constant even when

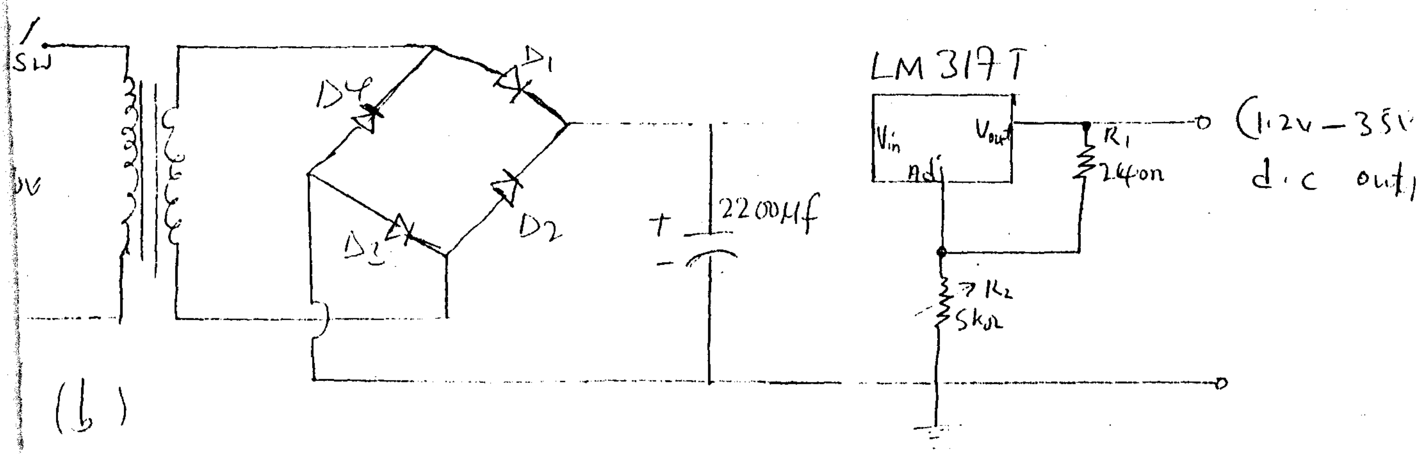
(i) a.c input voltage to the transformer varies; or

(ii) The load varies.

In this project LM 317IC voltage regulator was used. IC regulators have much improved performance as compared to those made from discrete components. They have a number of unique built – in features such as current limiting, self – protection against over temperature, remote control operation over a wide range of input voltages and fold back current limiting.

