DESIGN AND CONSTRUCTION OF

MELODY TONE GENERATOR

BY

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DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

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

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DECLARATION

I, Meredith Olusegun Ayodeji, hereby declare that this project is an original concept (which has never been presented before, either wholly or partially for other degree else where) was totally designed, modelled and constructed by me under the supervision and guidance of supervisor Engr. M. Shehu Ahmed.

Information obtained from published and unpublished works of others has been acknowledged accordingly.

Student's signature　　　　　　　　　　Date

CERTIFICATION

This is to certify that this project MELODY TONE GENERATOR was designed and constructed by MEREDITH OLUSEGUN AYODEJI for the partial fulfilment of the Award of Bachelor's Degree in Electrical/Computer Engineering (B.Eng), Federal University of Technology, Minna, Niger State, for the academic year 1999/2000.

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17/01/2007

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Date

DEDICATION

This project work is dedicated to the Lord God Almighty, for his Grace, goodness and mercies endure forever.

Also to my beloved mother, Mrs. Rachael Motunrayo Meredith and my humble sister, Mrs. Esther Omowunmi Olatunji.

ACKNOWLEDGEMENT

The success of any project work by a single student is almost always the result of research, creativity and support from various sources: individuals, companies, texts and technical manuals. This is certainly true of this project work.

My sincere gratitude goes to the following God-loving people, lecturers and guidance. My special thanks to my able supervisor and lecturer, Engr. M. S. Ahmed for his tireless assistance constructive advice, encouragement, time spent and his constant guidance. My thanks also go to my lecturers and Head of department, Dr. Engr. Y. A. Adediran, to my lecturers Mr. Danjuma, Mr. Pinne, Mr. Jedha and the host of others, I say thank you for all your fatherly and guidance advice.

I would like to record my sincere apppreciation and gratitude to my dear mother Mrs Rachael Moturayo Meredith, who never failing support and cooperation made it possible for me to finish this course successfully. .And to the entire member of celestial church of christ state Headquarters, Minna, and my sincere gratitude to the state Evangelist in the person of Senior Evangelist Raphael Akinkunmi. And lastly to my God Almighty for sparing my life and see me through rigth from my first day into this great institution till this present moment. My profound gratitude equally goes to the association of great Electrical/Computer Engineering students of the institution for their warmth, kindness and unblemished support. Also the association of well wishers in the person of Mr. Emmanuel Akpassa (NIMB), Mr. and Mrs. Esther Omowunmi-Olatunji, Mr. and Mrs. Abimbola Akinlade, Mrs. Esther Abiodun Alade, Ms. Ifederu, The Ijaolas, the Akannis, Mr. Raji Jonathan, Mrs. Oludaiye, Miss Eugenia Edaghese, to my Aunty Mrs. Femi H. Bankole and husband (father), to the Police Commissioner, Mr. Moses Olatunji, Col. Okuntimo, Mr. Kola Martins, Mr. Martins Njoku, Mrs. Helen Sanni Phillips and also to my Late guidance's family the Ojumus. I cannot but give thanks to my humble uncle in the person of Dr. F. A. O. Alade for all his financial, moral and otherwise support and contribution for the success of my project, also my greatest thanks

ABSTRACT

The scope of this project covers an elaborate approach to the design and implementation of Melody Tone Generator using a piezo sounder otherwise known as the Melody Generator Chip. The design and construction of a Melody Tone Generator is described in this project write-up. The project is intended to produce an output of audible sound melody signal in flashing light display using an LED (Light Emitting Diode) at an appropriate time interval. The output of the project depends solely upon the Melody Generator chip.

The UM66 Melody Generator Chip is compact model containing a logic-controlled tone generator. The oscillator runs at 64 kHz and its accurately affects the quality of the music. Its output is used as a time base for the tone and beat generators. Its output then passes to the tempo generator before entering the timing and controlled circuits. This produces two main signals one is fed into the program counter and the other to the output control circuit. A power on reset signal is also generated for the oscillator and program counter. This ensures that the melody begins from the first note each time power is applied to the chip.

After connecting the power, the tone will play once or twice and stops. The voltage supply to the chip must be moved then reapplied to re-trigger in. The output control stage acts as a sound gate turning on and off under the command of the timing circuit. The output buffer can supply 1.5 mA of drive current, enough for a piezo sounder to be driven directly by the chip. All this hi-tech circuitry is contained in a three pin plastic package looking more like a transistor than a complex chip.

CHAPTER ONE

GENERAL INTRODUCTION

1.1 INTRODUCTION

The word "Melody" is defined by Concise Oxford Dictionary in deferent categories, which include:

1. The act of producing melody sweet sounding sensation.
2. The act of generating sweet music, tunefulness, musical arrangement of words.

It is from the definition of number 2 angle that I will look at the issue of melody generator in relation to the piezo sounder.

Melody make a lot of impact in human being life. Melody creates a sweet sensation in ones life whenever any unforeseen situation occurs, and there is nothing which can extinguish this sad moment but, listening to a good melody—music which can create in one some sort of internal happiness which will then lead to one forgetting about the bad memories of life.

Therefore, human being cannot but do without good melody, which can come in various version from slow tempo, instrument classical jazz and lot more.

This project titled Design and Construction of Melody Tone Generator" centres around the electronics controlled, Hi-tech circuitry, which is built around the TTL family of integrated circuit (I.C) and other electronic components.

1.2 PROJECT OBJECTIVES AND MOTIVATION

1.2.1 PROJECT OBJECTIVES

Melody Tone Generator is designed to accomplish several objectives. In the world today music/melody is playing a major role in the life of the people of the world, that is why good ıd lot more. Without music/melody all this people with their melancholy life will be like ːll to them that's why I thought of designing and construction of thing that can generate ɔod melody.

his project is not only based on survey of the adult only. But also considered the kids which ːe believed it will serve them a lot too. Because mostly children, nowadays believe in using ɔys that can produce music in the form of melody which they can dance or laugh to whenever ıe generator is still being energized. They will be filled with high spirit of happiness all ver.

'here are four principal reasons why this project design is chosen; "Melody Tone Generator"

. It can be used as door alarm.
2. It can be integrated into smaller circuit and been fired into a design card.
3. It can be used for Christmas melody generator.
4. It can be used by little children during festive period.

1.2.3 MOTIVATION

Motivation to build this project is based on the fact that living a well meaningful life is all it wants for everybody, that is the reason why this project will put a smiling face on all those with MELANCHOLY. As the saying goes "once there is life, there is hope."

1.3 LITERATURE REVIEW

The most important thing about life is for everyone to live a well meaningful life without anything like boredom, is them life will be enjoyable by everyone at large.

Music/melody has come of age, the father of good melody was King David who wrote one hundred and fifty (150) melodious songs to prays God, and to awaken peoples with heavy laden, just to comfort them that when there is life, there is hope and uses melody to get them cheerful. Later in history Alberto B. Piera came about various fashions of melody, among

... mental music, classical jazz, sentimental music, circular music, pop music, rhymes, praise-worship and lot more. Melody has done a lot in saving thousands life everyday.

It was at this need that the designing and construction of Melody Tone Generator came into my mind and were developed, and each design were improved then the order by increasing the sensitivity of the Piezo chip in the generating system was reduced false melody in the system.

