

USING COMPUTER TO DESIGN ELECTRONICS CIRCUITS

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**DEPARTMENT OF MATHEMATICS AND
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**FEDERAL UNIVERSITY OF TECHNOLOGY,
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**A PROJECT SUBMITTED TO THE DEPARTMENT OF
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DEDICATION

This work is dedicated to Almighty Allah (SWT) and to the memory of my Late Father, Alhaji Tajudeen Akanno Shittu and my late mother Alhaja Tayibat Aduke Shittu.

CERTIFICATION

I certify that work was carried out by SHITTU SAHEED
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Date

ACKNOWLEDGEMENT

Praise is only due to Allah (SWT), the giver and taker of all things. Thanks to Him for His protection and guidance over me throughout my education life up this stage. May He continue His blessings on all of us throughout our life.

Prophet Muhammad says:

“He who can not show gratitude to Human being can not show gratitude to Allah (S.A.W.). Hadith.

In line of this statement, my profound gratitude firstly goes to my Supervisor Professor K.R. Adeboye, Mr. L.N. Ezeako (HOD of the department), Dr.Y.M. Aiyesimi, Mr. Audu Isah, Prince R.O. Badmus and other lecturers of the department.

I am also indebted to the following personalities my late mother and father, Mallam Luqman Abdur Rahman, Mallam Rufai Qasim Mallam Waliyullahi, Mallam Abdur Rasaq Garba, Brother Sa'eed Sanusi, Mallam Abdur-Rasheed Qasim (for typing this project at the odd time), my wife Umm Sofiyah, Mallam Ibrahim Manaja (HOD, Department of EEIM of FTC),the colleagues, the entire family members, the entire Muslims all over the world.

Finally, I pray Allah to shower His blessings on Prophet Muhammad and Muslims as well as those who contributed to my achievement.

ABSTRACT

The project is on using computer to design electronics circuits, this is with the aid of CAD (Computer Aided Design).

The project discusses about the CAD and how it works. It also talks on electronics components. Also, a small burglary alarm was designed with a program written on its timing and frequency.

The using of CAD was also recommend for the entire institution of higher learning.

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Appendix A

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technological competent with the rest of the world, there is need for them to understand the use of computer effectively.

Based on this assertion, CAD is the most important application of graphics which assist in designing problems. CAD is intended to make computer accessible to non-programmers.

1.2 PROJECT OBJECTIVITY AND MOTIVATION

Introduction of CAD is not more than twenty years now, but it has transformed the working practice of designer in many industries and has become huge in the world of industries itself. It has a wide range of application in the field of engineering which enhances their productivity, accuracy and creativity. With advent of CAD, learning strategy is possible. The future of education depends on development in technology, education and society.

In the Nigeria universities system CAD had also been used. The CAD usage in our universities will improve the knowledge and experience of students.

The electronics industries are not left out, the introduction of CAD had changed a lot in their production. The construction of their product are now easily done with the aid of CAD; since there are easy interactive between them and the computer. The engineering graduate must be trained in the use of computer graphic as design tools in much way that the engineers in the past used slide roles and today uses calculator.

Designing electronics circuit using CAD is of this project. So, the CAD usage under this project will be narrowed down to how it can be used to design the electronics circuit and a specific of a small burglary Alarm will be an example. QBasic is needed in designing the program of the circuit.

1.3 PROJECT LAYOUT

The format of the project is that, in chapter one general introduction that comprises of introduction, project objectives, and motivations, project layout and literature review were discussed. Chapter two discussed the compatibility of electronics and the computer effect of current of electronic component and advantages of electronics were also discussed. Chapter three focuses attention on the description of CAD, general application of CAD, advantage of CAD and CAD in electronics designed. Then, chapter four deals with programming aspect; introduction to programming, development of software, designing of small burglary alarm circuits and testing of burglary alarm, while chapter five is the summary, conclusion and the recommendation which discussed the importance of programming language in computer, survey of languages as well as summary, conclusion and recommendation.

The next section looks at the literature review of CAD.

1.4 LITERATURE REVIEW

For more than a decade, computer graphic has been in existence though, electronic circuit has been existing longer than the computer graphic.

CAD which the graphic is part, is an abbreviation of Computer Aided Design. In the area of graphic, it is used in creating two-and three- dimensional picture of every thing from hand tools to tractors. As a manager at Chryster said, "many companies have design data and manufacturing data and the two are never the same".

THE ELECTRONICS COMPUTER AIDED MANUFACTURING (ECAM), Project was a joint industry/ government/ university effort to promote factory Automation. It was a tri-service project (Army, Navy and Airforce) coordinated by USA Army missile command.

Columbus laboratories managed the project which involved vendors of military electronics equipment. Its overall goal was to develop technology planned for automated of military electronics. ECAM is involved in analysing integrated circuit, printed wiring boards, electronics assemblies, and wire wound magnetic component (Rober, 1982)

Computer Aided Teaching (CAT) is another need to be reviewed, is an highly interactive graphic oriented interface facilities for use in computer video disk education system called CAVEI. It was developed as a prototype system. it is an easy to use authorising system that is intended to be used by teacher within an interactive video-base learning environment. Teacher require no pre-knowledge of computers in order to use the system (barker 1987).

Linac and Lana are analysts (a CAD programme used by students Colchester Institute for Laboratory work in electronics and circuit design units in BTEC national and higher national programme). Both Linac and Lana can perform both numeric and lateral analysis of the circuit performance. Lateral analysis provide gain, phase or impedance, in terms of the circuit lateral components names (Whealer R, 1987).

Another powerful analysis programme by Gerald and Richard, 1975 called EL. This programme is for understanding of electronics circuit. It uses human's like reasoning to determine networks voltage and currents. They explained complicated electronics device in terms that are easily understood by electrical and electronics engineer.

The problem of storage was still solved since Leyden jar was limited in its storage capacity, but in 1800 Volta invented the electric battery. A "Volta pile" consisted of copper and zinc discs separated by a moistened cloth electrolyte. The pile was later improved to consist of paper discs, tin on one side, manganese dioxide on the other, stacked to provide 0.75 volt and between 1.0 diameter discs. This was soon followed by the first accumulator or rechargeable battery in 1803 by Ritter in Germany. In 1820, Integration of electricity and magnetism by Oersted in Denmark led him to develop Galvanometer, allowing accurate measurement of currents and voltages.

In 1831, Faraday made an important discovery by wounding an iron ring with two coils, one connected to a battery, the other to galvanometer. This gives a reading the galvanometer.

It was also in early 1800s that infrared, ultra-violet, thermoelectricity and photostatic were discovered too. Around 1860, work on low-pressure discharge tubes, glow discharges, new types of battery and the early microphone took place. Application of telephone, phonography, microphones and loudspeakers were between 1800 and 1875. Towards the end of this century, wireless-telegraphy, magnetic recording and the cathode-ray oscillograph were all developed.

The present-day electronics started in 1900s with the member of three-electrode valve used in radio broadcasting and Campbell Swinson put forward his theory of television.

The 1914/1918 war, made electronics to cover a wide field of application. New radio tubes and new circuits were developed for communications. The post-war brought development of radio astronomy, xerography, early radar and computer techniques. All these were further developed during 1939/1945 war. Under pressure of this war, radio and computers work led to a great increase in electronics research.

In 1948, transistors were invented by Bell Laboratories scientists by making a third contact to the normal P-n contacts in germanium. After advent of three-electrode tube in quantity, components such as resistors and capacitors began to assume form.

2.2 COMPATIBILITY OF ELECTRONICS AND COMPUTER

It is well known that without the discovery of electronics computer cannot be in existence and without the existence of computer improvement on electronics analysis cannot be easy. Hence, they are important to each other.

The area of compatibility are numerous, but few will be discussed in this project.

- (1) Electronics development brought the discovery of computer in 1642 when Blaise Pascal designed a mechanical device to calculate the sum of long columns of figures in his fathers tax office. With this development scientist were making efforts to improve and produce an electronic computer, but not until 1942 by the University of Pennsylvania when the first electronics computer was invented called ENIAC (Electronics numerator Integrator and computer). Hence, electronics brought the invention of computer. And up till today, computer is getting more sophisticated with the development of electronics component and circuits, that was why there are different types of computer, such as super computer, the main frame, minicomputer etc.
- (2) Computer invention also insists electronics in construction of electronics circuit as well as electrical circuit through the use of Computer Aided Design. It designs the electronics circuits for a designer, analyse and test the circuit work ability.
- (3) Computer assists electronics in controlling the numerically controlled (NC) machines. The microcomputer used for job receives commands in form of a sequence of numbers. On receipt of these numerical commands, the machine

interprets them and controls two or more axes simultaneously to achieve the required result. Examples of machines using this type of control are NC lathes, NC milling machines, and automatic printed circuit drilling and rolling machines.

- (4) Another compatibility of computer and electronics is the use of networking, E-mail etc. Due to electronics the networking of computer is possible because they make use of electricity to transfer information to one another. Likewise and other means of transferring information were possible because of electronics existence.
- (5) In medical terms, the electronics made use of heart sound amplifiers with cardiograph displays of heart beat waveforms. The electroencephalograph (EEG) displays brain rhythms and computer analysis their waveforms. Other electronics aids are laser retinal photocoagulators, radio pills, ultrasonic echo analysis and hearing aids, axial tomography, all these are also computerised.
- (6) The banking sector is another area that makes the computer and electronics to be compatible. The accounting ledger records and retrieval, updating and filling can be performed by the help of computer. This is also possible for computer because of electronic office.
- (7) In the field of security, electronics intruder alarms are now used as sound detectors, magnetic switches on door, light beams, laser beams, pressure mats and hoses, infra-red detection, microwave reader, surveillance scanners, security pass systems and IV coverage, all can also be computerised.

2.3 EFFECT OF CURRENT ON ELECTRONIC COMPONENTS

Electronics components are many that this project cannot cover all of them. The few of the electronics devices will be discussed with their response to the current flowing through them.

