

**DESIGN AND CONSTRUCTION OF A TOLL  
GATE COMPUTER BASED  
COUNTING SYSTEM.**

**BY**

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COMPUTER ENGINEERING,  
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FEDERAL UNIVERSITY OF TECHNOLOGY  
MINNA, NIGER STATE, NIGERIA**

**SEPTEMBER, 2003.**

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF  
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SCHOOL OF ENGINEERING AND ENGINEERING  
TECHNOLOGY, FEDERAL UNIVERSITTECHNOLOGY,  
MINNA,  
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FOR THE AWARD OF ENGINEERING (B.ENG.)  
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ENGINEERING.**


**SEPTEMBER, 20003**

## CERTIFICATION

I hereby certify that this project work titled "THE DESIGN AND  
CONSTRUCTION OF TOLL GATE COMPUTER BASED COUNTING  
SYSTEM", was carried out by SALIHU OTUOZE YAHAYA under the  
supervision of Engr. EMMANUEL ERONU and submitted to the  
Department of Electrical and Computer Engineering, Federal University of  
Technology Minna, in partial fulfillment of the requirement for the award  
of Bachelor of Engineering (B.Eng), degree in Electrical and Computer  
Engineering.

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Date and Sign

  
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Head Of Department

8/4/08  
Date and Sign

\_\_\_\_\_  
External Examiner

\_\_\_\_\_  
Date and Sign

## DECLARATION

I, Salihu Otuoze Yahaya. Hereby declare that this project work is an original work of mine and a record of my research work, which has never been presented elsewhere

Salihu Otuoze Yahaya     22/11/03

Date and sign

## DEDICATION

This work is dedicated to my late brother "ABDULAZEEZ OTUOZE  
ABDUSALAM" who lost his life during the course of struggling  
for knowledge.

## ACKNOWLEDGEMENT.

First and foremost to ALLAH is my acknowledgement who have endowed mankind with knowledge, and making me complete my course work Successfully.

I am grateful to my parents, Mall. Salihu Abdulsalam and Hajia Bilkis Salihu for there love, kindness and maximum support throughout my studies.

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## ABSTRACT

Counting the numbers of cars passing the TOLL GATE will be easier with the use of a microcomputer in a remote area via the monitor to collect the information about a particular gate which the cars passes through.

The system is made up of transmitter and receiver units which is achieved with the aid of Semiconductors. The transmitted carrier wave is built upon the  $120\text{k}\Omega$  resistor and latter amplified by the operational amplifier.

Writing a soft ware enhances and makes the whole system more powerful.

Visual basic, highly structured windows based was considered to be the best for such system. Whenever a car passes through a particular gate it cut off the signal from the receiver to the transmitter thereby incrementing the number by one with the aid of the software through the parallel port .



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## **CHAPTER ONE: GENERAL INTRODUCTION**

### **1.1 INTRODUCTION**

With the recent emergence of semiconductors in chips especially "Cmos and TTL" have helped greatly in the development of hardware which have paved way for the software techniques for easy communication between the two. This integration between the software and hardware has made computers faster, powerful and easier to use than ever before.

Personal Computer (PC) is now a common electronics machines used mostly in academic environment, industries, houses and offices. It has become indispensable tools for information storage and retrieval system, precision engineering design and robotic control and in communication (web browsing).

However, this project intend in interfacing microcomputer with an external device, which could be used in monitoring the movement of cars in a Toll gate.

### **1.2 AIMS AND OBJECTIVE**

1. To use an infrared transmitter and detector signal as a carrier wave to interface a microcomputer.
2. Use of parallel port to interface the external device.
3. Design and development of a software in visual basic that will communicate and display the status of the port
4. Design of a circuit for the integration of the software

### 1.3 LITERATURE REVIEW

Numeration systems of ancient men were very simple. When men first developed the idea of numbers they probably held up fingers to express numbers to each other. [1]

Ancient men learned to write numbers; the earlier written numerals were mark on the ground or scratch on a pieces of wood or wall . One very old numeration system not use a specified symbol for 5, this was the system of numerals developed in ancient Egypt 5,000 years ago. The Egyptians represented the first nine numbers by vertical tally mark [1]

The first calculator was the abacus; it was developed thousands of years ago, and it is use in many part of the world today. Blaise Parly built an early adding machine in the 1600's, . By the end of the 1800's machine that could add, subtract, divide and multiply had became popular . Much of time was spent in 1800 designing a machine called an "Analytical Engine". The machine never worked, but some of idea for this early computer are used in the design and programming of modern computer [1].

Modern monitoring system has benefited considerably from advance made in the electronics/computer field. The range of equipment available today include the ultrasonic, microwave, infrared and television or computer aided security system employing digital camera [2].

Most systems are design to monitor a continuous signal by means of an 8-segment display in industries. This is where all detection circuit terminates and where electronics monitors the circuit for the continuous presence of a high voltage. When the detecting equipment is disturbed, the circuit is broken and the 8-segment display register the numbers of time the signal is broken.

Infrared spectrum extends from the highest microwave frequencies to the longest wavelength of visible ray light and because they are invisible to human eye they are in considerably used in monitoring system. This system is made up of both a transmitter, which generates beam from gallium arsinide and a receiver. Any interception in the transmission path generates an alarm [2].

We are at least become accustomed to seeing in the dark nothing so exemplified the acceptable face of modern warfare as infrared image as a military installation being demolished by the pin -- point accuracy of a laser guided bomb. At the other end of the infrared technology, spectrum is the device that sees or at least sense intruders in our home and gardens and trigger automatic for mechanisms in offices and stops [2].

Intruder detector and automatic for systems are almost invariably based on single-element sensors. They can register a change in radiant energy within their field of view. The inevitable consequences are the garden security light that is continuously triggered by wandering cat and hedgehogs and the automatic doors that open needlessly in response to every passing pedestrian [2].

In digital techniques, computer interfacing with digital electronics circuitry comes to play. The computer used as the control unit, Monitor the movement of cars this is an area that we employed to be use in the design of Toll gate counting system to count the number of cars that cut the signal. Interfacing it with the personal computer greatly increases it's efficiency and reliability.

#### **L4 PROJECT OUTLINE**

**Chapter one:** This chapter gives the overview of the project. The aim and objective of the project also outline. The literature reviews the earlier research on this work with the basic concept. The outline of the entire project is also contained in this chapter.

**Chapter two:** This chapter deals with the overall system design the hardware and the software design was elaborated in this chapter.

**Chapter threes:** This chapter elaborates the construction procedure, the results obtained and the problem encountered during the construction.

**Chapter four:** Conclusions, recommendation, references and appendix. This chapter contained the authentic view of what has been achieved with reference to the aim and objective of the project.

The goals met and the difficulties or limitation encountered. Books and other material consulted was outlined under the reference. The program print out, drawing are contained in the appendix.

The block diagram of the project is illustrated below. The infrared circuit transmits a carrier wave that is received by the infrared phototransistor the signal obtain was used to activate the microcomputer with the aid of a soft ware written in visual basic.

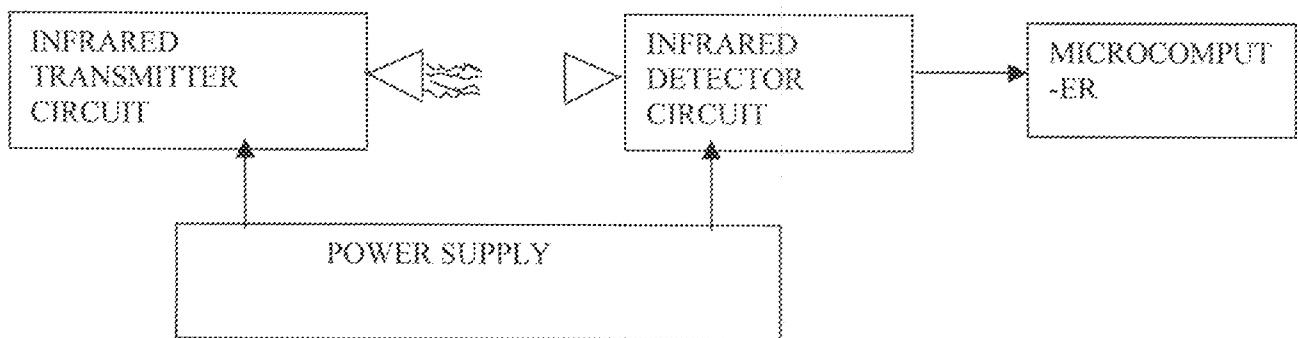


Fig 1.0 Block Diagram For Transmitter and receiver

## **CHAPTER TWO: SYSTEM DESIGN**

The system is approach with the intention of simplicity in mind. The system design is grouped into two sections viz: the hardware section and the software section.