1.4 APPLICATION AREA

The application area of Melody Tone Generator must always be put into consideration, since my aim is to create life and to make life more meaningful to those in pains and their about.

The application area includes the following:

- It can be used as door alarm
- It can be integrated into smaller circuit and been fixed into a designer card
- It can be used for Christmas melody generator
- It can be used by little children during festive period.

1.5 PROJECT LAYOUT

This project write-up is in four chapters for easy comprehension.

Chapter one encompasses the general introduction where a brief knowledge of Melody Tone Generator is discussed, also mention is the need for this system, where they are used and the main reason for undertaking the project work.

Chapter two deals with the system design which includes the circuit description; for clarity sake the circuit description to the melody generator has been subdivided into two sections which includes the melody signal stage and the amplifiers stage. Also list of materials used.

Chapter three deals with construction of the project, the test of the Melody Tone Generator ... of the tone produced at the output level.

Chapter four, which is the concluding chapter, comprises improvement on the project, summary for the whole project write-up, recommendation and references.

CHAPTER TWO

SYSTEM DESIGN

2.1 INTRODUCTION TO CIRCUIT DESCRIPTION

A good melody is a "food for the sick minded ones" and a source of great fun for the kids. For clarity sake the circuit description for the Melody Tone Generator has been divided into two sections:

a) The melody signal stage.

b) The amplifier stage.

2.2 MELODY SIGNAL STAGE

This stage is made up of four basic components as shown in block diagram of fig 3.2 The I.C UM66 is the most sensitive of all, when voltage is fed into it, if produces melody signal which is implied by the transistor TRI, the resistor R, and the capacitor C, helps in removing impurities in the circuit. The D.C (direct current) supply entering the circuit must have the correct polarity otherwise damage will occur to the semi conductor. The maximum operating voltage that can be applied to pin 2 and 3 of the UM66 I.C is 3.0 volts, that is why a special and separate power supply is provided for it. The chip reset condition occur when a momentary short circuit is switched between the reset pad. The melody out of pin 1 of I.C is fed into the base of TRI via R1 and 4.7 kVz resistor. An NPN silicon transistor TRI is used to provide sufficient drive current for the piezo sounder or a low impedance loudspeaker. This stage is as shown in fig 2.1

2.3 AMPLIFIER STAGE

This stage comprises of a carefully selected component like transistor which is powerful to amplifier the information from the melody. The signal from the melody circuit is fed into the transistor through the resistor 4.7k. And one of the collector is connected to the loudspeaker while the third leg of the I.C UM66 is connected to the other terminal of the loudspeaker.

2.4 LIST OF MATERIALS USED AS SHOWN IN TABLE 1

S/N	COMPONENT	QUANTITY	SPECIFICATION
1	Integrated circuit	1	UM66
2	Transistor	2	C547B
3	Sensor switch	1	—
4	Loud speaker	1	2\5 W 40 HMS
5	Battery casing	1	1.5 volts x 2 Batteries
6	Capacitor	4	50V – 1μF, 25V – 2200μF
7	Resistor	2	4.7 k
8	Ferro-Board	1	—
9	Wooden Box	1	—
10	Transformer	1	240V/50Hz, 6V 500mA
11	LM 317	1	LM 317T
12	Bridge rectifier	1	—
13	Variable resistor	1	5k
14	AC cord	1	240V/50Hz

CHAPTER THREE

CONSTRUCTION, TESTING AND RESULTS

3.1 INTRODUCTION

In this chapter of the report, it involves the report on the construction work, measurement and testing of the output of the generator. The audio output level of the Melody Tone Generator was also considered as the project is for a multi purpose usage.

3.2 CONSTRUCTION

The construction was undertaken by testing the designed outlined stage by stage. In this regard, breadboard was made use of as all constructions were make on it first and tested before transferring to vero-board and soldered permanently.

First, the supply unit was connected on the breadboard and tested to make sure all the constructions were properly done until the required output was obtained.

Next was the signal stage, which comprises of the UM66 IC, which is the most sensitive of all, when the voltage is fed into it. It produces melody signal, which is implied by the transistor TRI, resistor R, and the capacitor C, which helps in filtering unwanted noise in the circuit. The AC/DC supply entering the circuit must have the correct polarity otherwise damage will occur to the semi conductor.

The maximum operating voltage that can be applied to Pin 2 and 3 of the UM66 IC is 3.0 volts, that is why a special and separate power supply is provided for it. The chip-reset condition occur when a momentary short circuit is switched between the reset pad.

Then the amplifier stage, all connections were made as specified on the circuit design diagram. At every stage, test were carried out before the next connection with a digital multimeter. Because this stage comprises of a carefully selected components like transistor circuit is sent directly into the transistor through the resistor 4.7k. As all these were been tested and checked, one of the collector is connected to the loudspeaker while the third leg of the IC UM66 is connected to the other terminal of the loudspeaker. All this were done on breadboard before transferred to vero board also in stage, soldering of the components to the vero board was done as each component was transferred from the bread board tightly taking not of the polarity. Where necessary, the vero board was cut to ensure there was no short circuit with razor blade.

The casing of the project was also constructed having in mind the desired outlook. Melody Tone Generator system out look are usually decorative, for this purpose, a fanciful material that is not conductive was chosen (wooden box).

3.3 FLOWCHART DIAGRAM SHOWING THE ELEMENTS OF PROJECT DESIGN

In order to produce a successful design, it is necessary to employ an appropriate design process to ensure that the original goals of the design are met. This particular chapter covers some of the more important elements of any project design process.