According to the institute of electrical and electronics engineers the “electronics is that branch of science and engineering which deals with electron devices and their utilization”. And, IEEE define electronic devices as “ a device in which conduction by electrons take place in a vacuum, gas, or semi conductor” Taken together these two definitions it can be seen that electronics devices has vast variety of circuitry built around to countless tasks systems, instrumentation, and telemetry. There is no aspect of the listed field or other electronics components that can do without current in their components. In view of this, the current effect on some electronic components in will be discussed. More so, there are some electronics components that are passive while some are active. Passive components are ones that have little or no changes when current passes through them, while active component are ones that increase or reduce the current that passes through them. Examples of passive components are resistor, semi conductors, integrated circuit (I.C.) e.t.c so, few of these components are going to be discussed on the effect of current on them.

The following component are to be discussed about,

- (i) Resistor
- (ii) Capacitor
- (iii) Transistors

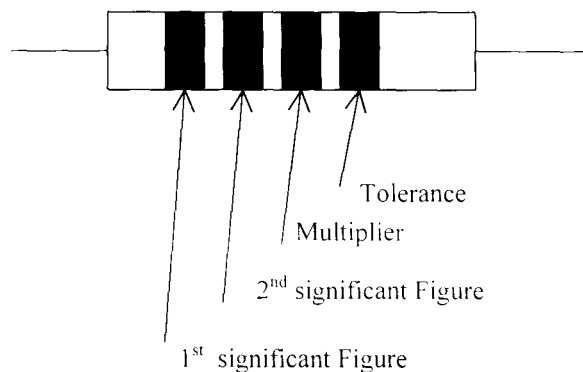
2.3.1 **RESISTOR:** Resistance of a component or material is the ability of the material to offer opposition to flow of current, hence converting the electrical energy into heat energy.

There are different types of resistors, which were classified, majorly into two categories; Fixed and variable resistors. Element Filament and Rheostat are examples of fixed and variable resistors respectively.

Fixed resistor has a predetermined resistance to a circuit. The standard unit of value of a resistor is the ohm (Ω). The higher the value, the more the resistance the component provides to the circuit.

The fixed resistor value are mostly determined by colour coding, which starts from the edge of the resistor and are mostly comprises of four, the five and some times six bands of different colours.

For example with the four-band colours shown below, band one, two, and three indicate the value of the resistor, while the fourth band indicates the tolerance of the resistor which is usually 5 or 10 percent.



The table below shows the meaning of the colour codes.

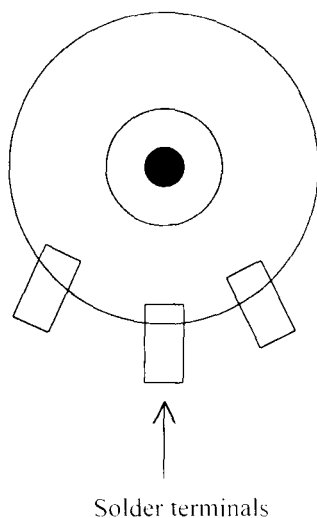
Colour	1 st digit	2 nd digit	multiplies	Tolerance
Black	0	0	x 1	±20%
Brown	1	1	x10	±1%
Red	2	2	x 100	± 2%
Orange	3	3	x1000	± 3%

Yellow	4	4	x10,000	± 4%
Green	5	5	x100,000	+4%
Blue	6	6	x1,000,000	-
Violet	7	7	x10,000,000	
Gray	8	8	x100,000,000	
White	9	9	---	
Gold			x0.1	±5%
Silver			x 0.01	±10%
None				±0%

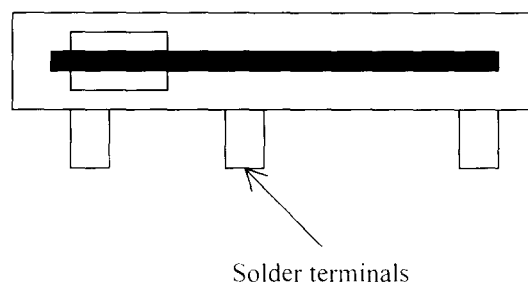
The variable resistors as the name indicates is an undetermined value and these are mostly potentiometer like fixed resistor, the higher you vary too, the higher it resist the amount of current that passes through.

Potentiometers are either dial or slide type as shown belows.

Dial



Slide

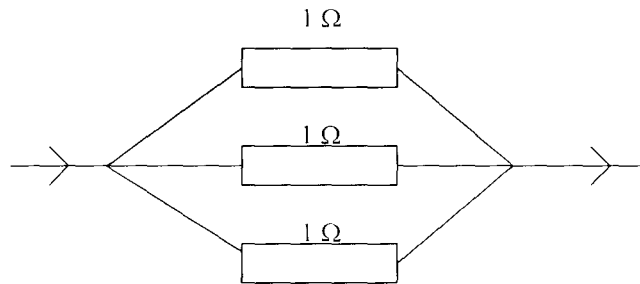


Generally, the effect of current on resistor is determined by the value of resistance of the resistor. The lower the ohm of a resistor, the higher the current

that passes through and the higher the ohm of resistor(s) the lower the current that passes through.

So, it is highly advisable to connect resistor in parallel then in series. The total ohm of three 1-2 resistors connected in parallel and series calculated belows

(1) In parallel



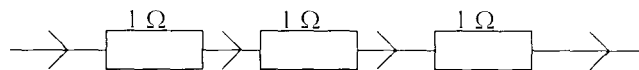
$$1/R_T = 1/R_1 + 1/R_2 + 1/R_3$$

$$1/R_T = 1/1 + 1/1 + 1/1$$

$$1/R_T = \frac{1+1+1}{1} = 3/1$$

$$R_T = 1/3 = 0.33\Omega$$

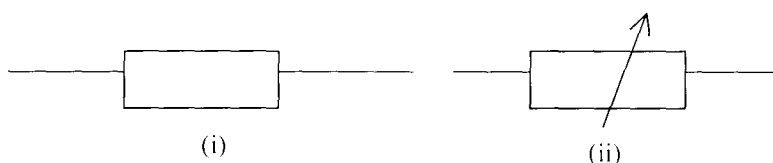
(ii) In series



$$R_T = R_1 + R_2 + R_3$$

$$R_T = 1 + 1 + 1 = 3\Omega$$

Symbol for resistors are shown below:



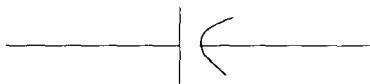
Fixed resistor symbol

Variable symbol

2.3.2 **CAPACITORS:** The most common component after resistor is the capacitors. Capacitors serve many purposes, removing traces of alternating current (AC) ripple in a power supply, delay the action of some portion of the circuit or removing harmful glitches. All these depend on the ability of capacitors to hold an electrical discharge for a predetermined period of time.

A capacitor consists of two conductors or metal plates separated by a dielectric (insulating) material. It stores an electrical charge and also isolates dc voltages from it, while permitting the transfer of an ac signal.

Capacitors are generally of two types, polarised and non polarised. Nonpolarised capacitors we use insert insulating material, such as air, paper, mica, and plastics, between the plates. The positive polarity of the dc circuit voltage may be connected to either terminal.



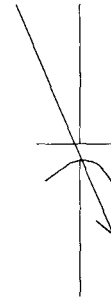
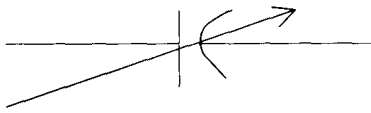
Non-polarised capacitors symbol.

But, the polarised capacitors have indication of the terminals either positive or negative. The positive terminal must be connected to either or red terminal of a circuit.

The tiny insulating material of a polarized capacitor is formed through an electrochemical process and will be destroyed with reversed polarity.

Fixed value capacitors are identified by their capacitance in microFarads (UF) or picaFarads (pF).

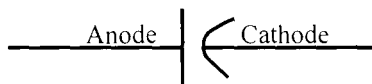
The symbol for variable capacitor is shown.



Capacitor serves as a means of storage in a storage in a circuit. The ability of capacitors to store and discharge electricity brings the case of time-delay.

2.3.3 **DIODES:** The diode is the most simple form of semi-conductor. Diodes are available in two basic flavors: germanium and silicon.

Diodes are of two-terminal semiconductors. They permit current to flow through in one direction only as indicated below.

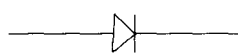


The above symbol of diodes indicator, the direction of conventional current flow from a positive potential to a negative or less positive potential. Election current flow is opposite in direction to conventional current flow.

Base on the only one directional flowing of current in diodes, they are applicable in many ways.

- (i) **RECTIFIER AND DEMODULATORS:-** As a rectifier it permits only one half-cycle of an alternating current (AC) to pass, hence it covers ac to dc and finds its application in a radio receiver. A diode and a capacitor serve to separate the audio-frequency intelligence from the modulated carrier or combination of radio-audio-frequency waves.

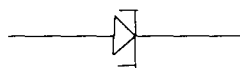
- (ii) ZENER DIODE:- This is a special diode used as a voltage regulator in power supply circuits. The breakdown of the applied voltage brings the conductivity of Zener diode which remains constant and independent of a load current.
- (iii) There are diodes that also function as an amplifier, oscillator or fast switching device, they are tunnel diode. It operates at extremely high frequencies and temperatures and will withstand nuclear radiation effects.
- (iv) A varactor diode is used as the voltage-tuned capacitance in high-frequency oscillators such as UHF television tuners.
- (v) The photodiode or solar cell type convert high energy to electrical energy.
- (vi) The diac is a two- terminal ac switching semi conductor. This device can conduct in either direction as indicated in its diagram below. They are used in motor speed control, heating controls and light-dimming applications.
- (vii) The light-emitting diode is the newly developed two-terminal semi conductor it operates in opposite of a photo-diode. hence, it emitted when current flow through it. Its simplest application is as a plot lamp since it consumes less energy than an incandescent. Also, it serves as the digital readout in calculators and electrical measuring instruments.