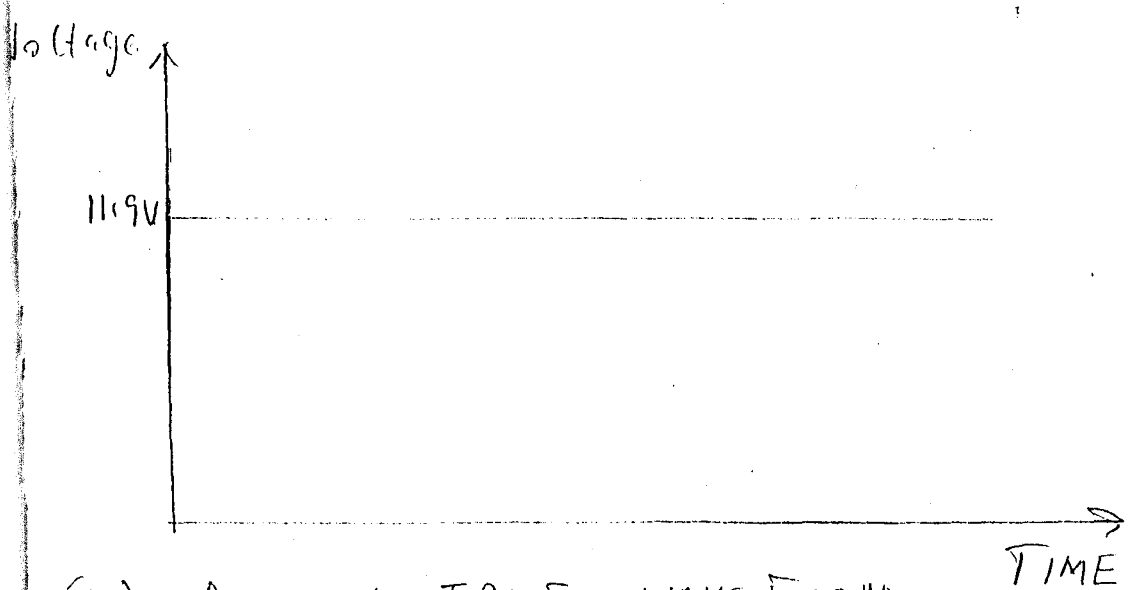


(a) BLOCK DIAGRAM OF A STABILISED POWER SUP



(b)

POWER SUPPLY UNIT



(c) D.C OUTPUT WAVEFORM

Fig 2.4 (a, b & c).

DODES (IN 4001)

This is a semiconductor device that allow current to pass through only in one direction. A diode consists of a p-n junction with one connection to the positive (p) – side the anode 'A' and another to the negative (n) – side, the cathode 'k'. Its symbol is shown below.

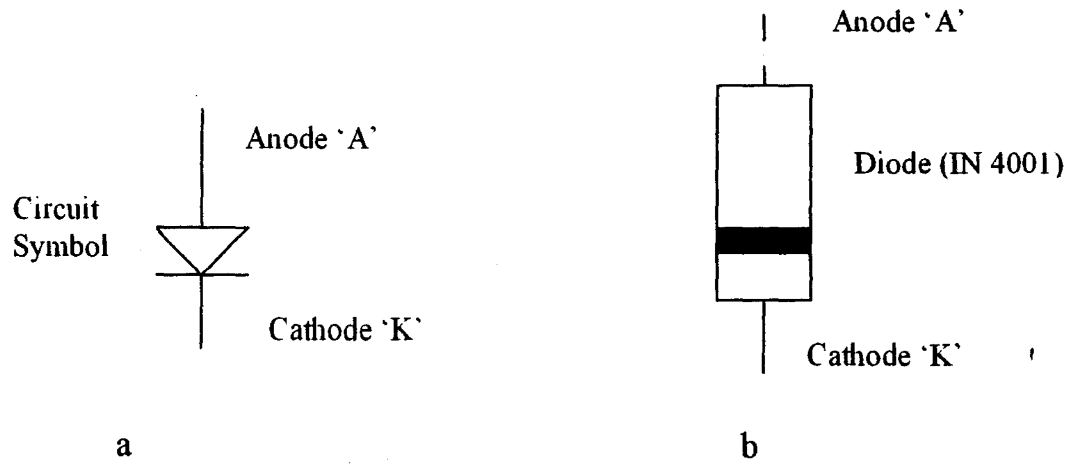


Fig 2.5 (a and b)

In actual diodes, a band often marks the cathode ends. It is from its end that conventional current leaves the diodes when forward biased.

TYPES OF DIODE

(1) Zener diode

(2) Rectifier diode

(3) Light emitting diode (LED)

(4) Photo diode

(5) Point contact diode

Here we shall discuss only about LED

Light Emitting Diode (LED) (As an indicator lamp). An LED is a p-n junction diode that gives-off visible light when it is energized. It is made from the semiconductor gallium arsenide phosphide (GaP). When forward biased, it conducts and emits red, yellow or green light depending on its composition. No light emission occurs on reverse bias.