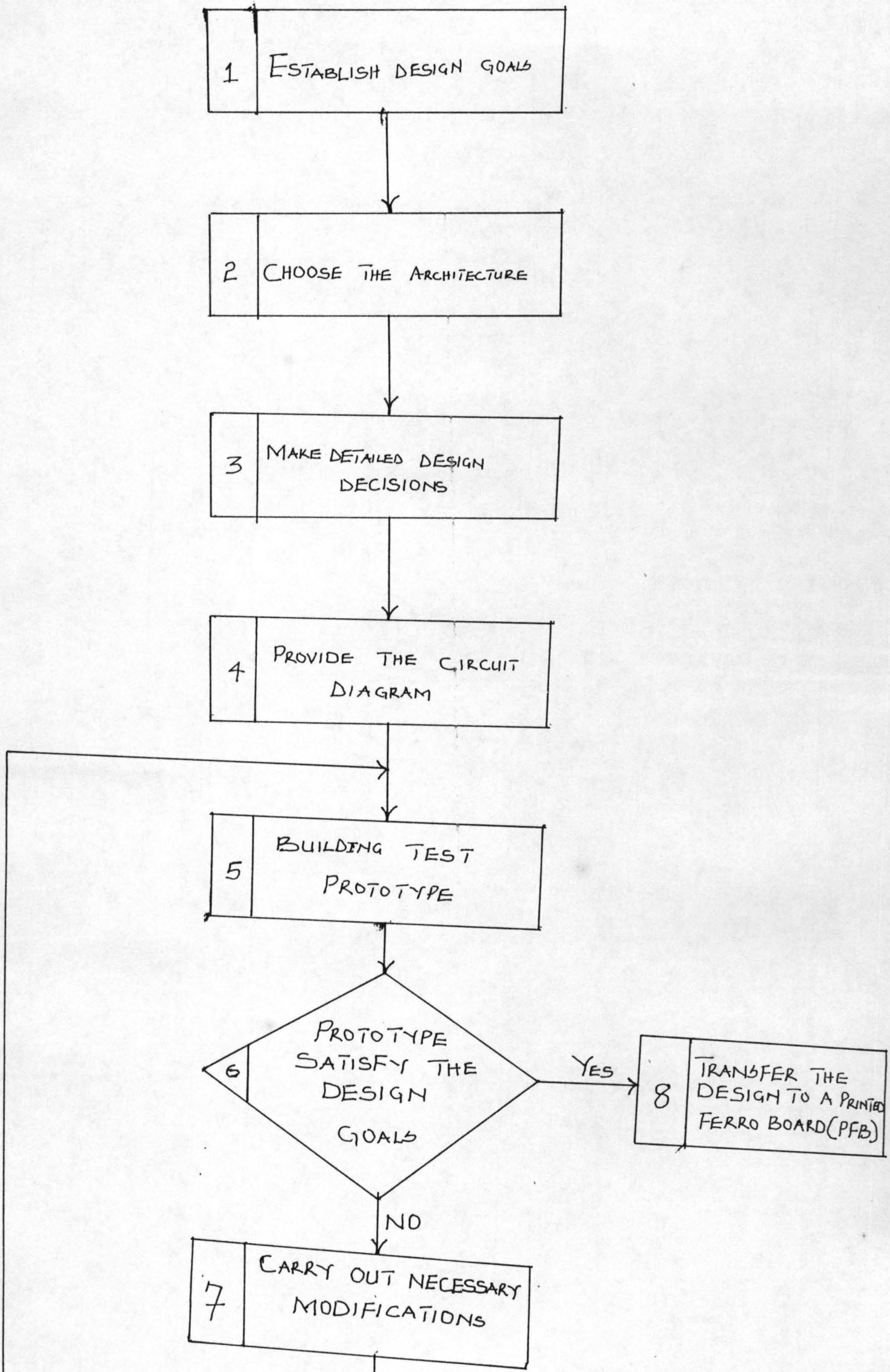
1 ESTABLISH DESIGN GOALS
2 CHOOSE THE ARCHITECTURE
3 MAKE DETAILED DESIGN DECISIONS
4 PROVIDE THE CIRCUIT DIAGRAM
5 BUILDING TEST PROTOTYPE
6 PROTOTYPE SATISFY THE DESIGN GOALS
YES
8 TRANSFER THE DESIGN TO A PRINTED FERRO BOARD(PFB)
NO
7 CARRY OUT NECESSARY MODIFICATIONS

FIG 3.1

3.3-1 ESTABLISHING THE DESIRE GOALS

These would include the level of consumption, the amount of space available, the target cost of the final project product.

3.3-2 CHOOSING THE CORRECT ARCHITECTURE

Having decided what is to be achieved, the correct approach to achieving those goals must be selected. Here major decision areas are achieved:

3.3-2.1 Partitioning the system into functional blocks (units)

The first step is to break up total system into manageable pieces. For example, if the design requires multiple boards, the precise functionality between each boards in the design must be defined. Then for each board, the functionality must further split into functional blocks and so on.

This stepwise refinement into small functional elements stops when the workings of the individual functional elements can be easily understood and all this will then be converted into real circuiting.

3.3-2.2 Choose the Tools

On of the most fundamental decisions is usually which tools to use at every stage of the design on the board, in order to make the design to be neat and trace any fault which may arise due to improper soldering, improper taping and so on.

Using the right tools for any given take is one of the fundamental rules in engineering project design

3.3-2.3 Methods of connection of the design project

A fundamental decision is how the connection of the design project will be and what shape the design will take. Right at this stage, the connection is left for the student to (bread board) before transferring the whole layout to the permanent ferro board

3.3-2.4 Using custom logic

The main decision technology for the application of each block.

3.3-3 DETAILED DESIGN DECISIONS

This includes the types of electronics components which will be suitable and relevant to the functionality of the project. The chips used for this project one has to considered the space it will occupy on the board couple with the other components such as the transistor, capacitor resistor, sensor switch, loud speaker, battery casing and so on.

3.3-4 PRODUCING THE CIRCUIT DIAGRAM

The next step, after the detailed design decisions, is to actually produce a circuit diagram (showing all the electrical connections) of each elements of every block. It is fairly unusual these days to draw circuit diagrams by hand. A schematic capture software package is used to produce the circuit diagram. The use of a software package has many advantages over hand drawn circuits, these include: neatness, easy to update, easier to make more copies, the computer can check the circuit for errors, clashing outputs and undriven signals.

3.3-5 PROTOTYPING

Having produced the circuit diagrams required for the project, the next step is to prototype the design, that is to produce a true prototype that uses different technology to the production of the project design or to go straight to what is effectively a pre-production prototype. The choice of which method to use depends on a number of factors, like the complexity of the project.

3.3-6 DESIGN GOALS AND SPECIFICATIONS MET BY THE PROTOTYPE?

If these goals and specifications of the project are met, the project prototype is transferred to a (PFB) printed ferro board, else desired modifications are made, and the prototype re-tested and decides base on the obtained outputs.

3.3-7 MODIFICATIONS

To modify the design only if the specifications are not met.

3.3-8 TRANSFERRING THE DESIGN TO A CIRCUIT BOARD (PFB)

Once the design has been satisfied okay, the prototype or the pre-production PFB can now go straight into the real project design. At this stage, that the whole design has been certified okay the design on the printed ferro board can then be house in a fitted casing.

