VISVESVARAYA TECHNOLOGICAL UNIVERSITY

MINI PROJECT REPORT ON

" AUDIO AMPLIFIER "

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled "**AUDIO AMPLIFIER**" carried out by **Poornima R.M (1NH18EC086), N. Lakshmi Prasanna (1NH18EC072), Shivani Yadav (1NH18EC103), Vutukuri Gowtham (1NH18EC122),** Bonafede students of Electronics and Communication Department, New Horizon College of Engineering, Bangalore.

The mini project report has been approved as it satisfies the academic requirements in respect of mini project work prescribed for the said degree.

Project Guide

HOD ECE

External Viva

Name of Examiner

Signature with Date

1.

2.

ACKNOWLEDGEMENT

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ABSTRACT

The aim of our project is to design an audio amplifier. A low voltage audio power amplifier LM386 is used for this purpose. By using audio amplifier, we can amplify frequencies between 15Hz and 20kHz. The amplifier which is designed for the entire band of frequencies in the audio range is considered as an audio amplifier.

Fig 0.1

CHAPTER 1

INTRODUCTION

The audio amplifier is a device which amplifies the audio signal and makes the signal strong enough to drive a loud speaker. The amplifier can be seen in a place where more sound is required. The audio amplifier is the electronic amplifier that tends to enhance the strength of electronic signals passing through it.

Each audio amplifier consists of 4 components: a power source, a signal input, an output for speaker, a volume button. The volume button is for changing the frequency value from high to low. Classification of an amplifier can be of two main types: The first classification is by function and the other one is by frequency response.
Sound is a type of vibrating energy through a medium, the energy, with in a frequency range is interpreted by human as sound.

Sound is made by 3 elements basically:

1) **Frequency:** how much fast the vibrations are coming
2) **Intensity:** how much loud the sound was
3) **Timber:** quality of the sound

The ears of human can listen sound of frequency ranging from 20 to 20,000 Hz.

The decibel (dB) is used for measuring the sound energy in relevant to how humans perceive loudness.

LM386 Amplifier. The Lm386 is a low power audio frequency amplifier, which can work on low level power supply like batteries in electronic circuits. It is designed as 8 pin mini DIP package. It provides voltage amplification of 20. By using external parts voltage gain can be raised up to 200.

fig 1.1

An amplifier is nothing but an electronic device that amplifies the voltage, current or power of a signal. Amplifiers are divided into two main types:

- First is by function

-second is by frequency response

The functional op-amps are nothing but voltage amplifiers output voltage gets amplified and in power amplifiers power gets amplified.

Frequency response of an amplifier refers to the band of frequencies that the amplifier can be designed to amplify. The components of an amplifier respond differently at different frequencies hence selected components of the amplifier can amplify certain range or band of frequencies. An audio amplifier is one, which can amplify a band of frequencies. LM386 audio power amplifier chip is used in this project.

LM386:

The LM386 IC is an audio power amplifier which is made to be used in low voltage applications only. The gain for given amplifier is like 20 though it goes up to 200 if we introduce components like resistor or capacitors at their respective pins. although the gain can be made anywhere from 20 to 200 using various circuitry, given audio power amplifier becomes a very humble choice for most of the applications. It has applications in almost all domains such as AM-FM radio amplifiers, ultrasonic drivers, power converters etc and so on.

CLASSIFICATIONS OF AUDIO AMPLIFIER:

There are so many types of audio amplifiers defined by the length of their conduction. They are class A, B, AB, and C.

CLASS A AMPLIFIER:

Among all the classes mentioned above class A is the mainly known one. These are the best audio amplifiers because of their very good linearity and it gives high gain and signal distortion is also very less when they are properly designed.