### **2.1 HARDWARE DESIGN**

The design of hardware section is grouped into two subsections: the transmitter and the receiver. Each of the subsection design of the monitoring counting system is basically followed with the basic principle. Transmitter subsection comprises of the astable multivibrator, Infrared light emitting diode and some passive component. While the receiver subsection consists of phototransistor, Voltage comparator voltage doubler, tri-state buffer, power supply unit and some miniature components for the reinforcement of the signal at the centered frequency.

### **2.2 TRANSMITTER**

Basically, the transmitters mainly transmit the infrared signal, which acts as Carrier waves to be transmitted to the receiver at the calculated centered frequency.

#### **2.2.1 THE ASTABLE MULTIVIBRATOR**

An astable multivibrator or free running is a device that has no stable state but it switches back and forth between two unstable states. The astable multivibrator was used as an oscillator to provide clock signal. For timing purposes and waveform generation.

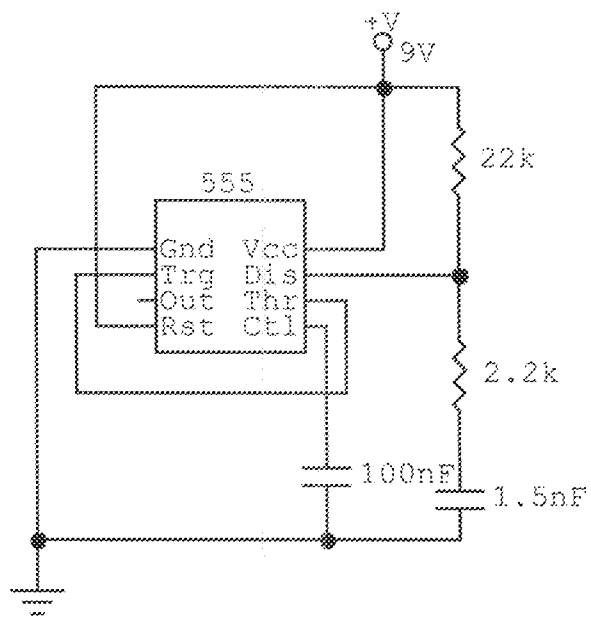


Fig 2.0 Astable Multivibrator.

Where Pin 1 - GND

Pin 2 - TRIGGER

Pin 3 - OUTPUT

Pin 4 - RESET

Pin 5 - CONTROL

Pin 6 - THRESHOLD

Pin 7 - DISCHARGE

Pin -Vcc

The output were from of Pin 3 i.e. shown below:

The Waveform for the charging time and the discharge time is shown in fig 2.2



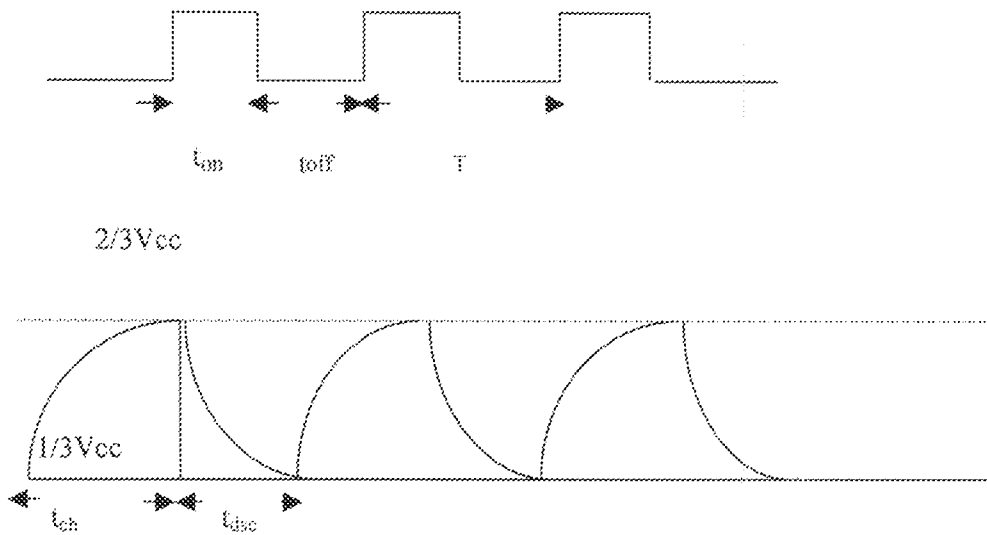


Fig. 2.1 The Waveform for the charging time and the discharge time

C charges through  $R_1$  and  $R_2$  during charging time and C discharge through  $R_2$

during the discharge time. The ON time of the multivibrator can be obtained using the following expression.

$$t_{on} = 0.693 (R_1 + R_2)C \quad \text{-----(1)}$$

and the OFF time can be obtained by using the expression

$$t_{off} = 0.693R_2C \quad \text{-----(2)}$$

But in our design  $R_1 = 2.206K$ ,  $R_2 = 22 K$  and  $C = 1 n5$

$$t_{on} = 0.639 (2.2 \times 10^3 + 2.2 \times 10^3) * 1.5 \times 10^{-9} = 25.1559 \mu s$$

$$\begin{aligned} t_{off} &= 0.693R_2C \\ &= 0.693 * 22 * 1.5 * 10^{-9} \\ &= 22.86 \mu s \end{aligned}$$

Period T can be calculated using the expression

$$T = t_{on} + t_{off} = 0.693 (R_1 + 2R_2) C$$

$$\text{and } F = 1/T = 1/(0.693(R_1 + 2R_2)C) = 1.44/(R_1 + 2R_2)C$$

$$F = 1.44/(2.2 * 10^3 + 44 * 10^3) * (1.5 * 10^{-9})$$

i.e. the infrared transmit at 20.8 kHz.

$$\text{Duty cycle} = (t_{on}/T) * 100\%$$

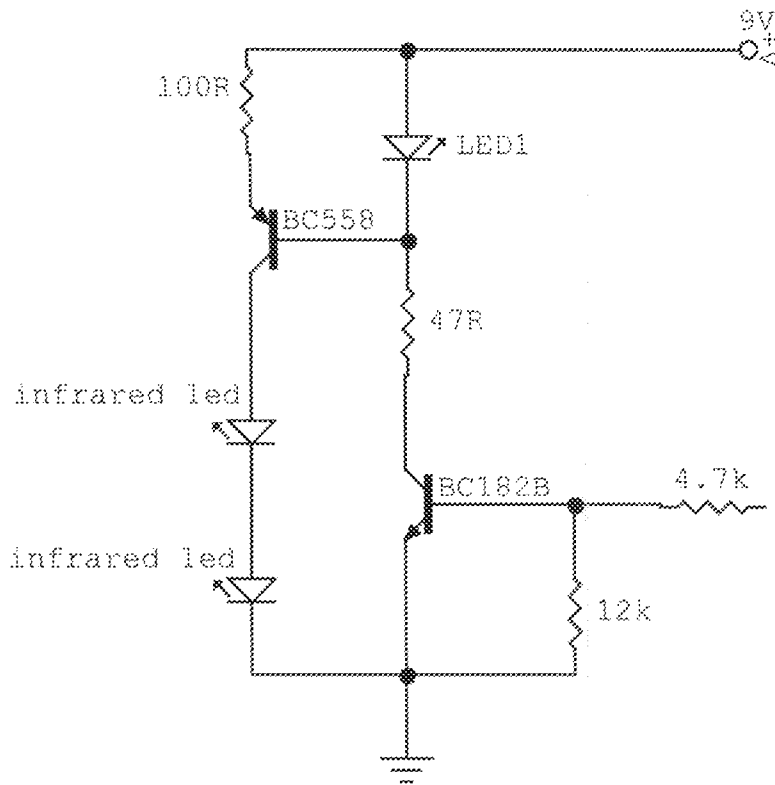
$$= ((R_1 + R_2)/(R_1 + 2R_2)) * 100\%$$