3.3-9 CIRCUIT DIAGRAM OF THE PROJECT

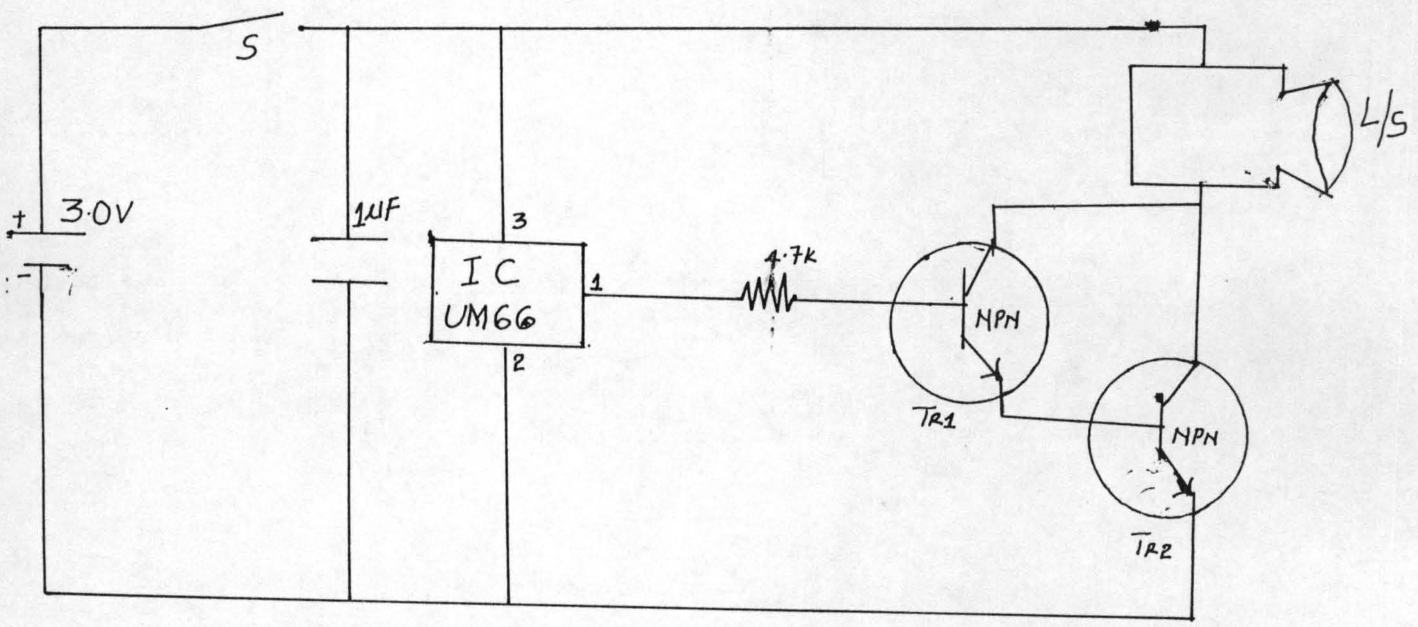

FIG 3.2

3.40 MEASUREMENT AND TESTING

In testing the system, which was constructed, the AC/DC connection was done in a synchronized way to be in line with the circuit as described in the circuit diagram above.

The voltage input (AC/DC) was measured to be 3.0 volts and the voltage output (AC/DC) was also measured to be 3.0 volts.

The effectiveness of the sensor switch was tested when connected in line to the loudspeaker. The output of the operational amplifier was also measured when the sensors triggers the circuit and energized the whole circuit.

3.4.1 IMPROVEMENT

The project can be improved upon from its present limitation of singing just once or twice and stop until it is re-triggered to play.

The tone of the project can be improved with the application of relay, which will make the project to be singing continuously without stopping until one is satisfied with the melody.

If the circuit below is well constructed it can play up to seven birthday songs non-stop.

Birthday song alarm.

3.4.2 SPECTRUM ANALYSIS OF THE SIGNAL OUTPUT AS SHOWN BELOW

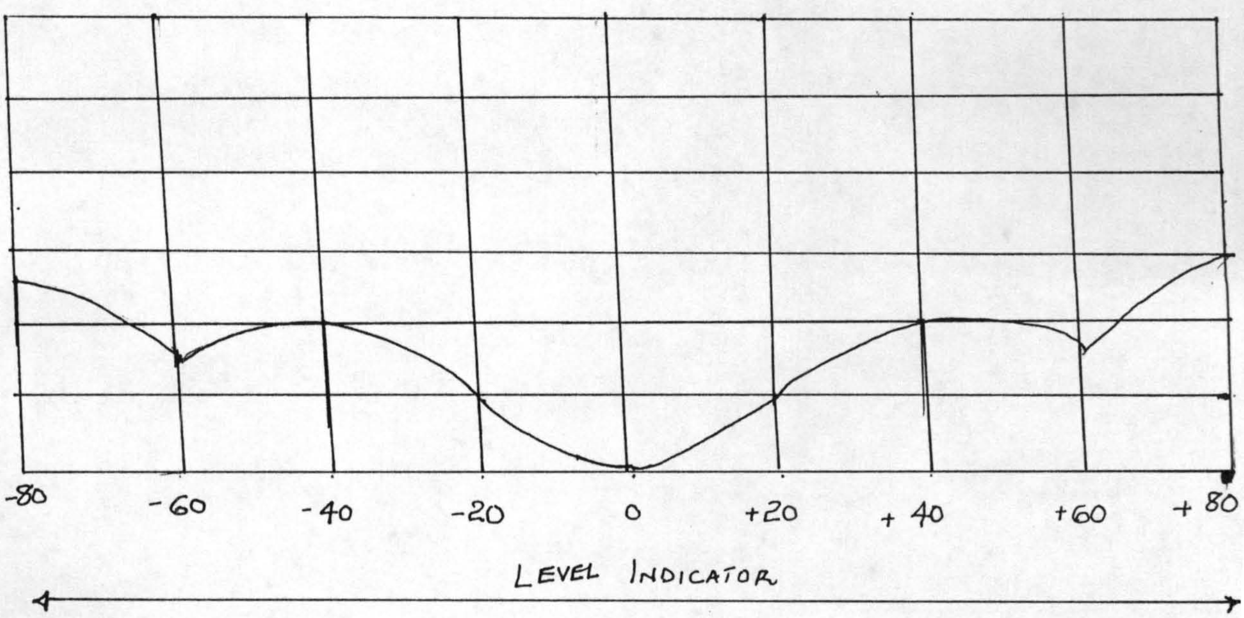

FIG 3.3

FIG

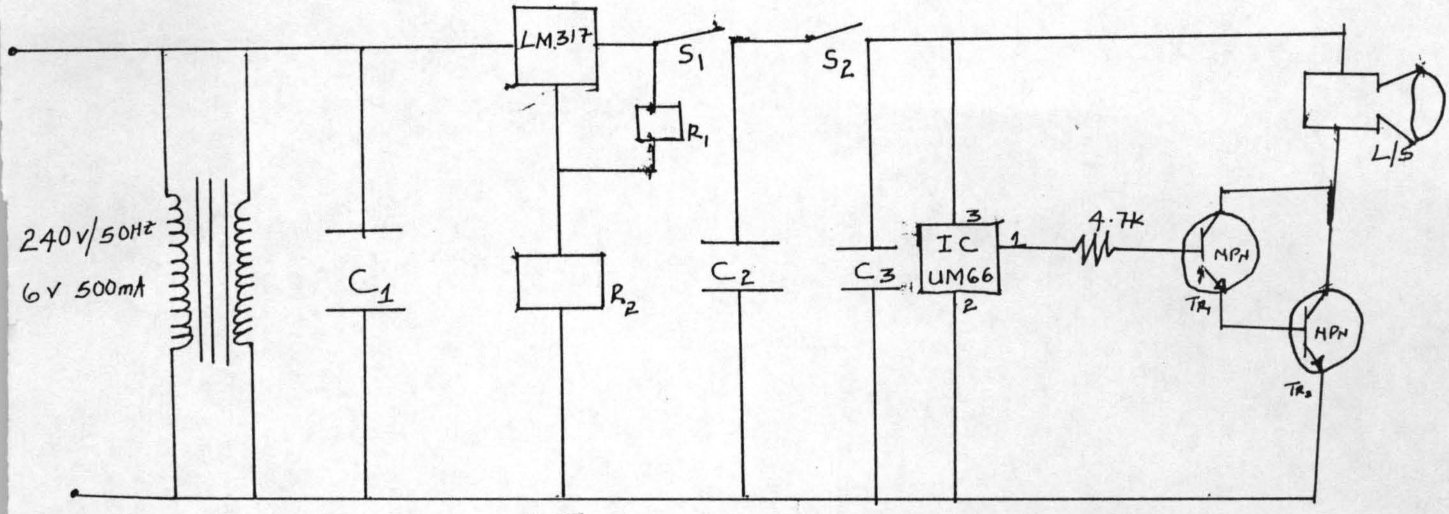

FIG 3.4

Fig 3.4 Showing the Improved Circuit diagram with A.C and D.C Source

C_1 = 1μF

C_2 = 2200μF

C_3 = 1μF

R_1 = 144Ω

R_2 = variable resistor 202Ω

R_3 = 4.7k

TR_1 = C547B

TR_2 = C547B

IC = UM66

POWER SUPPLY

All electronic circuits require some external power source usually this is provided either from the domestic mains or from batteries.