(i) Rectifier Diode



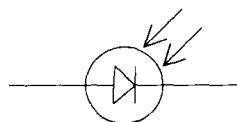
(ii) Zener Diode



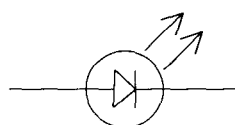
(iii) Tunnel Diode



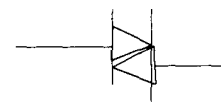
(iv) Varactor Diode



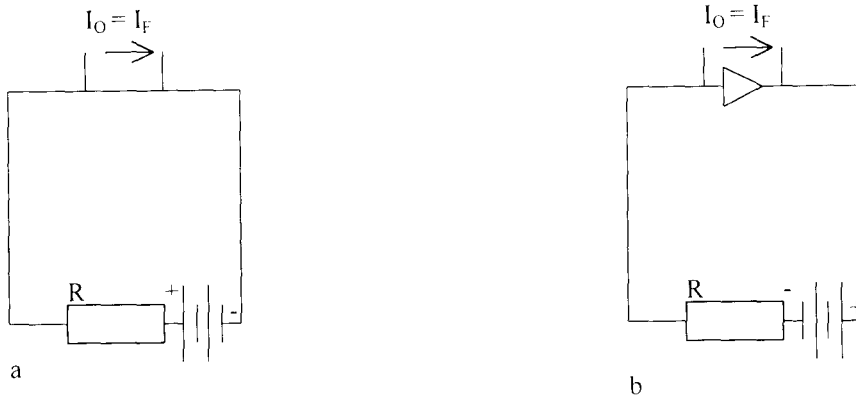
(v) Photo Diode



(vii) Light Emitting Diode



(vi) Diac Diode



The conduction of diode is either of forward- biased function or reverse- biased junction. Both junctions are shown in the figure above.

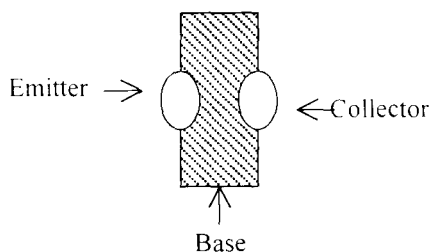
In the conducting state (forward-bias) there is a forward current (in the direction of conventional current) from P to N [fig (a)]. Fig (a) above shows a reverse biased connection with a reverse or leakage current. An increase in temperature results in increase available carries, which affect the current in diode directly.

2.3.4 **TRANSISTORS:** Transistor were designed as an alternative to the old vacuum tube and are used in similar application in either amplify a signal or to switch a signal on and off.

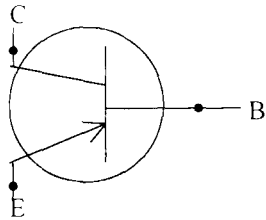
They are used both on low-current circuit such as radios, telephones etc, and a high –current circuit such as motor driver and power supplies. There are thousands different transistors currently available in the world. Few of them are as follows:

- I. Junction transistor (which will be related in this project)
- I. Field effect transistor (FET)
- II. Metal oxide semi conductor FET(MOSFET)
- III. Junction FET(JFET)

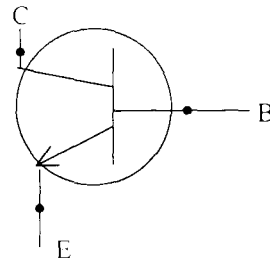
A typical alloy – type junction transistor is illustrated in the figure below.



From the figure, it will be seen that it consists of dope compare to emitter and collector. Emitter is similar to cathode of a thermionic valve, and collector to the anode. A transistor is either PNP or NPN. The figure below shown the P.N.P and N.P.N. -Transistor



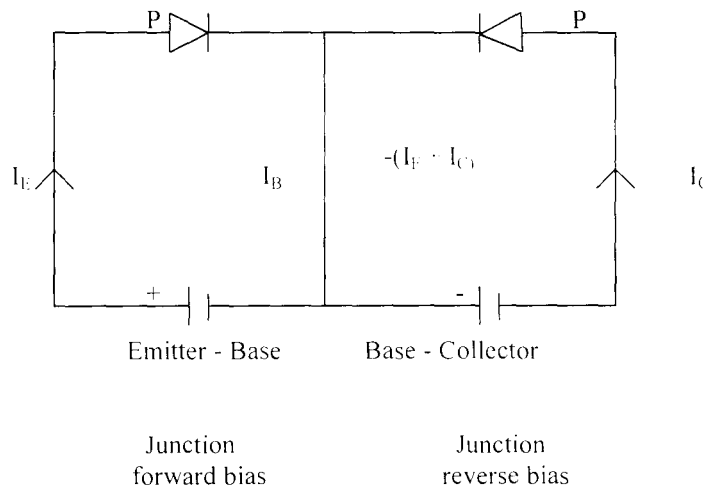
P-N-P transistors



N-P-N transistor

SCHEMATIC REPRESENTATION OF TRANSISTOR

Though pnp- and npn transistor are used as amplifier, but they have similar operational method to current and voltage of a circuit except with little different behaviour. The pnp transistor, has pn junction between emitter and base, and be represented by two diode as shown in the diagram below:



When the batteries is collected to it as shown above, the emitter-base junction is a reverse biased and the potential barriers are increase. The forward bias emitter-base junction causes hole to be injected into base since base is a minority carries (n type) At this point the holes will diffuse into base- collector junction provided they do not recombine with electrons in the region. This makes the junction to be forward biased for such minority carriers, and give rise to a current in the collector circuit.

There some holes that pass into the collector region, as small proportion will the electrons in the n- type base. The base current flow causes loess charge in the base layer. The varying of base current varies the voltage across the emitter-collectors.

As earlier mentioned npn behave in the same manner except that the minority carries through the base region is electrons instead of holes.

2.4 ADVANTAGES OF ELECTRONICS

When we mentioned the word electronics is as if we are talking of the whole world, because it's so vast in advantages from human being up to animals. The followings are the few examples of electronics.

1. **Communications:** The availability of electronics makes communication easier in the universe. We can easily communicate to ourselves through different means, like telephone, telegram, fax, e-mail etc.
2. **Design and construction:-**The ability of the electronic circuit design brings the design of cars and robbot easier. The car or robbot can also be controlled through electronics circuit with specification.
3. The electronics makes the radar possible, without it radar construction cannot be possible.

4. The computer ability work is through electronics means. The components used in computer are electronics devices.
5. The invention of electronics brings reduction of heat under the roof of building(s) through fan, air-conditioner, etc.
6. Taking bath with warm water is also through electronics invention, when bathroom(s) water bath were made of either cold or warm water.
7. Networking through computer is possible because of electronics.

CHAPTER THREE

3.0 COMPUTER AIDED DESIGN (CAD)

3.1 DESCRIPTION OF CAD

Computer uses are increasing tremendously everyday of our life. The computer acts as a tool useful in securing a wide range of problems in engineering. CAD is an acronym for the Computer Aided Design. It means use of computer as a tool for design.

Computers help Engineers to analyse, stimulate, and test their design. Due to economic reasons to make physical model and then subject them to test and destroy them is not practical. But with the help of computer, it is possible to make modification in the design. The use of computer dramatically extends the engineer's ability to analyse and design complex network. Though theoretically all the network can be served by hand, but due to drudgery and probability of error makes large scale analytic solution impractical. the computer removes these limitations.

CAD technology has emerged within the last decade or more, has yielded to increase engineering productivity, which is probably the primary consideration that influence most potential users to acquire CAD system. It results in improved quality of designs.

A design process is a creative activity, it involves a lot of routine work, the quantities have to calculate or look up in table. The characteristics and availability of different components have to be determined and ideas have to be studied to determine whether they are practicable. The essence of design is innovation, creativity and change. Design engineer creates, innovates and produces to solve a problem or set of problems by designing something to meet a defined use. Creating design can be expensive and time consuming, a computer with suitable data(s) base can be of help to solve all these

problems. Then, the design becomes an interactive process in which computer presents the design. With the help of computer simulation one can change the design and simulate it at a push of button. Computer simulation of this type is called "Computer Aided Design.

CAD is the important application of graphics which assist in design process. Computer graphics is the basis for computer aided design. CAD in any program provides logical assistance to user in creation of 2-or 3 – dimensional graphics. The primary function of a computer graphics system is to allow the user to generate an image on the screen and the purpose of CAD is to create a model of the object. The model is represented both mathematically and visually. The visual representation is controlled by the geometric model in the computer.

A design process with computer has several stages, some of it are outlined below:

1. The designer creates the network specifying which electronics are in it and how they are connected.
2. The initial design is subjected to analysis and simulation programs that test its operation or characteristics.
3. If the design doesn't work well enough, the network will be edited. In edition process elements are rearrange, added, and deleted and parameters are changed. Then it is retested (i.e. return to step 2).
4. When the design finally meets the designer requirements it stores in a data base and to the next phase, the next phase involves manufacturing, quality control and final production.

CAD allows designer to retrieve previous designs, try changes and elaboration and to observe the result. It allows designer to create the model, display it, make changes in the design, view it from different perspectives and distance, examine specific features or

parts of the model and create engineering drawing of the object. The designer interacts with the model through its visual representation on the display screen.

Computer Aided Engineering (CAE) includes Computer Aided Design and also encompasses the modeling, simulation, analysis and optimisation of designs. CAE is any application of the computer to facilitate the work of the engineers, including computation, problem saving, modelling and simulation.

Engineering design is defined as “Purposeful activity directed towards the goal of fulfilling human need, particularly those which can be met by technology factors of our culture, and CAD is described as computer aid for the whole design process from specification of requirement to final description of designed technical system. (Hubka V. 1982).

3.2 GENERAL APPLICATION OF CAD

The application of CAD is unlimited. It is used in engineering, architectural design, and as well as in industries. Also, CAD can be used by Astronautical engineers to find centre of gravity for a new airplane. In civil engineering CAD is used in determining the volume of a lake or dam in seconds. The application in some fields are explained below:

3.2.1 CAD IN MECHANICAL ENGINEERING

CAD is used as a very important mechanical drafting and designing tool. Designing and testing of mechanical structure is an important CAD application. Wire frame drawings are useful in interactive design, because they can be drawn rapidly, the designer can shift and rotate the view of the object and see how it took from every angle

by use of CAD. Then, the model is tested for strength or strain using a tool such as finite element in analysis routine.

3.3.2 CAD IN ARCHITECTURAL DESIGN

In field of architecture, CAD is also becoming important, it is needed for interactive architectural design. With CAD, an architect can construct a model of building by indicating various floor plans and elevation.