$$= ((2.2 + 22)/(2.2 + 44)) * 100\%$$

$$= 52.38\%$$

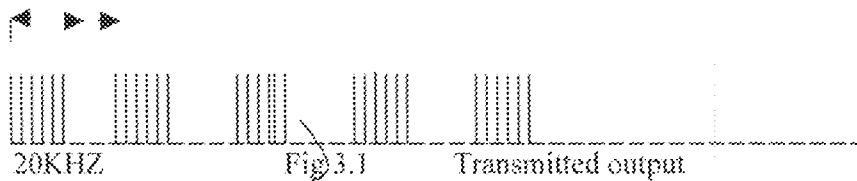
### 2.2.2 INFRARED EMITTER

The basic transmitter signal is generated by ICs at a frequency of 20kHz (astable) producing a period of 25.16 μs and 22.87 μs on and OFF, the resulting signal is used to get 600mA constant current generator Q<sub>1</sub> – R<sub>1</sub> – LED via Q<sub>2</sub> and this feed high emergency currents to the two series connected infrared transmitter diode. The high current transmitter pulses are derived from storage capacitor C.



$t_{on}$   $t_{off}$

Fig 3.0 infrared emitter circuits



## CALCULATION

From fig 3.0,  $R_1//R_2$ .

But  $R_1 = 4K7$ ,  $R_2 = 12k$

$$R_T = (R_1 R_2) / (R_1 + R_2) = (4.7k * 12k) / (4.7 + 12)k = 3.37k$$

But the voltage across the base of the transistor is given using voltage divider's theorem.

$$V_B = (12k * 9V) / (4k7 + 12k) = 6.47V$$

$$I_B = (V_B - V_{BE}) / R_T = (6.47 - 0.7) / 3.37k = 1.712mA$$

$$I_i = I_B \beta_{dc}$$

$\beta_{dc}$  for  $Q_1$  is 185 from the data sheet

$$I_i = 1.712 * 10^{-3} * 185$$

$$I_i = 316.72 \text{ mA}$$

But  $I_i = I_E$

$$I_E = 316.72 \text{ mA}$$

$$V_{CE} = V_{CC} - I_E * 47$$

$$= 9 - 14.885$$

$$= -5.885V$$

Which shows that the transistor operate at saturation mode.

## 2.3 RECEIVER

Basically the receiver is to capture the infrared carrier wave transmitted at 20kHz from the transmitter. The receiver is built at a centered frequency of 20kHz. The signal amplified is compared with a reference voltage. If the input signal is greater than the reference voltage there is a repetitive high pulses of signal at the output of the comparator. Likewise, if the reference voltage is greater than the input signal there is a low at the output of the comparator.

### 2.3.1 PHOTOTRANSISTOR

A phototransistor is a transistor that is sensitive to input when light shines on it. The collector current will greatly increase, while in the absence of light  $I_c$  is very small. We can view the effect of light as controlling the effective resistance between the collector and emitter. In the presence of light, this resistance is low, resulting in a large collector current while in the absence of light the opposite happens. The phototransistor is functioning as a switch no connection is made to the base.

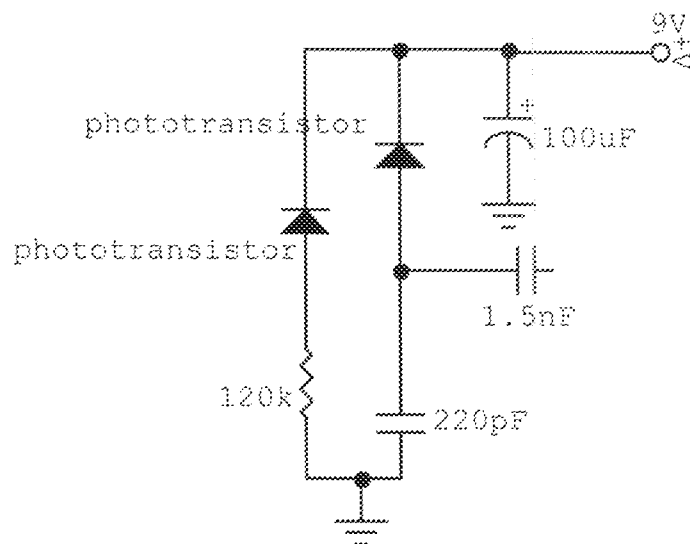


Fig 4.0 Infrared detector circuit

As shown in fig 4.0 two infrared is used to strengthen the signal and in any situation where there is a blockage of one infrared detector, it will not have effect on the overall circuit until the two detector is blocked. The detected signal is developed across 120k and the signal is amplifying by an operational. Amplifier.

### 2.3.2 OP – AMP/VOLTAGE DOUBLER

Op – amps an acronym for operational amplifiers. It has two input terminal and output terminal. The negative input terminal is known as inverting terminal while the positive terminal is known as non- Inverting. The OP-amps Senses the two input signal and amplify the difference. In the OP-amps circuit, coupling capacitor was used because the amplify signal is not d.c. rather a high frequency a.c. signal of 20kHz from the transmitter. The coupling capacitor will cause the gain to be zero at the output of the first stage amplifier coupled with a sensitive adjustable resistor to the second stage OP-amp. The output of the second stage OP-amp is fed to a voltage doubler network. The essence of the voltage doubler in the construction circuit is to rectify and smoothen the incoming voltage signal from the second stage OP-amp. This is fully achieved with the R-C network in the circuit.

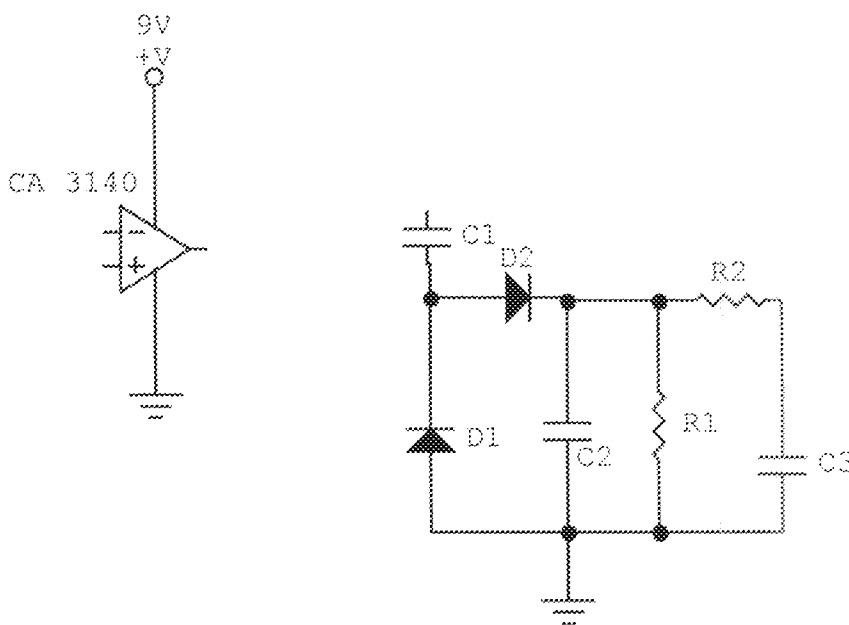


Fig 5.0: op-amp, voltage doubler and RC network

### 2.3.3 VOLTAGE COMPARATOR/TRI-STATE BUFFER

The same chip that was used for OP-amp was as well used for the voltage comparator. The difference is that the OP-amp incorporate feed back resistor from the output to the inverting terminal of the OP-amp while the voltage comparator does not. The voltage comparator compares the resulting signal from the voltage doubler network and compares it with the reference voltage. If the reference voltage is higher than the input signal, the output will be zero, and if the input signal is higher than the reference voltage the output signal will be high. In the design of the signal between the transmitter and the receiver, the output of the comparator will be zero; otherwise the output will be high.