The term power supply is normally used to refer to the complete circuitry, which performs the conversion of alternating current (a.c) to direct current (d.c). The voltages required can be as small as 1.5V in hearing aid, to 25kV for the final anode voltage of colour TV., and at current from a few micro-amps to several tens of amps.

This chapter describes the basic building block of power supply used in electronic equipment, of the following sections, transformation, rectification, filtration and regulation or stabilization as depicted in the figure below.

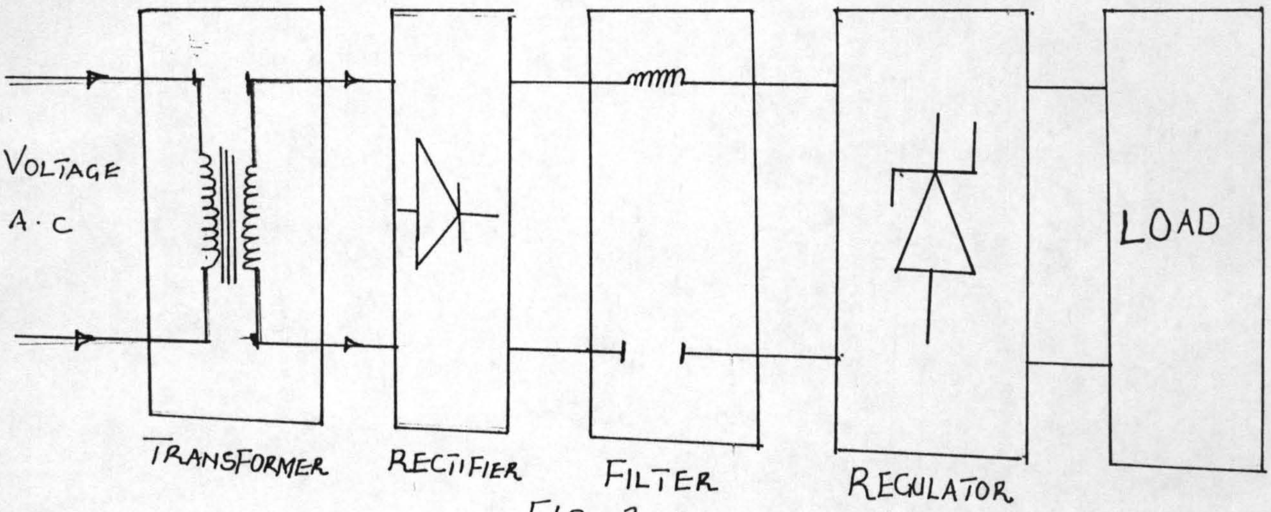

FIG 3.5

TRANSFORMER

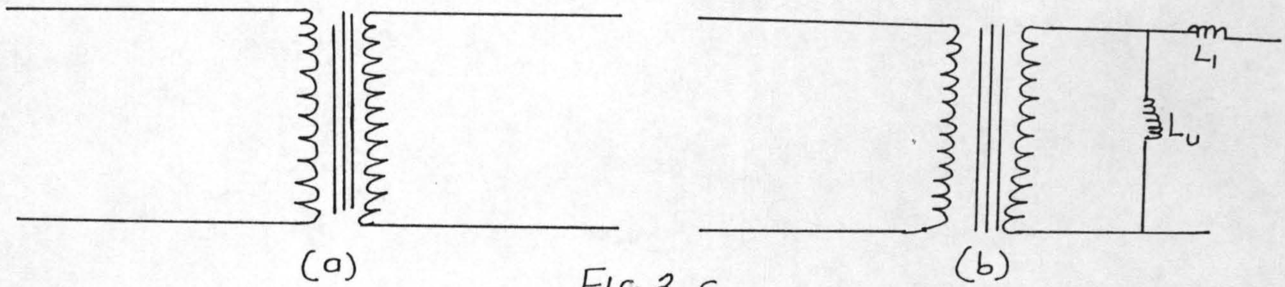

FIG 3.6

— Ideal all energy on primary coupled to secondary.

— Practical, leakage and magnetizing inductance shown.

A transformer is two or more inductors with a common magnetic field. A material with high permeability is used as a path for the magnetic field (iron). In a ideal transformer all the energy in one winding would be coupled to the other. The voltage on the primary and secondary of the transformer would be directly proportional to the turns ratio. The practical transformer may be close to this but non-ideal parameters cause errors.

In the non-ideal transformer a current will flow in the primary even when the secondary is open circuit. This is the magnetizing current and is necessary to create flux in the core. In the practical transformer above it is modelled as an inductor in parallel with the secondary winding. In the practical transformer not all the flux from one winding is coupled into the second. Some will follow a path through the air or surroundings back to its self. This is called LEAKAGE INDUCTANCE.

This has been modelled as an inductor in series with the secondary winding. The leakage inductance can couple into external circuitry and components. The reduce this a shorted turn of wire foil can be placed around the entire circuit, the leakage flux remains within this winding. If the secondary of a transformer is short circuited the leakage inductance is the inductance measured on the primary (approximately). There are other parasitic elements present in a transformer such as its resistance or inter winding capacitance.

TRANSFORMATION

The majority of electronics circuit run off the 240V, 50Hz supply. The transformer produces a.c at low voltage, transformers are specified by their output voltage(s) and their rating in VA. For a transformer, the following transformation ratio holds.

$$\frac{N_P}{N_S} = \frac{V_P}{V_S} = \frac{I_S}{I_P}$$

where N_p = Number of turns of primary windings.

N_s = Number of turns of secondary windings.

V_p = Voltage at primary

V_s = Voltage at secondary

I_p = Primary current.

I_s = Secondary current.

The melody tone generator requires a 3V 500mA supply. Thus, the ratio of transformer to be used is obtained as follows:

$$\frac{N_P}{N_S} = \frac{V_P}{V_S} \qquad V_p = V_{rms} = \sqrt{2} \times 240V = 339.4$$

$$\frac{N_P}{\;} = \frac{339.4}{\;}$$

Hence, transformer with turns ratio 17:1 is required as depicted below.