Architects have found CAD to be one of the most useful tools that has been available to them. The architect can assemble construction drawing using stone details. Data base capabilities can be used to extract information from the drawing and perform cost estimates and bills of materials. With CAD, designs can be formulated in a shorter period of time than is possible by tradition techniques. The designer can use 3-D modelling to assist him and his client to visualise the finished design.

3.3.3 CAD IN AEROSPACE INDUSTRY

Drawing and data acts sets from which aircraft is built and produced by CAD. CAD has permitted the correction of design errors and inconsistencies before testing and fabricating process is began, saving both time and money. CAD is used for development of engine which is the most important part of aircraft for fuel efficiency.

3.3 ADVANTAGES OF CAD

There are many advantages of CAD which cannot be overemphasised. But, the following are few of its advantages:

1. Engineering design is an interactive process. in this design consists of set of circuits set on diagrams in a structural manner to enable each component

relationship to the whole to be clearly seen. Subsequent interaction tends to blur this vision unless the whole structural layout can be readily adjusted to absorb the amendment in a tidy manner, CAD has facility to this.

2. CAD speeds the execution of all architectural and engineering drawings. Resulting in reduced construction and life cycle costs, eliminating redundant design, simplifying and expediting design and drafting work.
3. Many diagrams include repetitions details at repetitious spacing, CAD automates both of these. If a repetitive diagram is encountered, the user only needs to draw once, and with a simple command copy it automatically to other locations on the drawing.
4. CAD can be used in checking in electrical electronics drawings. Incorrect labelled components and illogical connections are identified (such as two parallel signal paths between the same connecting points). Missing connections of electronics components in a circuits are found. Error between an engineer's systematic and production wiring can be identified and located automatically by CAD system.
5. CAD has resulted in increase productivity, lower drafting and improved quality and consistency, greater design freedom, improved reliability and reduced maintenance.
6. Early discovery and reduction of errors is possible by CAD. It results in greater drawing accuracy than manual method. Errors are reduced, since most CAD system have semiautomatic dimensioning capabilities which automatically determines lines and length.

3.4 CAD IN ELECTRONICS DESIGN

The complexity of electrical and electronics circuits is increasing at a greater rate everyday. The complexity of circuits has grown, hence increase growth of electronics technology. Electronics circuits connected into a complex control schemes (such as computers or computers controlled systems) and communication circuits (such as radio and television equipments).

Circuit complexity has grown to such level that some printed circuits boards are built in eight or more layers, sandwiched together, and have tiny components assembled to both sides. Integrated circuits are built in such a way that one electronic package houses a complete computer.

Techniques have been developed for depositing complete electronic components as thick as 1 micrometer or less on an insulated base to produce complete microminiature circuit. This acquires many tedious hours of drafting design time, the complexity of circuit is so great that electronics packages are impossible to design by traditional method, hence it has been replaced by CAD.

In electrical and electronics engineering CAD is applied in printed circuit (PC), board layout (with automatic wire routing and automatic components replacement), IC (Integrated Circuit) and very large scale integration (VLSI) including schematic entry logic and circuit simulations and fault simulation.

Design in electronics falls into two major phases. The sequented and connected phase. In the first phase, logic design or logic modules are used to develop a circuit structure that satisfies a given specification. The types of logic module used and the way they are connected together determines the operation of the circuit. This is the creative phase of design.

Physical design comes next, and is referred to as implementation or layout phase.

There are modern computer tools that have been developed to aid electronics design.

These tools are listed below:

- (1) Computer Aided Engineering (CAE)
- (2) Computer Aided Electronics Design (CAED) is

CAEE is referred to as computer aided electronics engineering as above, it involves the creative phase of design process, where circuits overall structure is developed. CAEE includes tool for initial schematic design and logic simulation. Simulation reduces the need for bread boarding. Bread boarding involves constructing physical prototype using actual components so that the circuits can be tested in numbers of ways. Simulation is an essential features of IC design, since IC cannot be bread boarded.

CAED has facilities for developing the physical layout. CAED for printed circuit board (PCB) design provides facilities to draw schematic diagrams, logic networks and geometrical layout of companies. This system has facilities for checking that designs rule are adhered to, and for producing network list (connection list between logic components).

CAED is essential in designs of small chips, it is also used in engineering service departments.

In conclusion CAED is an important tool for increasing design productivity.

CHAPTER FOUR

4.0 PROGRAMMING DESIGN AND METHODOLOGY

4.1 INTRODUCTION TO PROGRAMMING

In introducing what programming is all about, we need to start by what programming is? Programming is an instruction given to computer for a specific job to be done. Generally, there is no way to use computer without certain instructions been passed to computer.

There are different types of languages which are classified under two endings; special-purpose language and general-purpose language. Special- purpose language are language for certain purpose which programmer developed most of the times their own, while general-purpose language is a language that handled general issues and these are commonly used by the computer users. Example of general-purpose and special-purpose language are listed as follow:

(1) GENERAL-PURPOSE LANGUAGES

PASCAL, LOGO, FORTRAN, COBOL, BASIC, Ada etc.

(2) Special-purpose languages

AMBUSH, MPSX, GAMMA 3 etc.

Some of these languages will be discussed in chapter five under the ending SURVEY OF LANGUAGES.

Programmer's job is to convert problem solution to instructions for the computer. That, he will give an understandable instructions to computer. Hence, the programmer prepares a computer program and runs, tests and correct the program. Programmer also help the user to develop new program especially to the tastes of the users. when problem(s) needs solution, weed out errors. In the exiting programs, or perform changes

on programs as a result of new equipments (such as a change in the payroll program to make automatic union dues deduction).

It is possible to do the above described activities alone, but it is highly preferable to interact with variety of programmer. For example, if a program is part of a system of several programs, the programmer coordinates with other programmers to make sure that the programs fit together well. The programmer(s) also has a meeting point with users, managers, and peers who evaluate what work done by the programmer(s) as he evaluate theirs too.

4.2 DEVELOPMENT OF SOFTWARE

The development of software involves the programming process and life cycle development of software. The two shall be discussed as follows:

4.2.1 THE PROGRAMMING PROCESS: Developing a program requires seven steps:

- (i) Defining the problem
 - (ii) Planning the solution
 - (iii) Coding the program
 - (iv) Debugging the program
 - (v) Testing the program
 - (vi) Documenting the program
 - (vii) Maintaining the program
-
- (i) Defining the program: As a programmer, one needs to define the problem solution for a problem. This is by outlining input, processing output required before the

commencement of the program. So, in developing a software, a programmer must be able to know what this input, the process and output of the software should be before embarking on it.

- (ii) Planning solution: Solution planning to a problem are of two types (a) Flowchart drawing (b) Writing pseudocode

Flowchart drawing is a symbolic pictorial representation of an orderly step-by-step solution to a problem. It is a map of what your program is going to do and how it is going to do it.

Pseudocode is an English-like language that you can use to state your solution with more precision than you can in plain English but with less precision than is required when using a formal programming language. It is easier to maintain. Being wordings, it can be stored into computer file and changed easily, using editing or word processing. It is a good vehicle for stating and following program logic. This makes it an edge over flowcharts.

- (iii) Coding the program: The next step is to code a program by expressing solution in a programming language. That is, by translating the logic from flowchart or pseudocode to a programming language. As earlier mentioned, languages like BASIC, COBOL, FORTRAN etc. can be used. They are more precise than English language.

- (iv) Debugging: The debugging process is intertwined with coding process. It involves identifying problems in the code and eliminating them, so that the code performs according to the design specifications. Debugging which is also called program verification, is making the program perform according to the design. There are some tools that aid debugging, these are of two major functions

(1) To pin the error down to short section of program.

(2) To provide more detailed information about what the computer is doing than its provided by normal runs, making the sources of error obvious.

The most common simple debugging tools are:

- (1) A break point facility
- (2) A single point facility
- (3) A trace facility
- (4) A register dump program
- (5) A memory dump program

Break point is a place at which the program will automatically halt. So the user can examine the current status of the system at the halting station. A program will not continue until the user orders its resumption. An entire section of program is checked by break points. To see if an initialisation routine is correct, a break is placed at the end of it and the program is run.

The simplest way to insert a break point in a program is to replace the first word of the instruction with the trap instruction. When the trap instruction is executed, program control is transferred to a break point routine specified by a trap vector, the processor is forced into supervisor mode, and the program counter and status are saved.

Single step facility executed a program with an instruction and one memory cycle at a time. Usually, single step is associated with some external circuiting which monitors the output times of the processor.

Trace facility allows the seeing of intermediate result since the status of processor's register after each instruction executed is determined.

Register dump is a facility that lists the content of all or some selected subset of the processor's registers. A register routine is very often part of a break point handling routine and debug program that controls the trace facility. Memory dump is a program that lists the contents of memory on an output device (such as printer). This is more efficient method of examining data arrays or entire program than just looking at a single location.

- (v) Testing the program: Imperfections of the world brings the idea of test programs by the programmers despite that their experts who believe a well designed program can be done once using a mathematical ways to prove correctness of a program(s).

So, after coding and keying program one needs to find the mistakes in it. To eliminate errors in program an unavoidable rigorous testing needs to be done. The following phases need to be employed for this task.