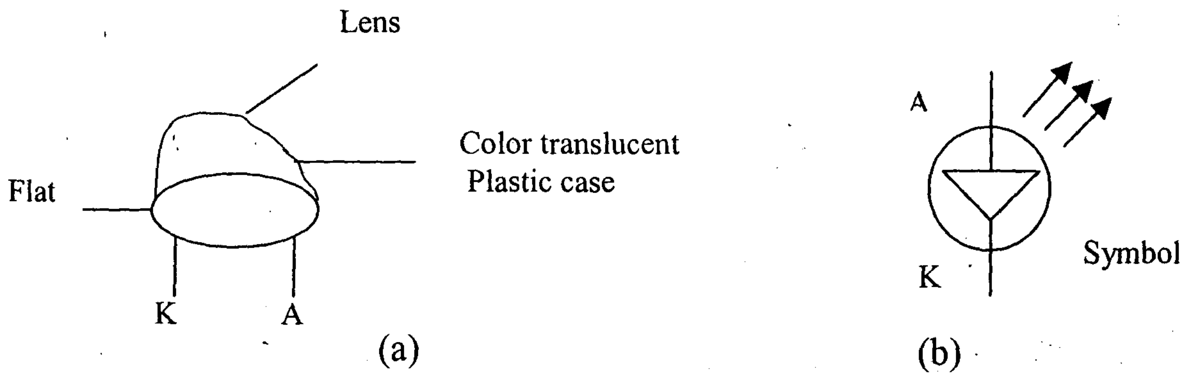


Fig 2.6 (a & b)

CHAPETR THREE

CONSTRUCTION AND TESTING

For the effective demonstration of the workability of the design of traffic light controller, a prototype model of the traffic light controller is designed and construed as described here under.

3.1 DESCRITPTION OF THE CONSTRUCTION

The design of the traffic light controller was not finally completed until the final circuit diagram was realized and the components specified by the design sourced and implemented on the Breadboard. In fact, it was on the breadboard implementation stage that most of the design calculations were detected and corrected.

After all the correction have been effected and the system tested, the final package was initiated by careful transfer of these component module – by –module until all the components are into the breadboard. Before the transfer to the breadboard, various locations for each component have been carefully planned and ascertained and all the necessary precautions was also observed especially when the integrated circuits (IC), that is, 555 timer and decade counter used was being soldered.

3.2 SYSTEM TESTING AND RESULT

When the construction was completed the sequence of the traffic light was tested. The light sequence was as designed: RED, RED and AMBER together, and GREEN AMBER together, GREEN and AMBER. Tests were carried out for all the various stages of the designed circuit. To simplify the complications in the testing of the system, the test was conducted in modular fashion starting from the power supply unit to the final output of the system. Most times, the result of the test tallied with the calculated values and sometimes the test lead to fault confirmation and correction.

The majority of the test conducted was accomplished with the use of Digital–Multimeter and sometimes with the use of light emitting diode (LED). Most times these tests were done and compared relative to some other test points. The result of these test at some considered test points were noted as follows.

The voltage across the output terminals of the 12V transformer was 11.59V approximately 12V. The voltage at the output of the smoothening capacity of 12V line was 11.69V approximately 12V, the voltage at the output of the LM 317 regulator could be varied but, its output on this circuit was 12V.

The current on load was 1.35A while the residual current that drives the LED lamps is 3.6mA.

The indicator lights were all functioning well. The RED light took 30 seconds for traffic A and C, and 40 second for traffic B. the AMBER light took 5 second, and AMBER and GREEN together or RED and AMBER together tool 5 seconds. GREEN light for traffic A and C took 25 seconds while that for traffic B took 15 seconds

Hence Road B is not as busv as roads A and C.

3.3 PACKAGING

The traffic light controller is a traffic instrument. Often this piece of instrument is installed in the area where environmental pollution and contamination can never be exempted. Such environmental factor like Rain, Humidity, altitude, radiation, dust and vibration are a number of considerations that have to be taken into account in the design and packaging of the whole system,.

Other factors such as temperature change have been taken care of during component specification. Another major important factor is its physical protection, so as to abide by the rules and regulations of traffic code.

This encompasses the use of iron pole to serve as the stand for each of the traffic head unit and the face of the traffic head until must be covered and sealed with a transparent plastic materials. The height of the traffic head control must not be below or above six (6) or eight (8) feet from the plain surface of the road.