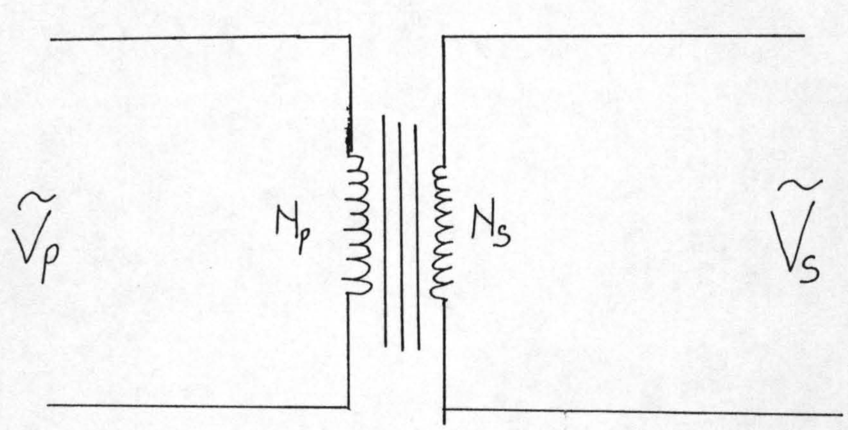

FIG 3.7

FILTERING

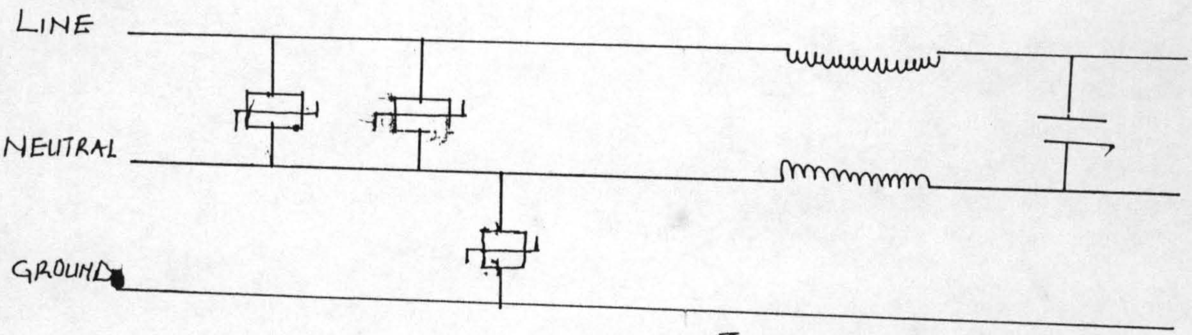

FIG 3.8

— Reduce Transients

— Block common and normal mode noise

— Block high frequency noise.

The filtering and protective circuitry shown above is typical of that in a switch mode power supply. It prevents noise and transients from the mains damaging the power supply and it prevents the power supply from affecting other components. Transients can be either common mode or normal mode.

A normal mode transient occurs between live and neutral. Common mode events occur on both live and neutral simultaneously. Surge suppressors are necessary between live or neutral and ground to reduce common mode transients. A common mode choke is designed to reduce common mode noise. Capacitors are good for reducing high frequency noise.

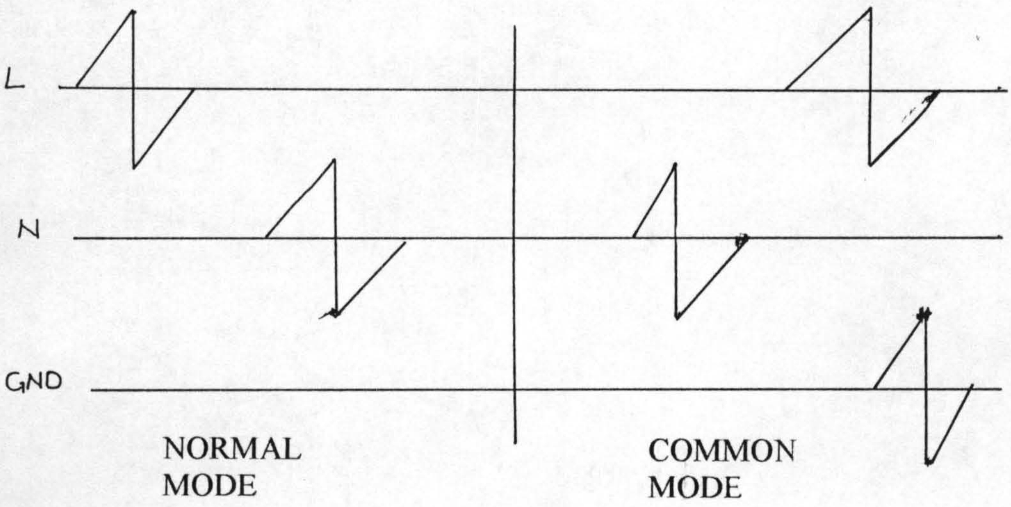

FIG 3.9

LM 317 ADJUSTABLE REGULATOR

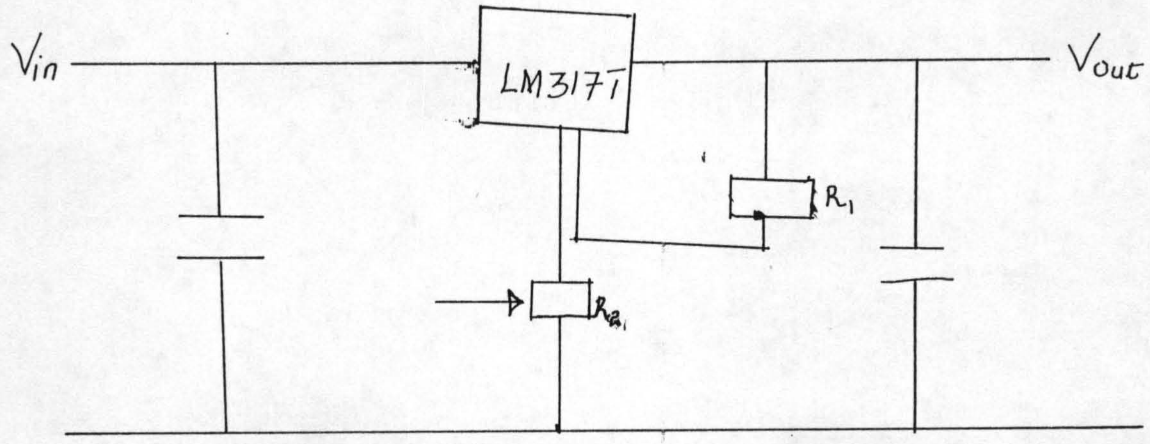

FIG 3.10

3-Terminal Regulator.

Built in current protection.

LINEAR REGULATOR

The LM317 is a three terminal adjustable regulator. It provides current limit and thermal overload protection. It only requires 2 resistors to adjust its output electronics shutdown can be achieved by clamping the adjustment terminal to ground.

It has a 1% output voltage tolerance. Capacitors are commonly added at the inputs and outputs to improve its response to transient loads.