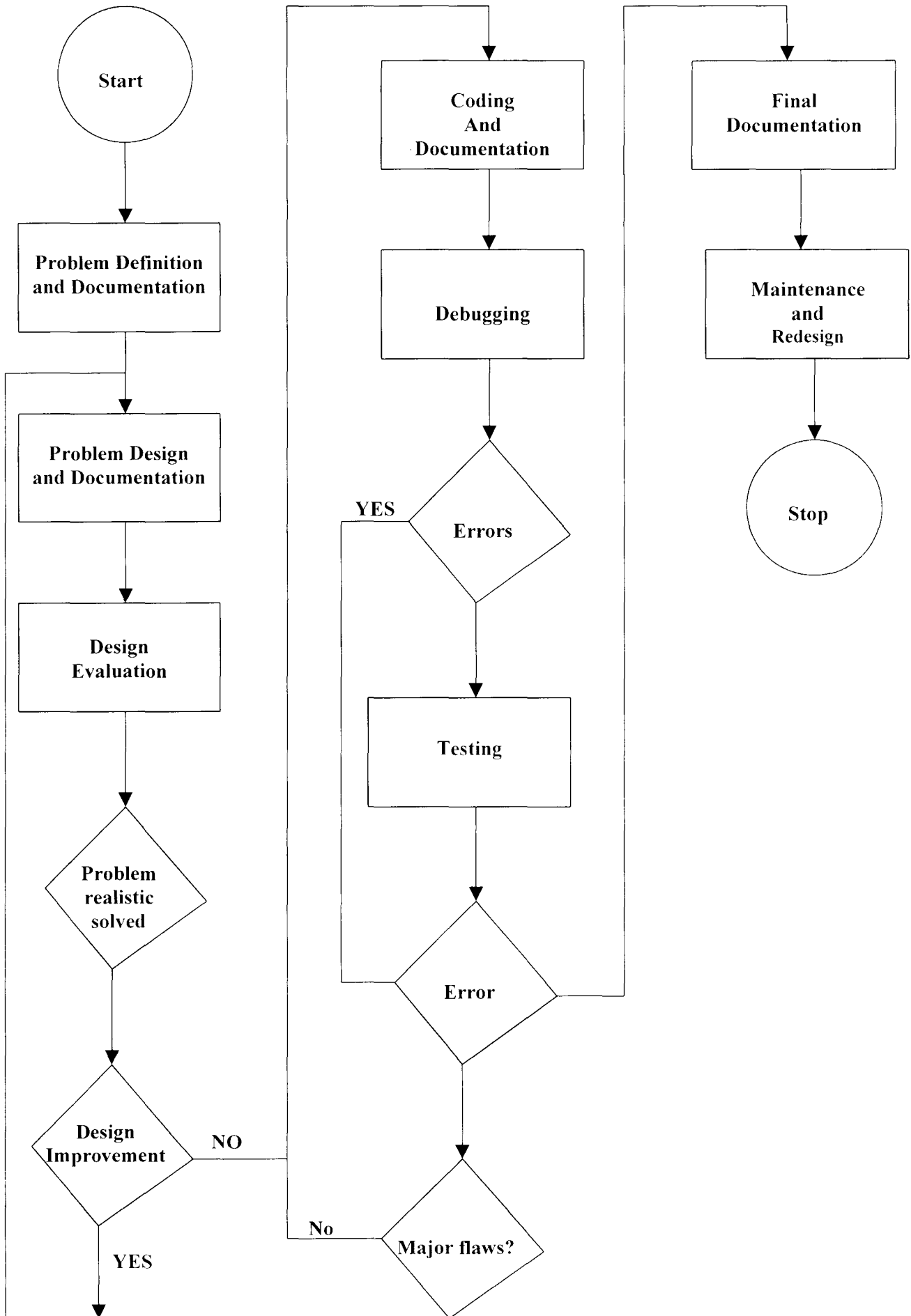
- (a) **Desk checking:** This phase is similar to proofreading. Desk checking is simply the checking of the logic of the program to ensure that it is error-free and workable. Careful desk-checking discovers several errors.
- (b) **Translating:** A translator is a program that translates program(s) into language the computer can understand. The improper used of programming language is discovered by a translator. These types of mistakes are called "SYNTAX ERRORS". There are different translators, but programs are mostly translated by a compiler or an interpreter. A compiler translates your entire program at one time giving all the syntax error messages called diagnostic at once. An interpreter, often used for BASIC language, translates your program one line at a time.

With the above two mentioned testing methods, debugging described earlier can also be used in deleting error(s) and workability of a program.

- (vi) Documenting the program: Documentation is a written detailed description of the programming cycle and specific facts about the program. Typical discrimination materials include the origin and nature of the problem, a brief narrative description of the program, logic tools such as flowcharts and pseudocode, data-record descriptions, program listings, and testing results. Comments in the program itself are also considered as an essential part of documentation. Many programmers document as the code.

The wise programmer continues to document the program throughout its design, development, and testing. Documentation is needed to supplement human memory and to help organise program planning. Documentation is also essential for any other programmer to modify or detect any error(s) missed by previous programmer of the program.

- (vii) Maintaining the program:- Maintenance and redesigning of program involves the subsequent improvement of the program. This is done in order to meet new requirements and to correct newly discovered discrepancies in the design.



4.2.2 LIFECYCLE DEVELOPMENT OF SOFTWARE

Developing a software (SW) is a very tedious job and involves a lot of stages. The SW lifecycle is taken into consideration for a standard software. This section summarises the software development. The lifecycle development of software diagram is shown in the figures below:

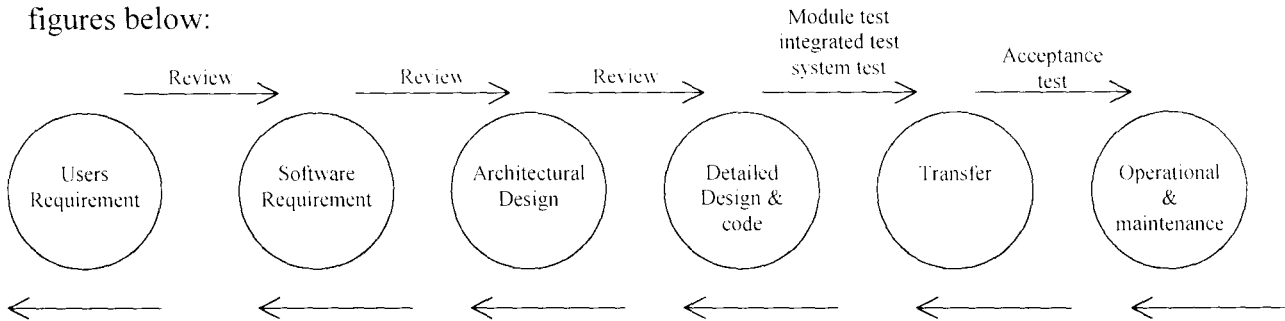
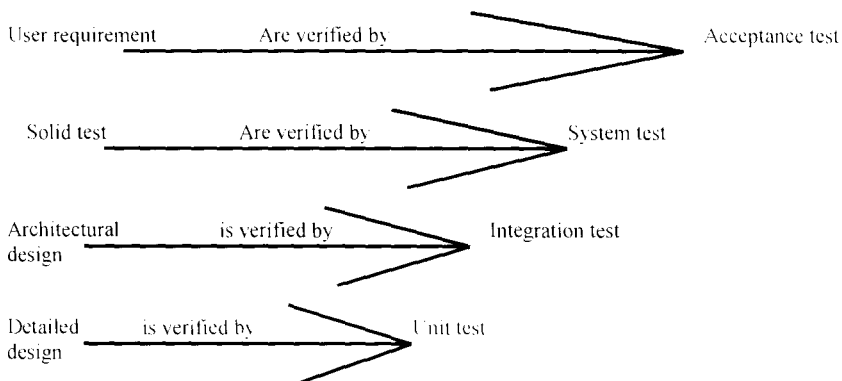


Fig. 1 lifecycle development of software



Dividing a lifecycle into phases is a key element in every practical software standard. The output for every phase is then defined which could be a set of requirement, a code with predefined qualities (fig. 1 above) shows a lifecycle development of software.

The first phase of the lifecycle finds what the user wants, which is the immediate problem. The users are the ones who need to be satisfied for the development to be a success. The user requirement phase ends with a review at which the requirement is chosen for implementation, then the project boundaries are defined.

The next phase is the software requirement phase which defines what the system must do. It defines an abstract solution to meet the result the user require, so it must be clear, which function do what and why?

Then, comes the architectural design phase which defines what will be built, at least at the top level. A high level design allows one to check that the system will work, different elements interface to one another, nothing has been forgotten, and that the elements are balance. The detailed design phase expands the architectural design into units and then finally the programmer can get going. Integration is a bottom up process, testing the modules usually in three levels to produce a working system. The programmer is responsible for module testing, then the verification sequence is carried out. During coding process work is subjected to peer group inspections to detect faults before code is written. The programming modules and interface development should be readable, consistent well documented.

Manual and help screen are then completed. During verification sequence, each descending level of design is verified as the software begins to take shape as shown in figure 2 above.

The final phase is transfer operation and maintenance phase. The transfer phase takes the working system into the operational environment under the control of the developer. The software is installed and tested on the operational equipment. Then, the user are trained to use it. Between provisional and final acceptance, all bugs are collected and corrected.

In net view, in any software development, the users needs are translated into software requirement, software requirement are transformed into design, the design is implemented in code, and the code is tested, documented and certified for use.

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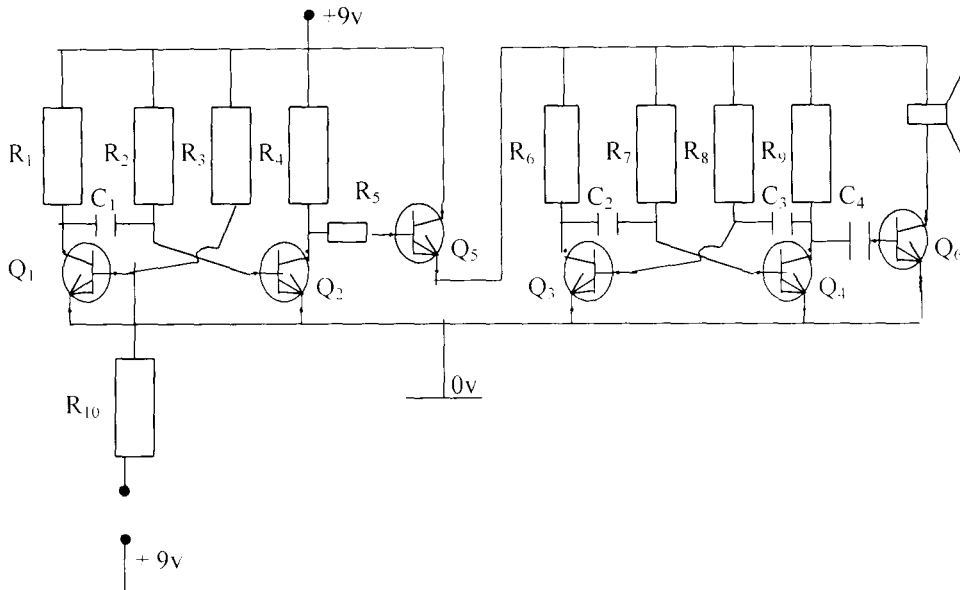
4.3 DESIGNING OF A SMALL BURGLARY ALARM

Security systems in recent years are benefited considerably from advance made in other ELECTRONICS fields. The range of equipment available today includes ULTRASONICS, MICROWAVE, INFRA-RED and TELEVISION, in addition to the more traditional window tube and batten, pressure mat, switches and simple bell systems.