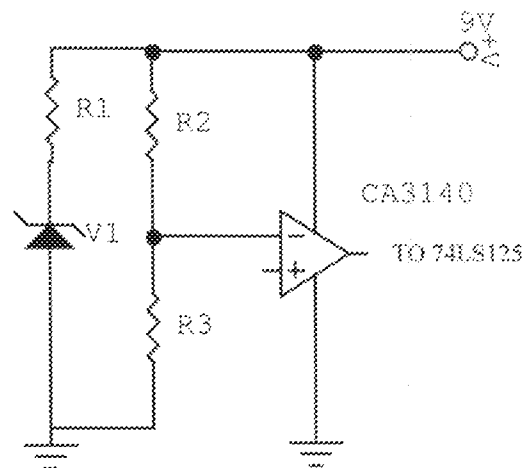


Fig 6.0 Voltage Comparator circuit

Using voltage divider theorem, the reference voltage can be expressed as

$$V_{ref} = (R_3 / (R_2 + R_3)) V1$$

We assumed

$$R_2 = 47k$$

$$R_3 = 10k$$

$$V_i = 5.8V \text{ (assuming)}$$

$$V_{ref} = (10/57) 5.8 = 1.017V$$

### 2.3.4 TRISTATE BUFFER

Input buffer are very essential when interfacing the computer to an external device. One of the reasons is to avoid physical contact between the external devices and the computers. Parallel port in an advent of current spikes or surges coming from the external device which can cause damage to the parallel port. The input buffer conditions the input current and voltages so that they are compatible with the Port requirement and specification.

Only one unit of TTL 74LS125 (tristate buffer) was used in the TGCS. In the design of the TGCS only two out of the four chips was used as an input to the status port. The input to the status port was a single bit wide each bit of the data was connected to pin 11 of the status port and pin 15 was connected to Vcc +5V with a pull-up resistor to monitor whether the hardware is connected or not. It is called tristate because it allows three possible output stage viz high, low and high impedance (Hi-Z). The high impedance state is a condition in which both transistors in the totem pole arrangement are turned off so that the output terminal is in high impedance to ground and to Vcc

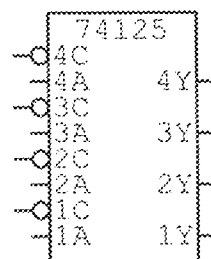


Fig. 7.0 Tristate buffer

## 2.4 Power supply unit

The power supplies from the mains are usually 220/50 HZ, which cannot be used directly For electronics equipment. However, most electronics equipment requires a direct Current (DC) voltage source for its operation. In the construction of power supply for the TGCS, a circuit to convert AC to DC was Employed one of the most important use of diodes is in the construction of rectifier Circuit. A diode rectifier forms an essential building block of the power supplies required to power the electronics equipment. A block diagram of a power supply system

to power the electronics equipment. A block diagram of a power supply system

is shown in fig8.0.

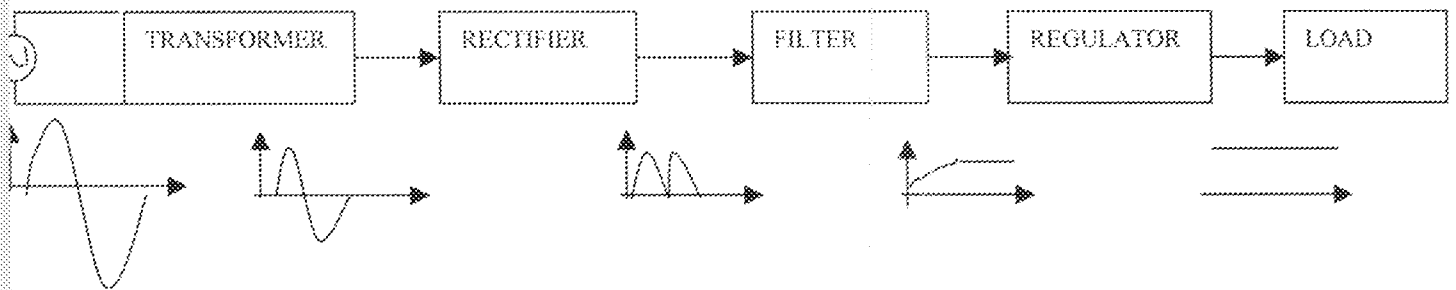


Fig8.0 Block Diagram for The Power supply

As shown in fig 8.0 a power supply is fed from the 220V(rms) 50HZ AC supply line and it delivers a dc voltage  $V_o$  (usually 5V to 20V) to electronics circuit represented by the load block. In our construction 5V and 9V was make use of as the voltage supply for activating the IC and the miniaure components. The first block in a DC power supply is the power transformer, it is made up of Two separate coils wound around an iron core that magnetically couples the two winding. The diodes rectifier converts the input sinusoid  $V_s$  to a unipolar output, which has the pulsating waveform as shown.



Although this waveform has non-zero average or DC components its pulsating nature makes it unsuitable as a DC source. The filter capacitor used was 2200 $\mu$ f 16V; the filter considerably reduced the variation in the magnitude of the rectifier output. However, the capacitor has the effect of opposing changes in voltage. Therefore, a bigger capacitor would tend to reduce the ripple magnitude. Since the input voltage was not regulated, a voltage regulator was used to overcome these setbacks. 7805 and 7809 voltage regulator was used.

### DESIGN ANALYSIS

The transformer was chosen on the facts that its output current is 1000mA, which is enough to drive the whole circuit. Its voltage is calculated as follows

$$VO = \frac{2 * VS * \sqrt{2}}{\Pi}$$

Where  $VO$  = output voltage.

$VS$  = Supply voltage 12Vrms

A 240Vrms step down transformer was employed

$$\begin{aligned} \text{Therefore, } VO &= \frac{2 * 12 * \sqrt{2}}{\Pi} \\ &= \frac{33.94}{\Pi} = 10.8 \end{aligned}$$

Considering the power input and power output of the transformer

Input power = output power

$$I_1 V_1 = I_2 V_2$$

$I_1$  - input current

$I_2$  - output current = 1A(chosen)

$V_1$  - input voltage (rms) = 240V

$V_2$  - output voltage (rms) = 12V

$$I_1 = \frac{1 \times 12}{240} = 50mA$$

At full load a current of 50mA flows through the primary of the transformer.

The Rectifier was chosen based on the following properties.

- Maximum peak reverse voltage (PRV) = 600V
- Average maximum voltage forward current = 1A
- Forward voltage drop (maximum) = 8V at 1A

The 1µf, 50V capacitor was used to filter the remaining ripple and for further Smoothing, 7805 was used to power the buffer at the receiver terminal at a constant Voltage of 5V, while 7809 regulator was used for 9V supply. A 5A fuse was used for Protection. A stabilizer switch with an inbuilt indicating power led was used for Switching purpose.