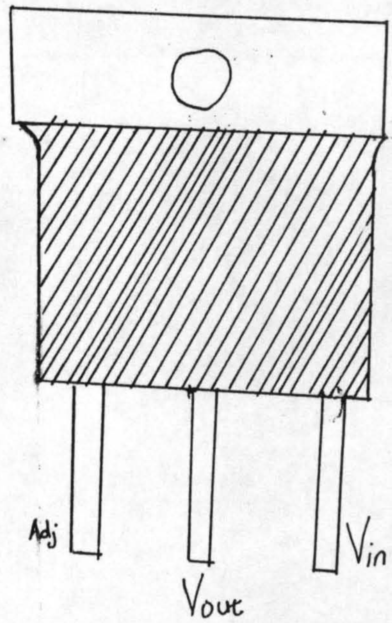

FIG 3.11

$$V_{out} = 1.25\times\left(1+\frac{R_2}{R_1}\right)$$

$R_1 = 144\Omega$, R_2 = variable resistor set at 202Ω.

$$V_{out} = 1.25\times\left(1+\frac{202}{144}\right) = 3.0 \text{ Volts.}$$

LINEAR INTEGRATED CIRCUITS

INTEGRATED CIRCUITS (ICs)

i. DESCRIPTION: An IC is a complete electronic circuit containing transistors and perhaps diodes, resistors, and capacitors all made from, and on, a chip of silicon about 5mm square and no more than 0.5mm thick. Instead of working with individual active and passive components, the designer could now take a whole circuit such as amplifier, adders, and counters and could assemble them into larger system performing a more complex functions required. A tiny part of the typical IC, which is the chip, is enveloped in its protective plastic case with the leads radiating from it to the pins that enable it to communicate with the outside world. ICs are packaged in different ways, a popular one is the DUAL-IN-LINE (DIL) arrangement with the pins 0.1 inch apart in two lines on either side of the case. Circular metal packages, similar to those used for some transistors are also common.

ii. SCALES OF INTEGRATION: The first ICs were made in the early 1960s and consisted of fairly simple circuits with fewer than 100 components per chip. They were small-scale integrated (SSI) circuits. This was chiefly considered remarkable for the small size of the resultant circuit. Improvement in the manufacturing technique led to the much higher components density. In the late 1960s more complex circuits classed a medium scale integrated (MSI) circuits with 100 to 1000 components, became available. Today, large-scale integrated (LSI) circuits have 100 to 10,000 components and very-large-scale integrated (VLSI) ones from 10,000 to approaching 1 million. It is foreseen that the component density is likely to be increased 10 fold in the near future.

iii <u>ADVANTAGES AND LIMITATIONS.</u> There are two features which together means that this new IC elements will radically change major aspect of domestic and industrial life. First is the enormous number of components in an IC element means that is huge electronics system rather than just a circuit and that it can therefore be used to carry out functions of great complexity. Secondly, compared with circuits built from separate components ICs are very much smaller, lighter, cheaper and more reliable. When a particular chip commands a mass market, it can be produced very cheaply. However, their small size limits their power and voltage (typically 30V max) they can handle. In addition, although silicon is ideal for making diodes and transistors it is not so good for high-value resistors and capacitors (where the present limits are about 50k and 200pf respectively) because they need too much space. Also, inductors and transformers cannot be produced on a silicon chip. A notable feature of earlier years of commercial exploitation of IC was the creation of such mass-market in watches, small personal calculators, radio games, cash registers and weighing machines. IC's were first used in relatively simple operations. The functions of any particular IC was made defined and fixed when it was and that functions could not afterwards be altered in anyway. Such IC's include those in watches and small memories. A microprocessor is a more complicated IC, which can be programmed by the user to perform any one of specified range of functions and operate with a variety of input and output devices. Some of the notable amplifiers are in IC form. These include operational amplifiers, radio frequency amplifiers, power amplifiers sideband amplifiers and Audio frequency amplifiers.

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iv. <u>MANUFACTURE:</u> Silicon containing no more than 1 in 10 parts of input is produced chemically from silicon dioxide, the main constituent of sand. It is then melted in an inetmosphere and crystallisation starts when a small crystal of pure silicon is inserted and slowly withdrawn from it. A cylindrical bar is formed as a single, near-perfect crystal. The bar is cut into ¼ to ½ mm thick wafers whose surfaces are ground and highly polished. Depending on their size, the chips are formed side by side on the surface of one wafer by an extension of the planer process used for transistors. The first involves depositing an insulating layer of silicon dioxide on the wafer and then using a pattern of photographic masks, designed from a large drawing of one chip, to create "WINDOWS" in the oxide by exposure to ultra violet, followed by developing and etching away with acids. See Fig. A below. Doping then occurs in one method by exposing the wafer at high temperature to the vapour of either boron or phosphorous, so that their atoms diffuse through the "WINDOWS" (guided by masks) into the silicon. The p- and n-type regions so produced for the various circuit by depositing aluminium, again using masks see Fig. B. Several layers can be built one on top of the other in this way.

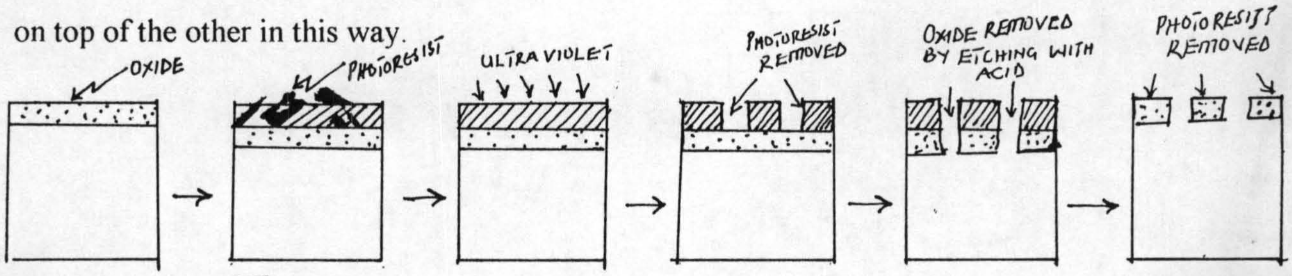
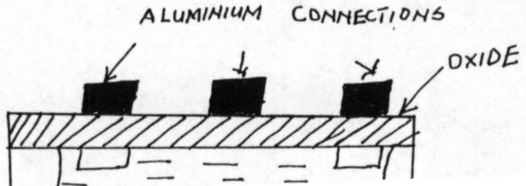


FIG A.



The construction of integrated diodes and transistors is similar to that of their discrete versions. Integrated resistors are thin layers of p-type silicon whose value depends on their length, cross-sectional area and degree of doping. Integrated capacitors are either reverse biased p-n sections or two conducting areas (e.g. of aluminium or doped silicon) separated by a layer of silicon dioxide as dielectric. Each chip is tested and faulty ones discarded. The wafers are next cut into separate chips. Each is then packaged and connected by gold wires to the pins on the case. The complete process which can require up to three months, must be done in a controlled, absolutely clean environment.

v. TYPES: As with discrete components circuits, there are two broad groups of integrated circuit—linear (or analogue) and digital. The earliest IC's (1960) were digital because they are easier to make and the market for them was larger. Linear ICs e.g. operational amplifiers, which were then first linear type (1964). Most linear ICs are based on bipolar transistors but in some cases FETs are used either exclusively or in addition to bipolar types.

vi. HOW LINEAR INTEGRATED CIRCUITS WORK: Most linear ICs, especially Op-amps, consists of four steps shown below. The first stage is a differential amplifier, the second is the voltage amplifier, the third is a level shifter and the fourth is usually a complementary emitter follower out stage.