The security systems are designed for the monitoring of signal by means of a control panel. Any bridging of the equipment, cause the interruption of the signal, hence an alarm is cut off.

There are perimeter and space protection systems, perimeter protection systems is concerned with sensing intruders at vulnerable points in a protected area. Such as fences, walls, windows, and doors, while space protection employs sensing device in a restricted area like a warehouse.

Meanwhile, under this project a perimeter protection system of a burglary alarm system in a door will be discussed. The simple circuit of the alarm system is drawn below



$Q_1 - Q_4 = C945$

$Q_5 = D882$

$Q_6 = BF451$

$R_1, R_4, R_5, R_6, R_9 = 116\Omega$

$C_3 = 100\mu F, C_1 = C_3 = 100Nf, C_4 = 1\mu f$

$R_2 = 500K\Omega, R_3 = 1M\Omega, R_7 = R_8 = 80K\Omega$

The working principle of the circuit is that when triggered signal sets the output Q_2 ON and the capacitor G starts charging. When the capacitor reaches +9v, the output tuned off the capacitor G return to its initial condition. Meanwhile, the Q_5 input signal in the astable stage. (second stage), and the set Q_3 ON. Astable needs no triggering it's a continue process once it starts. This stage is being controlled by the monostable multivibrator base on the time regulation. When Q_3 is powered, and it is highly powered, as the time capacitor C_2 is charged through R_7 until the voltage is about 6v or more, this

causes Q₄ to send into the Q₆ which amplifies the output and a sound is heard through the speaker at a determined time (the formula for timing = 0.69RC).

The time and frequency for the two stages are shown below:

$$\begin{aligned}
 T &= 0.69R_2C_1 \\
 &= 0.69 \times 500 \times 10^3 \times 100 \times 10^{-6} \\
 &= 34.5 \text{ sec.} \\
 F &= 1/T \\
 &= 1/34.5
 \end{aligned}$$

Astable stage:

$$\begin{aligned}
 T_1 &= T_2 \\
 &= T_1 = 0.69 R_7 C_2 \\
 &= 0.69 \times 80 \times 10^3 \times 100 \times 10^{-9} \\
 T_1 &= 0.00552 \\
 T_t(\text{total time}) &= T_1 + T_2 = 0.00552 + 0.00552 \\
 &= 0.01104 \\
 F &= \frac{1}{T_1 + T_2} = \frac{1}{T_t} = 1/0.01104 \\
 &= 90.5797\text{Hz}
 \end{aligned}$$

TESTING

The circuit is tested through Computer Aided Design (CAD) for electronic circuit and its confirmed working. When one of the components was removed through the CAD, it stops operation.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 IMPORTANCE OF PROGRAMMING LANGUAGES IN COMPUTER

The programming language is a wide area in computer area. The wideness of the area makes it more importance than the computer itself, that is why without it hardly could computer work. So, enumerating all its importance in this project will be too much, hence few of its importance will be enumerated.

- (1) Programming language makes the computer itself as well as its users, because, the computer is a tool. So, learning to write simple programs as one master the machine increases one's confidence level.
- (2) Learning programming lets one find out quickly whether like programming and whether one have analytical turn of mind programmers need.
- (3) Programming improves the literacy of a computer user and gives the appreciation of what a programmer does.
- (4) Programming language is also important in mathematical arena for fast and easy calculation. Languages like GAMMAZ, MPS& etc. are used in this arena.
- (5) The development of Fortran language brings the idea of designing of scientific and engineering problems easily. Through some languages like Fortran, Pascal, Algol the scientific and engineering design are made easier and saves time.
- (6) The invention of programming in computer area gives opportunity for a programmer to be able to distinguish between good and bad programming through the use of VAX-BASIC.
- (7) The programming languages support industry and governments users.

- (8) The writing of programs for a variety of business applications is one of the advantages of programming languages.
- (9) The programming languages close the communication gap between computers and their users.
- (10) Computerisation of the FUTMINNA campus can be made easier through the development of software, which can be possible with the assistance of writing a good program.

5.2 SURVEY OF LANGUAGES

5.2.1 INTRODUCTION

Many people of different fields have different meaning for computer, but the most acceptable of them are the mathematician definition and some individuals.

A mathematician says that computer is a number crushing machine with an electronic engineer, it is a collection of integrated circuits, resistors, capacitors, transistors, accompanied with some electro-mechanical components.

Some say computer is a replica of the human brain even though computer has limitation compare to human brain, but, some called computer a mere simulator device.

The invention of computer was as far back as 1946 with the first generation called ENIAC (Electronic Numerical Integrator And Calculator) built at University of Pennsylvania and largely financed by the U.S.A. army, it was mainly for computation of ballistics, weather forecasting and census. The logic circuitry of these machines was based on vacuum tube (or electronic valve) technology, because the vacuum tube used is extremely large compare to the present day computers. The second generation computer is a transistorised logic circuitry. The transistor is more reliable, consumed only a tiny

portion of energy needed by a valve, smaller in size and cost less. It spanned between the period of 1959 and 1964.

The invention of integrated circuits (IC) brings the evolution of third generation computer in the earlier 1960s. This is smaller in size compare to the transistorised one. The fifth generation computers is the dream computers of the near future. This generation is expected to produce what is called the knowledge based machines, artificial intelligence, speech processing, expert system characterise this generation thinking machines.

The computer system can be grouped under two main headings: (1) The Hardware, (2) The Software

The hardware comprises of the physical features like monitors or video display unit (VDU), printer, tape unit, diskette and hard disk, they are all output of the computer. The input of computer are keyboard, tape unit, diskette, light pen, mouse, code reader and scanner. The hardware has also Central Processing Unit (CPU) which comprises the processor, control unit (CU) and the memory unit.

The software is the main functioning part of computer, without it computer is useless. The software refers to all forms of program that control the activities of the computer. The software can be classified into system software and application software.

System software are managers of hardware resources. They are manufactured to perform functions that enable users to execute the computing tasks with ease. They are also memory's manager and controller of information. Examples of system software are operating systems, interpreters, compilers, assemblers etc.

The application software are of two application packages and application programs. The former is a designer program for data processing tasks which can be applied in many different organisations. Examples are database management packages.

spreadsheet packages, word processing packages, statistical packages etc. But application programs are program written by user or programmers to perform specific tasks for local application.

5.2.2 PROGRAMMING LANGUAGES

As earlier mentioned computer system without programming languages is useless. The programming languages are many but classified under three categories (1) The machine language (2) Middle level language (3) High level language.

The machine language adopts binary (hexadecimal) codes to represent both instructions and address. It is a language mainly for first generation of computer. Hence, only a specialised few can interact with it.

The middle level languages adopt memoric names for both operands, operators, addresses and instructions. They are largely machine dependent.

The high level were created to permit the use of English like expressions as to encourage more people to use the computers, and to facilitate portability.

Machine languages are too cumbersome, detailed and complex to develop despite of its efficiency in execution and importance.

Low-level languages are less cumbersome but required an assembler transistor.

Meanwhile, high level languages like Fortran are the most easiest to write because of their English-like phrases. They are portable but require appropriate compilers to translate them to machine code.

The following high level languages will be discussed in this project:

FORTRAN PROGRAMMING

BASIC PROGRAMMING

Apart from the aforementioned programming here are the list of some other programming languages: ADA, a technical language developed for the U.S.A. defence application department.

ALGOL60, a scientific language developed in Europe with full meaning Algorithm language.

APL, a programming language for teaching mathematics.

C, this is a well structured language designed for systems programming.

COBOL, mostly used for commercial and business applications. The full meaning is common business oriented language.

PL//, program language I, an excellent language for scientific applications.

WATFOR, WATERLOO FORTRAN language. An interpretive Fortran version developed at Waterloo University, Canada. These are few out of many other languages.

5.2.2.1 FORTRAN PROGRAMMING: Fortran is acronym for FORMULAR TRANSLATION. The development of it was by John Backus at the international Business machine (IBM) corporation in the United States between 1953 and 1957. It is a scientific in nature, which run exclusively on IBM 704 in 1957.

The program was extended to Fortran II in 1958 and to a more machine independent version called Fortran IV in 1962. In 1966, Fortran 66 was introduced by a committee set up by American National Standard Institute (ANSI) which was widely adopted. A revised standard was developed in the year 1978 called Fortran 77.

Being the earlier worldwide adopted language. Fortran still maintains its dominance role both in academic and industrial sectors. There are however other problem

oriented languages which apart from having better structure than Fortran are superior for manipulating text and graphics.

The latest version of Fortran is Fortran 90 which can compete with the well structured languages like PASCAL and C. Its also advancing beyond them in operations.

As earlier mentioned, Fortran was originally designed to be used for scientific and engineering data processing which requires complex mathematical computations and it has remained the most widely used computer programming language for this purpose. It has also been designed as an algebra-based programming language. Any formula or those mathematical relationships that can be expressed algebraically can easily be expressed as a Fortran instruction.

A Fortran program consists of sequence of Fortran instructions called Fortran statements. These statements are entered using the following rules:

- (1) Columns 1 through 5 contains the statements number and they are unsigned positive integers with maximum of five digits. Though the numbers are optional.
- (2) Column 6 is a continuation column. If a Fortran statement is too long for a particular line, then it can be continued on the next line. This is possible only if a "1" (or any symbol other than zero) is typed on column 6 of the new line. It will indicate to computer that the statement is a continuation of the last statement.
- (3) Column 7 through 72 is where the actual Fortran statements are contained. This is where the body of the Fortran program is stated.
- (4) Column 73 through 80 are ignored by the computer which implies that part of a Fortran statement entered into these columns are not executed. The columns are used for identification, sequencing, or any other purpose.
- (5) Comments are added to a program by typing letter "C" in column 1 of the line that contains comment. The letter C in the first column indicates to computer not to

execute the content of the line. The comment itself can be typed anywhere between column 2 and column 80. Comments have no actual bearing on the program. They are usually used to identify a program and for explanation.