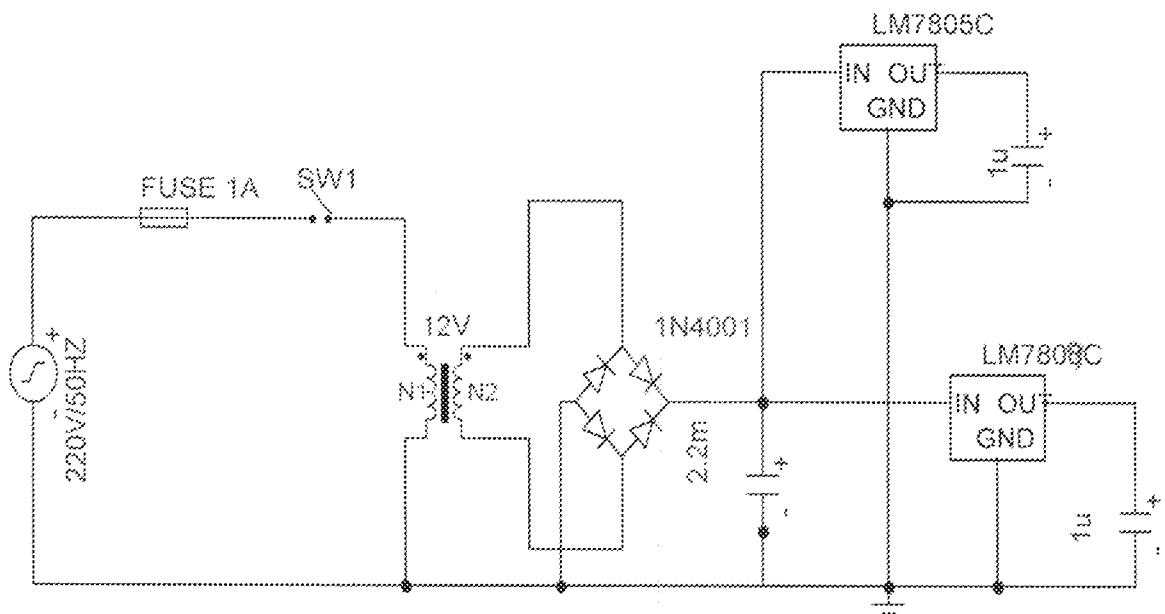


Fig 9.0: Power supply unit

## 2.5 STANDARD PARALLEL PORT HARDWARE PROPERTIES

The parallel port is the most commonly used port for interfacing real time project. The parallel port allowed the input of up to 9 bits or the output of 12 bits at any given time. Thus marking minimal external circuit to implement many tasks. The parallel port is accessible through a D-Type 25 pin female connector at the back of a personal computer. The IEEE 1284 standardize the connectors for use with the parallel port. The first one, 1284 Type A is the D Type found on the back of personal computers. It was the type used in the designing of the TMCS. The 2<sup>nd</sup> type is the 1284 Type B, which is the 36 pin electronic printer.

IEEE 1284 Type C however, is a 36-conductor connector like the centronics; it has a better chip latch, buffer electrically properties and is easier to assemble. It also contains 2 more pins for device connection and power On .The table below shows the "Pin Out" of the D-Type 25 pins connector and the centronics 34-pin connector. The most commonly used is the D-Type 25 pin connector.

Table 1.0: Pin Assignment of the D-Type 25 pin parallel port connection

PIN NO (D-TYPE)	PIN NO (CENTRONICS)	SPP SIGNAL	DIRECTION (IN/OUT)
1	1	n strobe	In/Out
2	2	Data 0	Out
3	3	Data 1	Out
4	4	Data 2	Out
5	5	Data 3	Out
6	6	Data 4	Out
7	7	Data 5	Out
8	8	Data 6	Out
9	9	Data 7	Out

10	10	n type	In
11	11	Busy	In
12	12	Paper-out/paper end	In
13	13	Select	In
14	14	n auto-line feed	In/Out
15	32	n error/n fault	In
16	31	n minimize	In/Out
17	36	n select-printer/n select-in	In/Out
18-25	19-30	Ground	GND

In the above table "n" in front of the signal name denote that the signal is active low. E.g. n error. If the printer has occurred on error then this line is low. This line normally is high, should the printer be functioning correctly. The "hardware Inverted" means the signal is inverted by the parallel example is the busy line. If +5V (logic 1) was applied to this pin and the status register read, it would return back a 0 in bit 7 of the status registers, it was the pin used in the manipulation of the TGCS.

The output of the parallel port is normally TTL logic levels. The current that can be sink and source varies from port to port. Most parallel port implemented in ASCII, can sink and source around 12 mA. However, these are just some of the figures taken from the data sheets sink/source 6mA, source 12mA/sink 20mA, sink 16mA/source 4mA, sink/source 12mA. As it can be seen it varies with bit. It justifies the reason while buffer (tristate) was used to at least draw a minimum current from the parallel port.

## PORT ADDRESSES

The parallel port has three commonly used base addresses. They are showed on table.

Table 2.0 PORT ADDRESSES

ADDRESS	NOTES
3BCh-3BFh	Used for parallel port which were incorporated into video cards and now, commonly an optimum for ports controlled by BIOS does not support ECP nodes
378h-37Fh	Using address for LPT 1
278h-27Fh	Using address for LPT 2

378 h and 278h are commonly used for parallel ports. The design of TMCS used 378h as base address. The 'h' denotes hexadecimal.

Table 3.0: Data ports

OFFSET	NAME	READ/WRITE	BIT NO	PROPERTIES
Base + 0	Data Port	Write (and read if bi-directional)	Bit 7	Data 7 (Pin 9)
			Bit 6	Data 6 (Pin 8)
			Bit 5	Data 5 (Pin 7)
			Bit 4	Data 4 (Pin 6)
			Bit 3	Data 3 (Pin 5)
			Bit 2	Data 2 (Pin 4)
			Bit 1	Data 1 (Pin 3)
			Bit 0	Data 0 (Pin 2)

The base address usually called the data port or data register is simply used for outputting data on a parallel ports data line (pin 2-pin 9). This register is normally a write only port. If a reading is done the last byte sent is gotten. However, if the port is bi-directional data can be received on this address.

Table 4.0 : STATUS PORT

Base +1	Status port	Read	Bit 7	Busy (Pin 11)
			Bit 6	Ack Pin 10
			Bit 5	Paper out (Pin 12)
			Bit 4	Select line (Pin 13)
			Bit 3	Error (Pin 15)
			Bit 2	IRQ (NOT)
			Bit 1	Recovery
			Bit 0	Reservoir

The status port (base address +1) is a read only port. Any data written to this port will be ignored. It is made up of 5 input lines (pin 10, 11, 12, 13, and 15) an IRQ status register and two reserved bits. Bit 7 (busy) is active low input. If bit 7 happens to show logic 0, it means that there is a +5V at pin 11. It was basically the bit used for the manipulation of the TGMCS.

Table 5.0: Data Port

Offset	Name	Read/Write	Bit No	Properties
Base + 0	Data Port	Write (Note-1)	Bit 7	Data 7 (Pin 9)
			Bit 6	Data 6 (Pin 8)
			Bit 5	Data 5 (Pin 7)

			Bit 4	Data 4 (Pin 6)
			Bit 3	Data 3 (Pin 5)
			Bit 2	Data 2 (Pin 4)
			Bit 1	Data 1 (Pin 3)
			Bit 0	Data 0 (Pin 2)

Offset	Name	Read/Write	Bit No	Properties
Base + 2	Control Port	Read/Write	Bit 7	Unused
			Bit 6	Unused
			Bit 5	Enable bi-directionality port
			Bit 4	Enable IRQ via ACC Line
			Bit 3	Select printer
			Bit 2	Initialize printer (Reset)
			Bit 1	Auto line feed
			Bit 0	Stable

The control port (Base address +2) was intended as a write only port but in most cases where the outputs of the control port are open collector, the pins can be grounded so that the port be used to input data.