But for the prototype constructed here, that is, on this project, plastic Materials were used to substitute for the iron poles.

CHAPTER FOUR

4.1 CONCLUSION AND RECOMMENDATION

It must be emphasized that the solution to social problems embodies not only the engineering and technical provisions but, also the Psychological, social and economical considerations. While most of these aspects can be manned and tackled, social and particularly psychological considerations are mostly individualistic or group – dependent and one finds it rather extremely difficult to produce a device that will satisfy all the society's needs for the given application.

The system has attempted to solve to a large extent, the delays in traffic flow and the risks incurred at T-junctions, as a matter of fact, due to right of way conflicts.

This project report has a background history and analysis of the design and construction of traffic light controller. The various methods and procedures followed in the realization of this project have been treated. It provides a report on the tests and observations as well as discusses the measures taken to solve the various technical and design problems encountered, and finally some results of vital significance have been shown.

In this chapter, attention is paid to ways by which some of the inherent problems have been solved and ways of improving the design using either the techniques adopted here or some other advanced techniques that may have been developed.

One of the most prominent problems encountered in the operational design is in the design of the traffic head control unit. The unit can be compared to the timing and control unit of a microprocessor for specialize application. Additional circuitry can be designed and included to achieve this objective of design and research in this direction. By this approach the typical application of microprocessor can be emulated.

This type of system is particularly relevant in our country now that the rate of increase in the number of road user is much higher than the rate of increase in the number of road networks.

Economic activities have also been on the increase and roads delays will invariably affect the smooth running of our system which relies to a large extent on road transport as major means of transportation and information transfer.

When considered on the basis of better traffic flow, pedestrian safety accident record, and savings in manpower due to the elimination of manual control, the economic value of the installation of traffic signals can easily be understood. The benefit of this system can therefore not be over – emphasized.

Thus if the project is fully financed by the government and mass-produced with the aim of installation at every T-junction road network, accidents on our roads will be minimized and traffic flow will be enhance effectively.

Nevertheless, the cost of production and maintenance are expensive for an individual to mass – produce the project implementation for sale. Improved types of traffic controllers can be constructed to enhance reliability.

Thus, if every road junction in this country is mounted with a traffic control system, the possibility of eliminating accident is assured.

RECOMMENDATION

Having implemented this design as prototype, the following recommendation is hereby made to enhance the reliability of the operation and safe guard.

The design consideration was that, there should be regular or constant power supply where this system is to be installed. If it is installed in area where there is always interruption of power supply, appropriate standby generator should be provided to take over the supply of power.

Moreover, there should be traffic warder to control traffic incase if the traffic light goes off, to avoid any forced stop which may lead to accident.

REFERENCES

(1) F. D HOBBS TRAFFIC PLANNING AND ENGINEERING second Edition 1978, PP 383 –c415.

(2) HARRY T. DIMITRIOU, URBAN TARSPOR PLANNING, A development approaches (1979) PP 44-56.

(3) M. J BRUTON, INTRODUCTION TO TRANSPORTATION PLANNING (1981) PPM 145-162.

(4) THOMAS L. FLOYO, ELECTRONIC DEVICES, (1982), PP 126-140, PP 150-173.