There are different types of statement:

- (a) Type statement, is a statement that overrides the implicit rule, Fortran provides us with several explicit TYPE declaration statements. This statement is of Real and Integer.
- (b) Arithmetic statement, is also Real and Integer Arithmetic statement. Arithmetic statement has five basic arithmetic operators in Fortran and they are of priority in their operations.

OPERATORS		PRIORITY NUMBER
**	Exponentiation	1
*	Multiplication	2
/	Division	2
+	Addition	3
-	Subtraction	3

From the above, it can be observed the priority rules employed.

All the operators associated with level 1 are performed in order from left to right, all operators if any associated with level 2 are performed in order from left to right, while these operators associated with level 3 are also performed from left to right order.

For instance, to evaluate below:

$$4 + 3 \cdot 6 / 2 - 4 * 2 / 8 + 4 * 3 ** 2 = 47.$$

But, in case of parenthesis, computer evaluate the parenthesis first like the one below.

$$(4+3)*6/2 - 4**2/8+4*3**2 = 55$$

Apart from the above mentioned operators, there are also relational operators and they are as follows:

- (i) EQ - Equal to
- GT - Greater than
- LT - Less than
- GE - Greater or Equal to
- LE - Less or Equal to
- NE - Not equal to

(c) Assignment statement. another type of statement is assignment which is used in assigning variable values be it constant or an arithmetic expression. The assignment symbol is “=” and the format of an assignment is:

$$A = 5.0 \text{ (means 5.0 should be stored in location A)}$$

(d) Input and output statement: Input is a statement to make the program to obtain data values and which has READ as its mechanism in Fortran. But, output is a result statement which mediums like screen, disc, printer etc. and its own mechanism is write.

The input and output statement are of the form unformatted or formatted types.

Unformatted input is of the form:

$$\text{Read } (*,*) \text{ A,B,C, (where A,B,C, are variable names).}$$

Unformatted output is of Format

$$\text{Write } (*,*) \text{ A,B,C, (where A,B,C, are variable names.}$$

whose contents have to be printed)

formatted input statement Format is:

```
READ (N1,N2)
```

This gives the programmer to control the layout of input data and the necessary actions that may be taken during the process of reading input data.

The formatted output statement allows the programmer to have control over the layout of the output results to be printed. Its format is:

```
WRITE (N1,N2)
```

Before Fortran can carry out a formatted input and output action, it needs to know the variable type and width of each of the variables involved. Field specifications (Ar field descriptions) are various ways of describing a variable. They are meant to state the variable type, its width and the general layout of a READ and WRITE statements. The field descriptions are of many such as I-Field; F-Field; E-Filed etc.

- (i) I – Field: This informs the computer that are the data values is to be read or written represent an integer constant. The general format is IW.
- (ii) Where I indicates that the data is an integer
- (iii) W is an unsigned number and it represents the size of the data value (i.e. number of digits).
- (iv) Considering READ and FORMAT statements below:

```
READ (5,10) I,J,K,L.
```

```
10 FORMAT (I3, I3,I3,I4)
```

The above READ statements means computer should read in values from corresponding input device (5) into the variables (I,J, K,L using the FORMAT statement number 10.

The repeated factor can be employed in the FORMAT statement to reduce the coding exercise as follows:

10 FORMAT (3I3.I4).

(ii) F-Field: This is used for real constant in decimal form and which can be read in or printed out. The format is:

F.W.d

Where F indicates that the data type is REAL and the number is written in decimal form.

W represents the total number of characters of the real constants to be read or written. It includes the number of digits before and after the decimal point plus the point itself.

D represents the number of digits after the decimal point.

(iii) E-Field: This is similar to F-Field except that it is in exponential form. The Format is

E.w.d

Where E indicates that the data type is real, and the constant is written in exponential form.

W is an unsigned integer denoting the number of characters in the variable (i.e. field width).

D is an unsigned integer (i.e. number of digit after the decimal point)

(iv) A-Field: This is a descriptor prescribing number of characters to be read or written. A character may be an alphabetic character, numeric digit, arithmetic operator, or any special character in the Fortran character set. The general Format is: AW

Where A implies read or write alphanumeric

W represents the character length of the data

Like earlier mentioned there are other field specifications but only few are mentioned here.

The next to discuss under Fortran language is

- (i) Data statement
- (ii) Transfer control

- (iii) Array and dimensions statement
- (iv) Built-in mathematical functions
- (v) Suprograms (function and subordinates)
- (vi) Program loop (iteration)
- (vii) Data statement: The statement is used to set values to variables names. It works like an assignment statement. Using DATA statement requires the word data followed by variable name, and then by its value enclosed in slash. That is, data variable/constant/

Data can be used to initialised the variables to be used in a program.

(ii) Transfer control: The control statement available in Fortran are discussed as follows:

GOTO STATEMENT: This is an unconditional branching which transfers control to specific statement with the program.

The unconditional transfer of control can be accomplished by writing the statement – GO TO N where N is a statement number. This is expressed in the following program.

```

I = 1
20 write (*,*)I
I = 1+2
Goto 20
Stop
End

```

From the above program the fourth line back to number 20 is unconditional statement which will result to an endless loop, so its advisable to use GO TO with a conditional transfer control. **IF STATEMENT:** This is a conditional transfer control. It requires testing of a condition through a relational expression in order to make decision. The general format is:

If (logexp) statement A

The above IF statement implies that If (Logexp) is TRUE, then statement A is executed. But, the below Format indicate that IF logexp is TRUE, statement A is executed, and then statement B. If on the other hand, the logexp is FALSE, statement A is skipped and statement B is executed.

(iv) **ARRAY AND DIMENSION STATEMENTS:** An array is sequence of consecutive memory location in which data are stored. Any element in an array and a position number (subscript) indicating the position of the desired element.

The allocation of memory locations to arrays is always necessary in Fortran, before an array can be used. This is done by the use of DIMENSION statement.

Dimension statement tells the computer to reserve locations for the array elements.

Its general format is

Dimension variable name (N)

Several arrays may be declared by a single dimension statement. For instance:

Dimension I (50), (100)

This declares I to be a linear integer array with 50 elements and A to be a linear real array with 100 elements. Note that DIMENSION statement is none-executable and must be placed before executable statement in the program.

(v) **BUILT-IN MATHEMATICAL FUNCTIONS:** These consist of functions that are recognised by a computer. They vary from one programming language to the other. In Fortran, there are mathematical functions which can be used by programmers.

They include the following:

FUNCTION	EXPLANATION
ABS (X)	RETURNS THE ABSOLUTE VALUE OF X
SQRT (X)	RETURNS THE SQUARE ROOT OF X
FXP (X)	RETURNS THE EXPONENTIAL OF X
SIN (X)	RETURNS THE SINE OF X
COS (X)	RETURNS THE COSINE OF X
TAN (X)	RETURNS THE TANGENT OF X
ALOG 10 (X)	RETURNS THE ABSOLUTE VALUE OF X
ALOG (X)	RETURNS THE NATURAL LOGARITHM OF X I.E. $\text{LOG}_e(X)$
FLOAT (I)	CONVERTS INTEGER I TO REAL
IFIX (X)	TRUNCATES REAL X TO INTEGER
INT(X)	RETURNS THE INTEGER PART OF X

However, any of the functions above can be called by typing the name of the functions followed by the argument(s) enclosed in parenthesis. Once, the function name is called, the computer will be prepared to perform the designed task it is expected perform.

For instance, the mathematical expression:

$$A^2 = B^2 + C^2$$

Can be written in Fortran expression as

$$A = \text{SQRT}(B^{**2} + C^{**2}) \text{ or } A = \text{SQRT}(B*B + C**C)$$

(V) **Subprograms:-** Is a complete and independent program which can be used (invoked or called by the main program or other subprograms. A subprograms receives values (called arguments) from a calling (originating) program, performs calculations and then sends back (RETURNS) THE RESULTS TO THE CALLING PROGRAM.

(a) **Function**: Subprogram is of two basic categories:

(c) **Subroutine program**: this is used for computing several values

(VI) PROGRAM LOOP: A loop is a set of instructions while a certain condition prevails.

In Fortran, the way of executing a loop is achieved by the use of DO/CONTINUE statement ends it

The general format is

```
DO KJ = N1, N2, N3.
```

```
.....
```

```
.....
```

```
K CONTINUE
```

The other type of looping in Fortran is NESTED LOOP

This is a loop within another loop.

The general format is :

```
DO 20 K = 1, 5
```

```
DO 40 I = 1, 10
```

```
-----
```

```
.....
```

```
40 continue
```

```
20 continue
```

Having gone through the FORTRAN, the following examples of problems will be looked into:

2. Give that the side of a triangle are represented by A,B,C, write a Fortran program that will accept value for these sides in order to compute the perimeter and area of the triangle. Using the Hero formular.

Note that perimeter = A+B+C

$$\text{Area} = \sqrt{S(S-A)(S-B)(S-C)}$$

where $S = (A+B+C)/2$

PRG1

C SOLUTION TO PROBLEM 2

WRITE(*,*) ' ENTER VALUE FOR A,B,C'

READ(*,*) A,B,C

P = A+B+C

S = P/2.0

AREA = (S*(S-A)*(S-B)(S-C)**0.5

10 FORMAT (3F4.1)

WRITE (*,20) ABC

20 FORMAT (THE SIDES OF THE TRIANGLE AREA: IF 4.1",,

30 FORMAT (15HTHE PERIMETER 1 =.F5.1)

WRITE (*,40) AREA

40 FORMA (THE AREA 1 = F6.2)

STOP

END

(2) Write a Fortran program that calculates the simple interest and Amount of the various values for principal, Rate and time given below. Note subroutine for the necessary compulsion and the output should look like the table below:

Principal	Time	Rate	Interest	Amount
100	2	10	?	?
500	4	15	?	?
900	6	20	?	?