## 2.6 SOFTWARE DESIGN

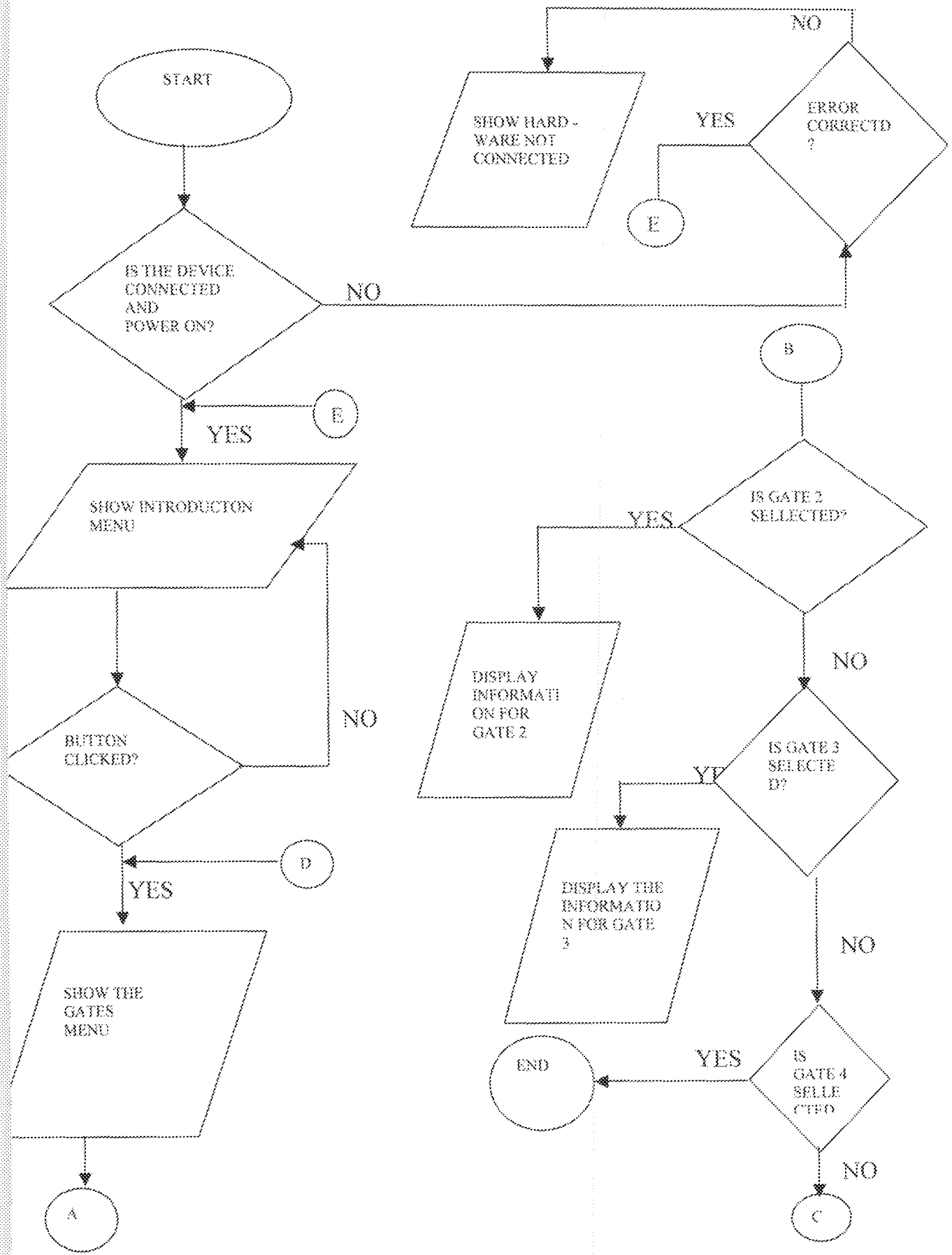
In every real time computer control, the ingenuity in the software design determines the intelligence of the system. The software directs the Microprocessor on the activities to execute on or with data inputted from the I/O port. The software is therefore, a stored program instruction in RAM that directs the computer's hardware on the activities to perform.

The driving software for this project was written in visual Basic. Visual Basic was chosen because of its flexibility and easy to use than any other programming languages.

### INPUT /OUTPUT ROUTINE.

Input and output routine involves a communication between the microprocessor and the external device via the parallel port. It includes sending a signal from the external devices via the status port. Access to the parallel port through the visual basic was accomplished by the inclusion of an active x component called the IOPORT. DLL to the windows systems used for the programming. This was gotten from the Internet as a shareware. Flow of data depend on the controlling program code written for it .In the design of the TGCS only one of the pin from the status port was used. However, the base address as set to that of data port, which was 378H.the address of the status port was set to 379H. Pin11 and 15 was used to input a bit to the controlling of the program.Bit 7 of the status port was used for counting of any change of signal.





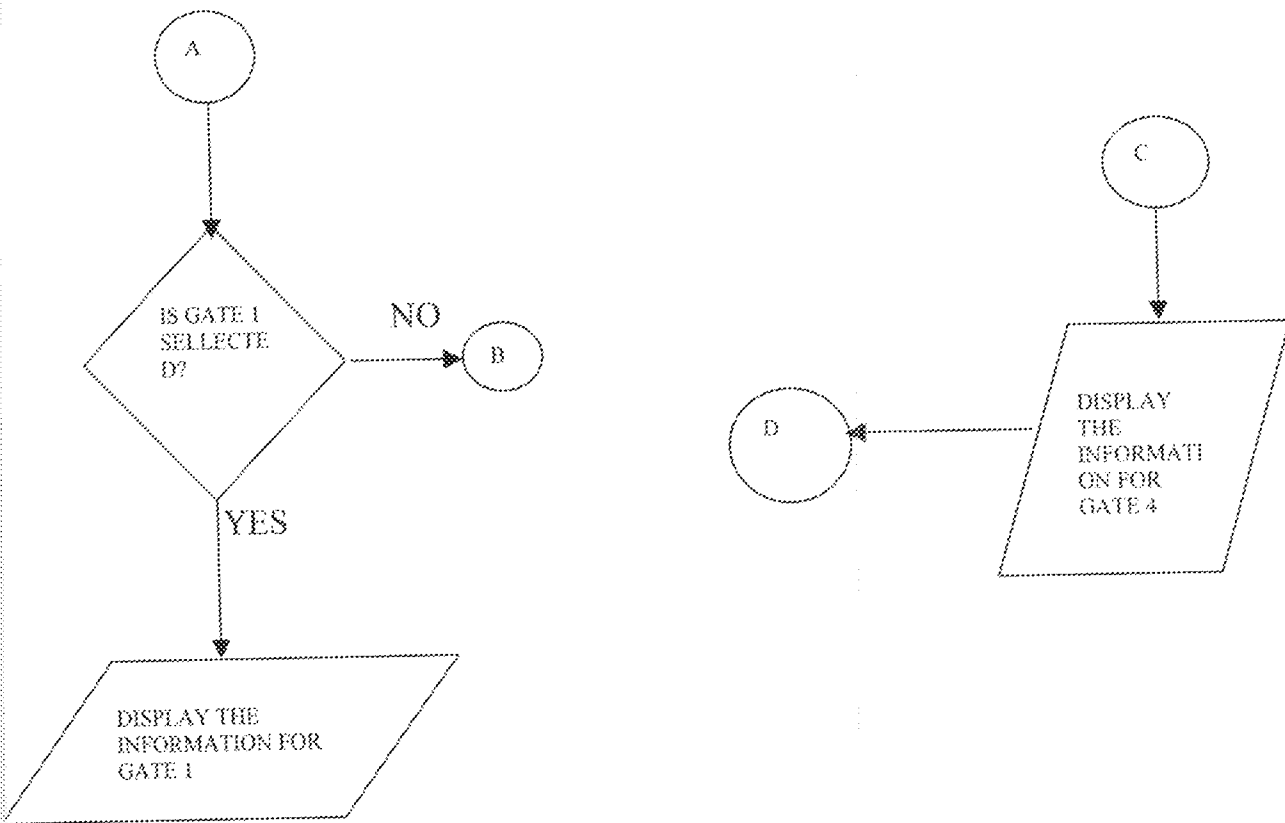


Fig 10.0 Flow chart for the program

## **CHAPTER THREE: CONSTRUCTION, TESTING AND RESULT.**

In the design construction of TGCS, the design specifications were adhere to.