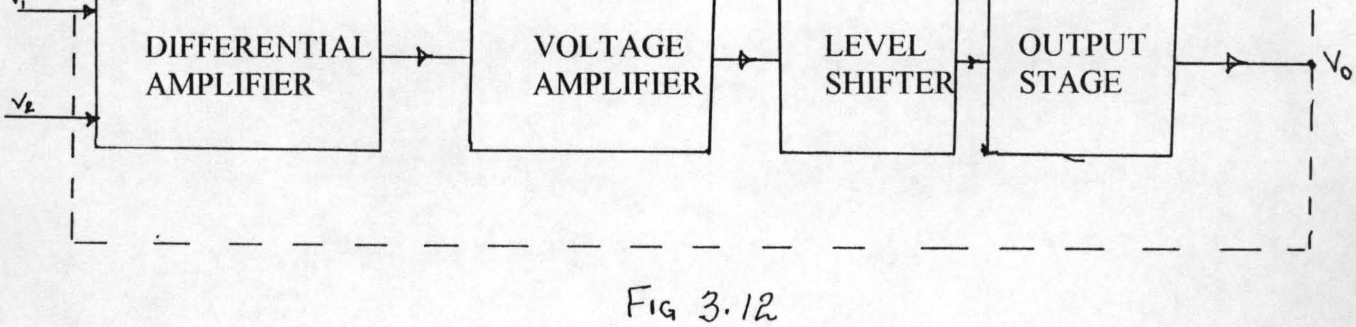


FIG 3.12

COMPONENTS DESCRIPTION (FUNCTIONS)

RESISTOR:

1. Provide the required bias voltage necessary for proper transistor action.

2. Acts as a stabilizer to limit current and voltage variation to safer the required values.

3. Provide the required output voltage for coupling to the next stage.

CAPACITORS

1. Act as filter for removing the ripples on the output waveform.

2. Prevent feedback of the a.c signal into the circuit.

3. Used for coupling from one stage to the other.

4. Separate the a.c and d.c conditions of the amplifier from interfering with one another.

LOUDSPEAKER:

A loudspeaker is an electro-acoustic transducer actuated by energy from an electrical system radiating into an acoustical system, the spectral composition of the energy in the two system being substantially equivalent. Transformation of electrical into sound energy is usually accomplished by electrically actuating a surface diaphragm in contact with air or some other fluid, causing it to move and set the adjacent air particles in motion.

TYPES AND CHARACTERISTICS

Loudspeakers may be classified as to the type of radiation or radiating system, type of motion and reversibility. Some examples are:

(a) Moving conductor speaker

(b) Direct radiation or hornless speaker

(c) Horn-type moving-coil (or conductor) speaker

(d) Magnetic armature speaker

(e) Condenser speaker

(f) Pneumatic speaker.

<u>THE MOVING CONDUCTOR LOUDSPEAKER</u>

For the purpose of this project, moving conductor loudspeaker was used. The electrical signal applied to a coil suspended between the poles of a strong permanent magnet. The current produces forces on the coil, deflecting the diaphragm. The deflection on the diaphragm causes sound waves to be radiated from the loudspeaker; the sound waves will be a copy of the applied voltage.

CHAPTER FOUR

CONSTRUCTION, CONCLUSION AND RECOMMENDATION

4.1 INTRODUCTION

This chapter marks the concluding part of this project report. It invokes the report on the construction work, measurement and testing of the outputs of the system. The noise level of the system was also considered, as the project output is an audible sound, this was meant for the purpose of installation of the system. The areas, which the system can be further improved upon, were also discussed and finally the summary and conclusion of the project report.

4.2 CONSTRUCTION

The construction was undertaken by testing the designed outline stage by stage. In this regard, breadboard was made use of as all connections were made on it first and tested before transferring to ferro board and soldered permanently.

First the power supply circuit was connected on the breadboard and tested to make sure all the connections were properly done until the required output was obtained.

Next was the control circuit, which comprises of the integrated circuit I.C, transistor, the sensor switch, loudspeaker, the battery package, capacitor, resistor, and these were connected permanently on the ferro board.

The melody signal stage, all connections were made as they were specified on the circuit design diagram. At every stage, tests were carried out before the next connection.

The connection were then transferred to ferro board also in stages, soldering of the components to the ferro board was done as each component was transferred from the breadboard tightly taking note of the polarity. Where necessary, the ferro board was cut to

The casing of the project was also constructed having in mind the desired outlook. The Melody Tone Generator outlooks are decorative, for this purpose, a fanciful material that is not conducive was chosen [wooden box].

4.3 MEASUREMENT AND TEST

In testing the system, which was constructed, the AC/DC connection was done in a systematic way to be in line with the circuit as described in the circuit diagram above which was explicit to understand. The voltage input (AC/DC) was measured to be 3.0 volt and the voltage output (AC/DC) was also measured to be 3.0 volts. The effectiveness of the sensor switch was tested when connected in line to the loud speaker. The output of the operational amplifier was also measured when the sensors trigger the whole circuit and energized the whole system as described in the circuit.

When further improvement was done on this project instead of using only one source of power supply, this was improved to two power source d.c and a.c for more effective and economical purpose. The a.c circuit implemented to this project really made the project to be more functional with the use of LM317 adjustable regulator, which was connected in parallel with the variable resistor, which provides current limitation and thermal overloading protection. And the two resistors required are adjusted to its output electronics shutdown can be achieved by clamping the adjustment terminal to ground. And the capacitors used, also provide a smoothing output by removing the ripples which may wanted to stand as attenuation to the output stage through the speaker.

LM 317 Adjustable regulator is a linear regulator, which has 1% output voltage tolerance. Capacitors are commonly added at the inputs and outputs to improve the response to transient loads.

4.4 AREAS FOR IMPROVEMENT

Since the design can still be improved upon, it will serve as a stepping stone for whosoever is

PIERA who says music is a food of life, hence I will give a hint of recommendation on these areas. The tone of this project can be improved with the application of relay, which will make the project to be singing continuously without stopping until one is satisfied with the melody.

If some adjustment and improvement were been made in order to improve the duration of the sound produced.

4.5 CONCLUSION

The design and construction of a functioning Melody Tone Generator had successfully been carried out as described in this chapter, which entails thorough research work and extensive and explicit design work. The simple melody tone generator is designed with a small I.C (integrated circuit), which is capable of producing different notes.

The I.C requires no high voltage, a 3.0 volts d.c and a.c. battery can be used in operating it and if a large value of the I.C is used, more melodies can be generated. However, the melody generator could be used by the little children during any festive period.

This project shows low in valuable the study of electrical/computer engineering can be to man. With careful research work most of man's need can be met especially the much need food of life as well as security to life and property at minimum cost. Moreover, experience from this project at minimum cost shows clearly that learning is generally made effective when we putting what we study into practice by ourselves.

Theoretical study of the principles of electrical engineering is one thing and putting the knowledge acquired through study into practice. They are not the same but I must say that practice enhances understanding. Practice makes the seemingly obstruct electronic principles more tangible and easily grabbed by the mind. Initially, one might make many mistakes especially in soldering work, components layout and even in the general principle or biasing of active components but as corrections are made after each mistake, understanding and skill are increased. The experience gained while carrying out this project work is, indeed, great and full of excitement. The more you practice, the more interesting the exercise becomes to the extent that you would not want to stop.

As a result, I am recommending strongly that students of Electrical/Computer Engineering be given the opportunity to embark on project work as often as possible. This will, no doubt, make them more practical oriented and also increase their interest and understanding of the course as they become more inquisitive and desirous of technological breakthroughs.

Without mincing words, project work is invaluable for effective engineering study.

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