PRG 2

C SOLUTION TO PROBLEM 15

DIMENSION (3), T(3), R(3)

DATA P/100.0, 500.0, 900.0/

DATA T/2.0, 4.0, 6.0/

DATA R/10.0, 15.0 20.0/

WRITE (*,10)

10 FORMAT ("PRINCIPAL; 2 X TIME 4 X, 3X, AMOUNT)

DO 20K = 1,3

CALL SI (P(K), T(K) R(K)

WRITE (*, 300) P(K) T(K), R(K) RINT, AMT.

20 CONTINUE

30 FORMAT IX, F6.2, 4X, 3.1, 5X, F4.1, 5X, F6.2, 7X, F8.2)

STOP

END

SUBROUTINE 81 (PR, II, RA, RINT)

RINT = PR * II * RA / 100.0

AMT = PR + PRINT

RETURN

END

5.2.22 BASIC PROGRAMMING

Basic is high level languages developed at Dartmouth College, U.S.A., in 1964, by professors John Kennedy and Thomas Kurt. The word BASIC is an acronym for Beginners All Purpose Symbolic Instruction Code. It is an easy to learn language designed for people who are first timers in computer programming, to solve problems on varieties of applications on many different types of digital computer.

The language is a friendly, which is readily available on most microcomputers. The evolution of BASIC language in dialects was due to different statement compatible of the language in computers.

The BASIC translators available include the following

- (a) GWBASIC
- (b) BASIC
- (c) BASICA
- (d) TURBOBASIC
- (e) QBASIC

Like other languages the instructions to computers are of two; commands and statements.

5.2.2.2.1 COMMANDS: These do not constitute part of the program. But, they process programs by performing various tasks related to the program.

The following are some commands that aid the processing of BASIC programs.

- (1) Accessing basic: Once computer(s) is booted, accessing basic is very easy by typing any of the following at the DOS prompt, depending on the type of basic language need. GWBASIC or BASIC or BASICA OR QBASIC.
- (2) LIST: This command displays the program statements that are stored in main memory.

- (3) RUN: Run is a command use to execution a program.
- (4) Delete: This is a command use in erasing a section(s) from main memory.
- (5) New: The NEW command erases the program from main memory in preparation for a new program. The next to be discussed is the statement.

5.2.2.2.2 STATEMENT: A basic program is made up of a group of statements, with each statement written in conformity with the language syntax – the pattern or structure of the word order. The order in which the statements are written is of vital importance, since the computer executes a program by embodying the ingredients of sequence of statements, and iteration, which implies that it is directed by a loop to repeat a sequence of instructions.

A typical BASIC program conforms to the following rules:

- (1) One instruction or statement per line
- (2) 10 each statement begins with a statement number
- (3) 20 statement numbers should increase in say, steps of 10 to allow for the insertion of extra lines at a later stage of program development. Generally format is:
nn keyword arguments.

BASIC statements are either executable or non executable. An executable statement tells the computer to do something when a program is run. The non-executable is a statement that does not require computer to do something.

Different types of statement basic has as follows: REM: Is a simple way of including a comment in program. It takes the form.

5.2.2.2.3 REM: Is a simple way of including a comment in a program. It takes the form.
nn REMargument

5.2.2.2.4 PRINT: This directs the computer to display something on the screen of a monitor or visual display unit (V.D.U.). It has a format this: nn printlist.

5.2.2.2.5 END: The END statement tells the computer that there are no more statements to execute. It is usually at the end of a program. It has no arguments.

5.2.2.2.6 LET: It takes the format:

nn LET variable = expression

5.2.2.2.7 LET statement indicates the known value of an assignment when a program is written. Using LET statements implies rewriting the program each time.

5.2.2.2.8 INPUT: This is a statement whose execution results in a value being put into a variable. Unlike LET statements, there is no place for expression in an INPUT statement.

This following example shows how to use the INPUT statement:

- (1) INPUT A
- (2) INPUT A,B,Q&
- (3) INPUT " what is your name" NAMS

5.2.2.2.9 DATE/READ: Read statement is an assignment that assign many variable in one statement.

A DATA statement may include string or numeric constants separated by comma in any order.

e.g. DATA " TREE" 62,-28.5, "MT758"

READ statement contains variables (numeric or string) for storing values to be read from DATA statement (s)

e.g. READ A&, PAY, CHANG, COURSES.

SOME DEFINATIONS

1. **CONSTANTS:** A CONSTANT is a specific quality or whose value does change during the execution of a program
2. **STRING CONSTANT:** Any character capable of production by computer can be part of a string. e.g. "MYCARZ". -31.5
3. **Numeric constants:** NUMERIC constants are made up of numeric value, might be either integers or real numbers.
4. **NUMERIC EXPRESSION:** A numeric expression is made up of numeric constants or variables or combinations of both connected by arithmetic operator that tells the computer how to combine the values.

THE ARITHMETIC OPERATORS OF BASIC

ORDER	OPERATION	OPERATORS
1	Exponential	^
2	multiplication	*
	or	
	Division	/
3	Addition	+
	or	
	Subtraction	-

5 ASSIGNMENT: Assignment is a process of putting a constant into a variable. This implies that that we take a value, numeric or string, and store it in main memory in a storage location under a particular variable main. The basic statement that performs assignment include: LETS INPUT AND READ/DATA STATEMENT.

Let us examine an example at this junction.

Write a program to calculate and output the length of arc of any sector, of a circle upon the input of its angle and radius.

PROGRAM

```
REM program to calculate length of arc
REM of a sector
INPUT "supply the sector's angles and radius", angle, radius
Data "360,2,3.142"
READ DEG 360. TWO. PI
LET Length = (Angle/DEG 360)* TWO*PI*Radius
PRINT "Length of arc is"; length.
```

All discussed so far are simple programs designed methodology.

There are some complicated programs which involve sequence, selection and repetition.

SELECTION: There are single. double and multiple selection. And each one has its pseudocode format.

SINGLE SELECTION: The single selection pseudocode format:

If condition THEN

Statement(s)

ENDIF

DOUBLE SELECTION: This is concern with execution of an alternative set of statement based on the result of a condition being false. It is pseudocode is:

IF condition THEN

Statement 1

ELSE

Statement 2

ENDIF

MULTIPLE SELECTION:

This is applicable where there are many alternatives each to be executed based on the outcome of a certain condition. If format is:

IF condition – 1 THEN

Statement 1

ELSEIF Condition –2 THEN

Statement 2

ELSEIF condition – n THEN

Statement – n

ELSE statement - x

ENDIF

In the above pseudocode, if condition – 1 is true, all the statements represented by statement – 1 are executed. Control is then transferred to the statement following ENDIF.

The same thing applies to any other condition in the program. However, if none of the condition is true, program execution is transferred to the statement following ELSE. After that execution continues with the statement following ENDIF.

ADVANTAGES OF BASIC PROGRAMMING

1. Being easy to learn language. It is friendly advantageous
2. It is flexible, allowing the programmer to developing new programmes and to alter existing programs with relatively little efforts.
3. It is well suited for use in an interactive environment. This includes dedicated micro computer application as well as large – computer time sharing applications.
4. It is universally available on both large and small computer.

5. The commonly used features of BASIC are relative standard, despite of differences in basic versions.

5.3 RECOMMENDATION

Based on the importance of electronics and computer to the society, be it higher institutions, industries and environment in larger perspective, the followings are the recommendations made:

1. There should be a section of computer department that will be developing software for the usage of the schools
2. The ableness of CAD to design electronic circuit within a specific time schedule, it is highly recommended that design of electronics/electrical circle as well as all other areas of sciences through CAD/CAL should be introduced in all institutions of higher learning.
3. Development of designing software like CAPP (Computer Aided Process Planning) should be introduced in our manufacturing industries especially government establishments for easy process of products, since what they needed will be given within shortest time before practically done.

REFERENCES

1. Herbert W. Richer. Electrical and Electronics Drafting pg. 47- 56. 1997.
2. Jack Fisher, Bruce Gatland. Electronics Theory into Practice pg. 93-111, 1976.
3. George M. Chute, Robert D. Chute Electronics In industry pg. 3-8
4. Gordon McComb. Gorden McComb's Tips and Techniques for the electronics.
5. Eric Teicholic Editor in Chief CAD/CAM Handbook pg. 10.9 – 10.11.
6. G.W.A. Dummer, M.B.E. C.Eng., F.I.E.E.E., F.I.E.R.E. Electronics Inventions and Discoveries, pg. 1-2, 1983
7. O.C. Akinyomi, Principles and practice of Computing 1999.
8. Simeon Ola Fatunla, Fundamentals of Fortran Programming, 1993.
9. Computers In Industry, An International Application oriented research journal vol. 29, number 3, 1st Aug. 1996.

THIS IS THE DISPLAYED RESULT

PROGRAMME FOR TIMING OF BURGLARY ALARM CIRCUIT

R	C	T	F
500000	.0001	34.5	2.898551E-02

PRESS ANY KEY TO CONTINUE

PROGRAMME FOR TIMING OF BURGLARY ALARM CIRCUIT

R	C	T	F	T1
80000	.0000001	.01104	90.57971	.00552

SINCE T1=T2 R8=R7 C3=C2

Press any key to continue

```
'PROGRAMME FOR TIMING OF BURGLARY ALARM CIRCUIT (1)
CLS: PRINT "PROGRAMME FOR TIMING OF BURGLARY ALARM CIRCUIT"
R = 500000!
C = .0001
T = .69 * R * C
F = 1 / T
COLOR 5
PRINT
PRINT "R", "C", "T", "F"
PRINT R, C, T, F
LOCATE 12, 10: PRINT "PRESS ANY KEY TO CONTINUE "
SLEEP
```

```
!*****
'PROGRAMME FOR TIMING OF BURGLARY ALARM CIRCUIT (2)
CLS : PRINT "PROGRAMME FOR TIMING OF BURGLARY ALARM CIRCUIT"
R7 = 80000!
C2 = .0000001
T1 = .69 * R7 * C2
R8 = R7
C3 = C2
T2 = T1
T = T1 + T2
F = 1 / T
COLOR 2
PRINT
PRINT "R", "C", "T", "F", "T1"
PRINT R7, C2, T, F, T1
PRINT "SINCE T1=T2 R8=R7 C3=C2 "
```