All test For both transmitter and receiver signals was carried out to avoid strays of signal to the receiver.

### **3.0 COSTRUCTION PROCEDURE**

The constructions involves bringing together the entire component that is required to make up the system to its final stage. During the course of Construction, the instrument include:

#### **CONTRUCTION OF POWER SUPPLY**

The components used includes the transformer, voltage regulator, rectifier, Capacitors, fuse, fuse socket and switches. The primary side of the transformer was connected to the main source while the secondary side rated 12V was connected via the fuse and the switch to voltage rectifier. The positive terminal of the rectifier was connected to the positive terminal of 2200 $\mu$ f capacitor and the Negative terminal to the common (GND). The positive terminal of the capacitor Was passed to the regulator, 7805 and 7809 an the out put of the regulator to Positive terminal of 1 $\mu$ f 50V capacitor for final filter of the ripple. The output was Passed to Vcc

#### **CONSTRUCTION OF THE TRANSMITTER**

The transmitter consists of transistors, astable multivibrator, resistor, and infrared Emitter, capacitors, light emitting diode. The legs of all the miniature Components were cleaned to remove any insulation. The 555timer was configured as required to ensure it gives 20.1 KHZ carrier waves

## CONSTRUCTION OF THE RECEIVER

The receiver captured the carrier waves transmitted by the transmitter. It consists of phototransistor, comparators, capacitors, resistor, diodes, buffers. The comparators and the buffer were carefully inserted into an IC socket for easy replacement of any damaged IC. The final signal was passed through the 74125.

## CONSTRUCTION OF CASING

In the construction of the casing, aluminum metal sheet was used for both transmitter and receiver. Appropriate dimensions, cut was made for fuse socket, the switch, the infrared transmitter, the DB 25 connector and the Phototransistors

**Bread board:** - this is board on which the circuit was tested to ensure its workability before transferring to Vero board

**Soldering iron:** - This is an alloyed hot metal used to melt the lead which hold the component firmly on the Vero board

**Lead sucker:** - Its principle is based on suction pressure. It was used to remove an unwanted lead from the Vero board.

**Lead:** - this was used to hold the component s firmly on the Vero board

**Digital multimeter:** - It is a multifunctional instrument used in measuring the Voltage, current, current gain and continuity

## 3.2 TESTING AND RESULT

**TESTING:** the following test was carried out during the course of the research work. The LED on the transmitter was used for testing if the transmitter is transmitting the required carrier wave, on putting the power supply ON the LED was not coming On first attempt. The circuit was gone through carefully and the

power was put ON again the indicating LED Came On as expected indicating the transmission of of the carrier wave. Initially there was not sense of signal at the receiver, the phototransistor was replaced with another type and the required carrier wave signal was received at the output of the receiver.

**RESULT:** The program driver for TGCS was ran on a personal computer System, after connecting the hardware on the DB-25 connector. On selecting the DB-25 connector. On selecting the GATE1, there was no changes on the program. The source code was revisited Again. The program was ran ,yet no respond. The hardware was checked and was giving the require signal.

### **3.3 PROBLEMS ENCOUNTERED**

During the construction of the prototype, the problems faced include

Lack of oscilloscope to measure and view the carrier wave from the transmitter. A lot of components were damaged and was replaced.

Interruptible power supply was persistent during the soldering.

Again the problems of capturing the carrier wave at the receiver was encountered and resolved .

## **CHAPTER FOUR: CONCLUSION AND RECOMMENDATION**

### **4.0 CONCLUSION**

Having completed the project and tested at different stages of the circuit it came into conclusion that using an infrared transmitter and detector with Microcomputer the problems of corruption could be minimize in a Toll Gate.

### **3.1 RECOMMENDATION**

It is highly recommended that while embarking on this project care must be taken in other not to have a stray infrared signal from any other sources.

Again it is also recommended that a serial port should be used since the signal is a single bit wide. This project could also be used in a processing industry, and cottage industry. Further improvement could be make by increasing the number of gate

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## APPENDIX A :

```
'declaration of base address
Private Sub form_load()
Const BASE = &H378
Const STATUS = BASE + 1

'declaration cods
Dim Gate(4) As Gates
Dim amountVals(4) As Currency
Dim sysReady As Boolean
Dim amount vals(4) As currency
Dim sysready as Boolean
type Gates
    numberOfVehicles As Integer
    interval As Integer
    active As Boolean
End Type

'codes for data to work on
Private Sub Form_Load()
okCmd.Enabled = False
Timer1.Enabled = True
amountVals(0) = 50
amountVals(1) = 100
amountVals(2) = 70
amountVals(3) = 80
End Sub

'codes to check the state of the hardware
Private Sub Timer1_Timer()
a = Inp(STATUS) Xor 128
If Inp(STATUS) And 8 = 8 Then
    statusMsg = "Hardware is connected and fully functional"
    sysReady = True
ElseIf Inp(STATUS) And 8 <> 8 Then
    statusMsg = "Check that hardware is connected and fully functional"
    sysReady = False
End If
sysReady = True
If sysReady = True Then

'code to start counting
For x = 0 To 3
If a And 2 ^ (7 - x) = 2 ^ (7 - x) Then
    If Gate(x).active = True Then
        Gate(x).interval = Gate(x).interval + 1
    ElseIf Gate(x).active = False Then
```



```

Gate(x).active = True
Gate(x).interval = 0
End If
Elseif a And  $2^{(7-x)} < 2^{(7-x)}$  Then

'seting of time for counting
If Gate(x).active = True Then
    timeF = Gate(x).interval / 100
If timeF >= 5 Then Gate(x).numberOfVehicles = Gate(x).numberOfVehicles + 1
    End If
End If

'codes for the monitoring panel
If gateData(x).Value = True Then
    okCmd.Enabled = True
    Form2.amountLbl = "Amount for " & gateData(x).Caption
    Form2.totalVehLbl = "Total num of " & gateData(x).Caption & " per day"
    Form2.amountVal = amountVals(x)
    Form2.totalVehVal = Gate(x).numberOfVehicles
    Form2.totalAmtVal = amountVals(x) * Gate(x).numberOfVehicles
    Form2.dateLbl = Format(Now, "dd:mm:yyyy hh:mm:ss ampm")

'code for displaying next gate
End If

Next x

End If

End Sub