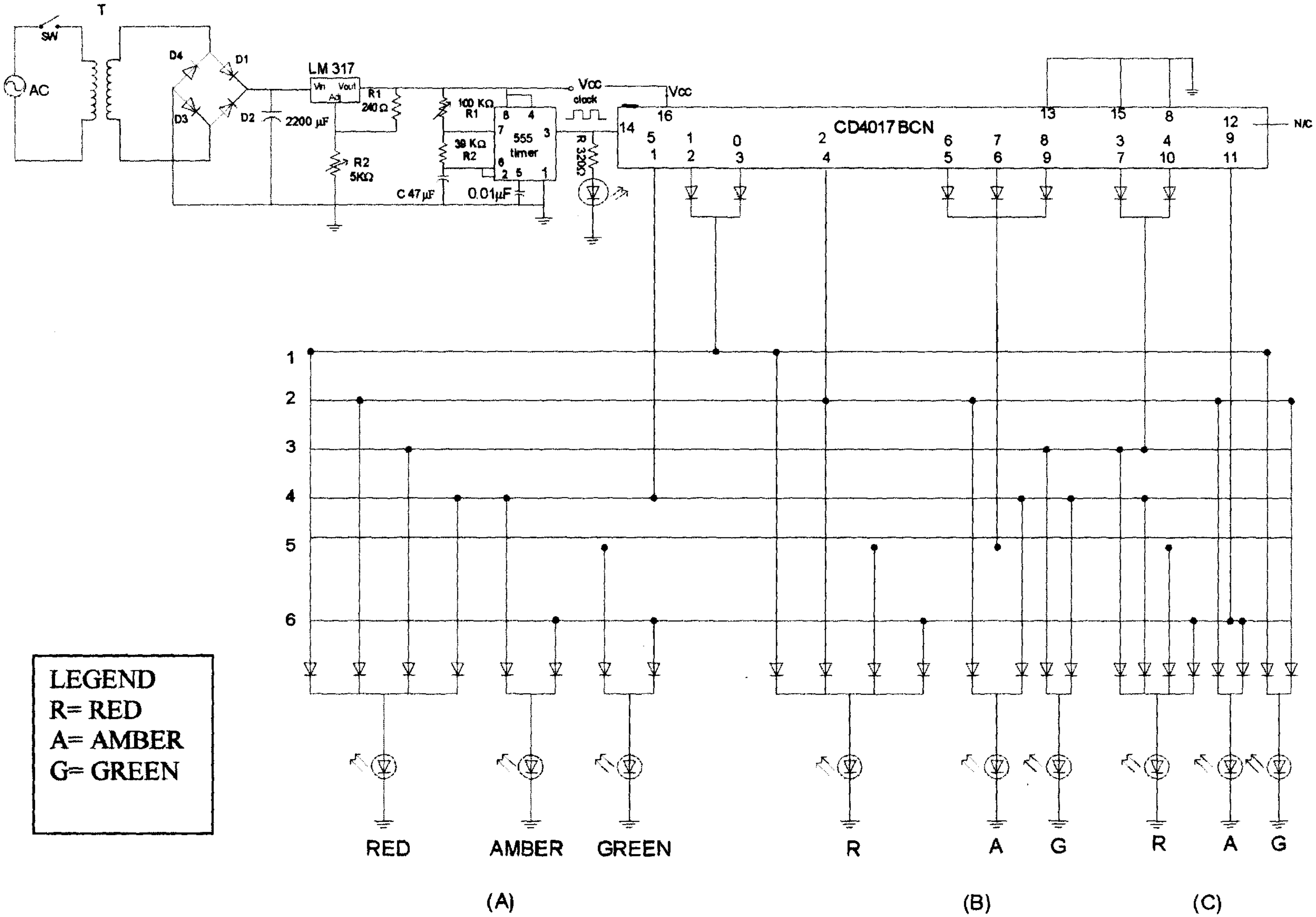
(5) CHARLES L. ALLY, KENNETH W. ATWOOD, ELECTRRONIC ENGINEERING, 1973. PP 123-148

(6) ANDREW PARR, LOGIC DESINERS HANDBOOK (1993) (CIRCUIT AND SYSTESM) PP 181-199, PP 207-213

(7) PAUL M. CHIRLIAW, ANALYSIS AND DESIGN OF INETRGARTED ELECTRONIC CIRCUITS, 1981 PP 361-419

(8) W. E BURKEY, (Ed). This is Electronic Basic principles Bobbles merrily educational publishing Book 1. Indiana Pp, 1980 PP. 170

40



A T - JUNCTION LIGHT TRAFFIC CONTROL CIRCUIT DIAGRAM