```

APPENDIX B: COMPLETE CIRCUIT DIAGRAM

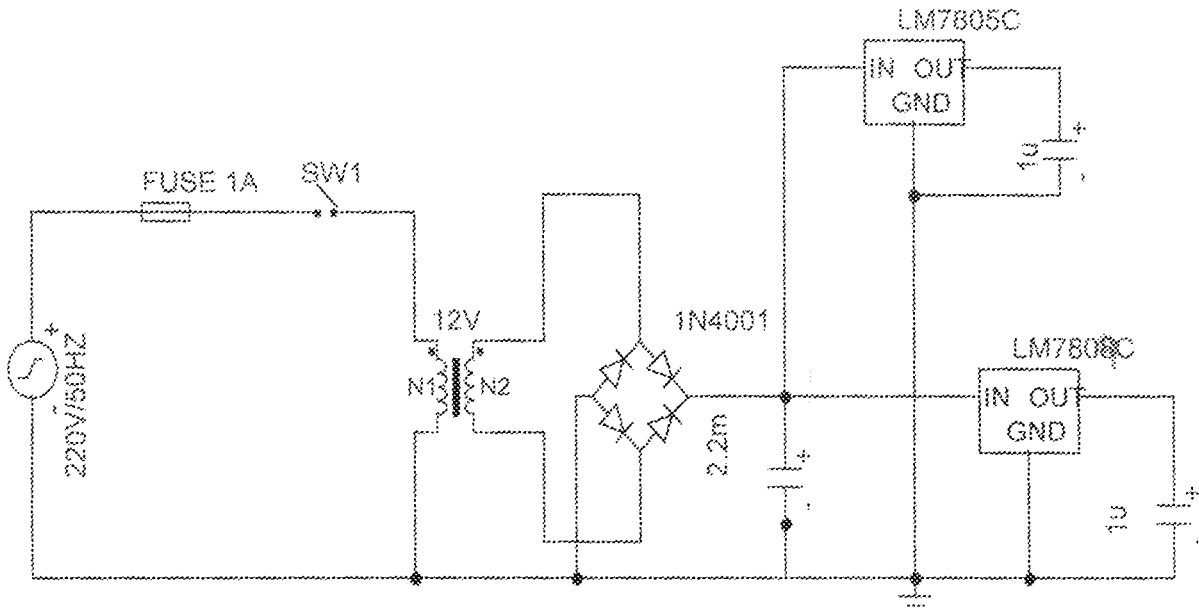


FIG 10.1 POWER SUPPLY UNIT

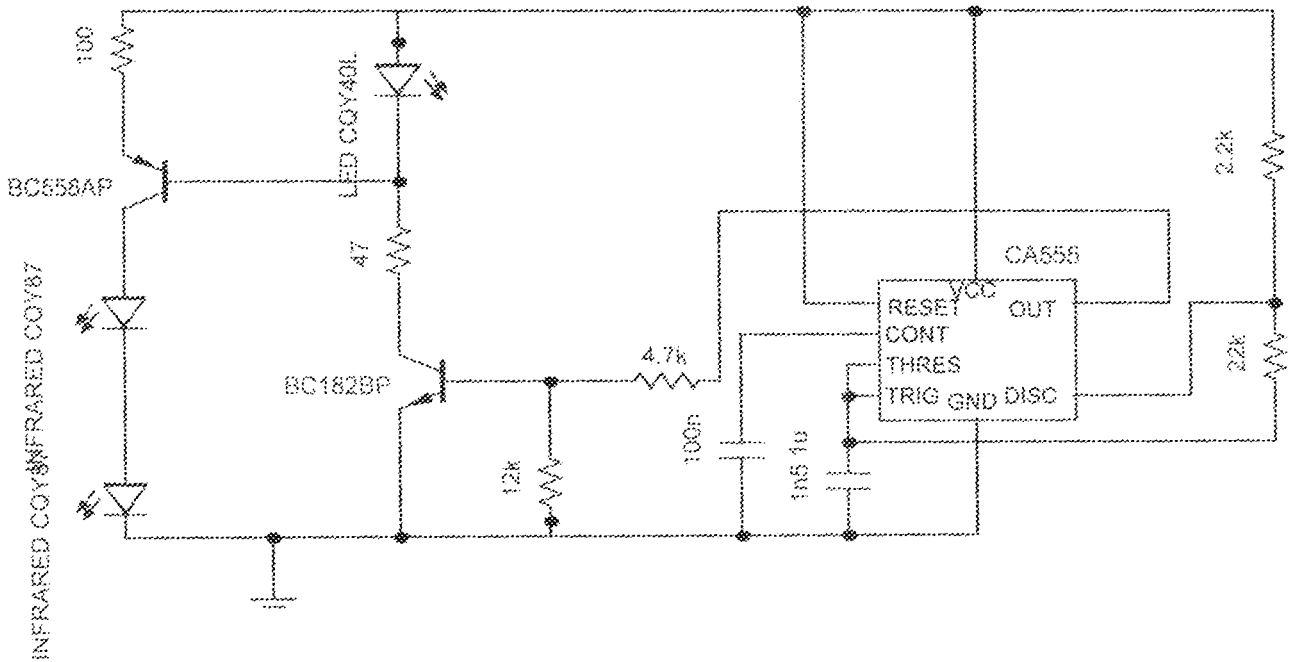


FIG 10.2 TRANSMITTER CIRCUIT DIAGRAM

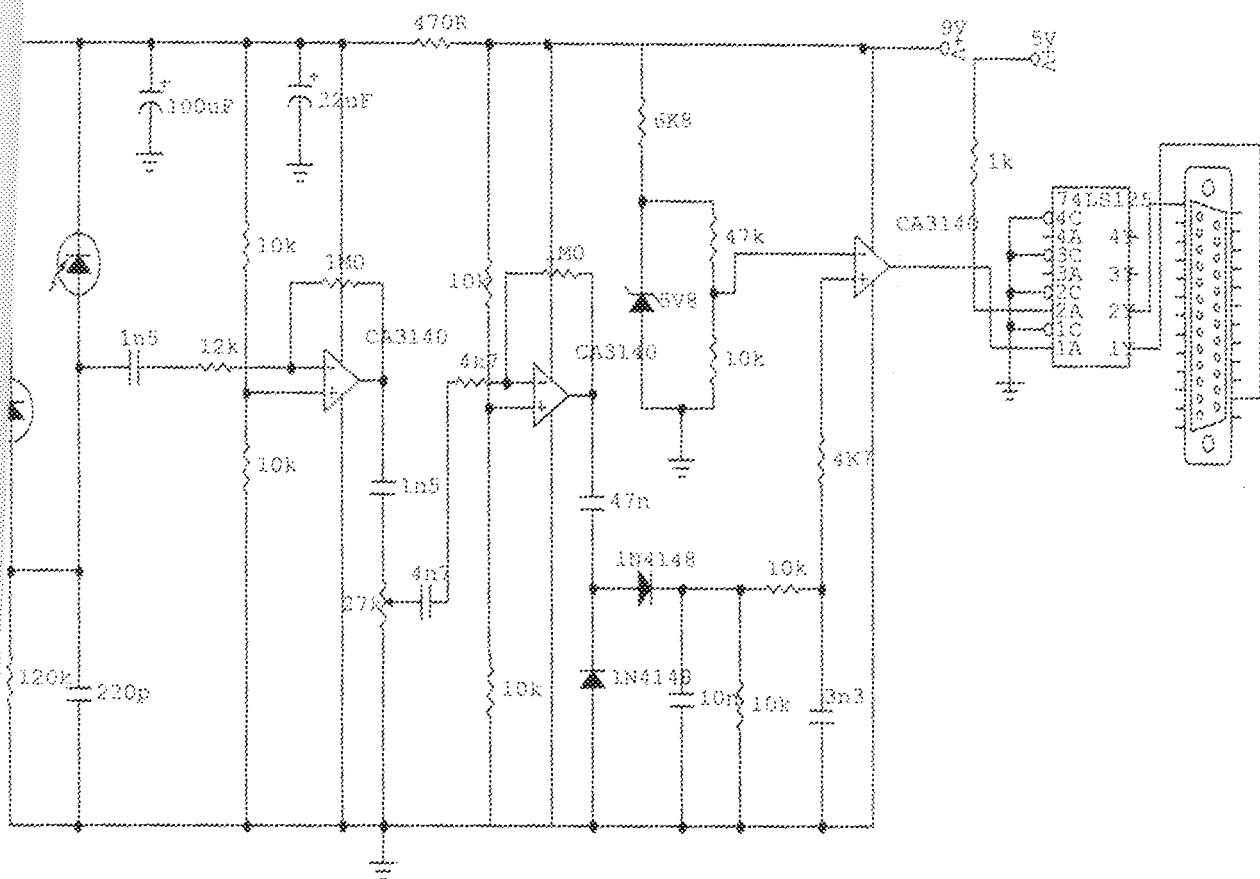


Fig 10.3 RECEIVER CIRCUIT DIAGRAM