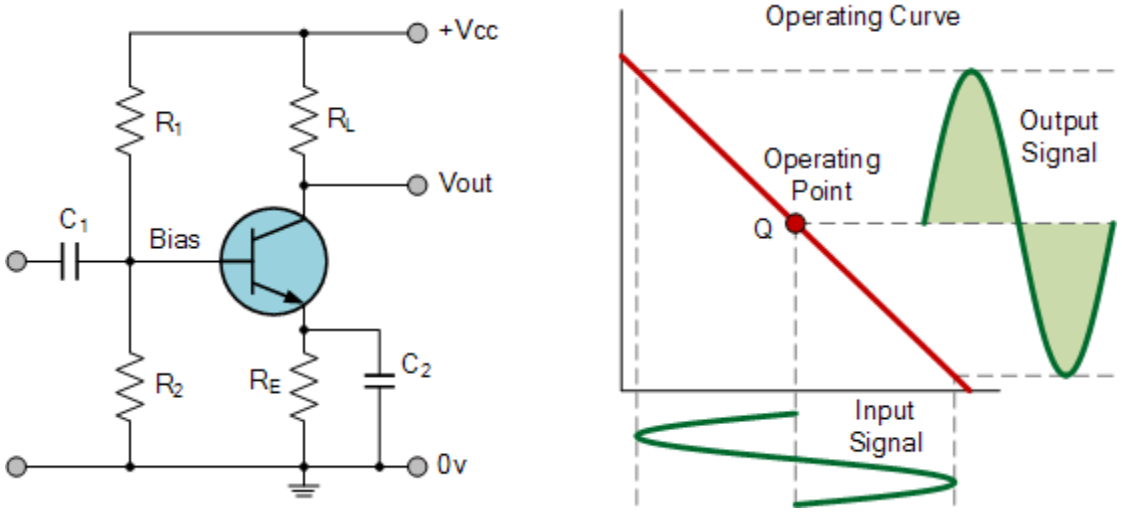

Fig 1.2

CLASS B AUDIO AMPLIFIER:

When we are using class A amplifiers there will be some problems like efficiency and heat. By using class B amplifiers we can avoid this type of problems. When compared to class A, class B can give more efficiency. Quiescent current in class B amplifiers is zero.

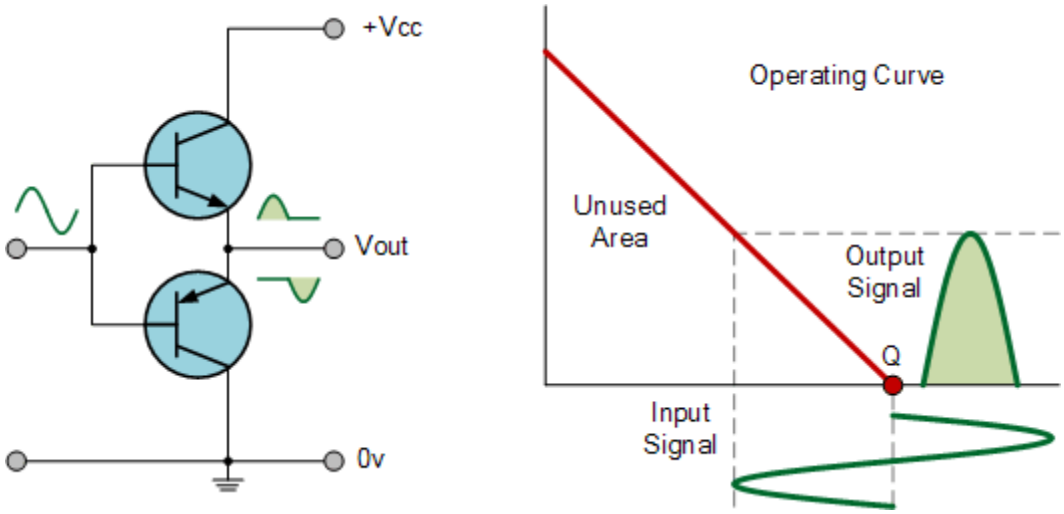

Fig 1.3

CLASS AB AMPLIFIER:

These are the combination of both class A and class B amplifiers. It has advantages of both the amplifiers. By using this we can overcome the crossover distortion caused by class B. Efficiency of class AB is very good when compared to A and B.

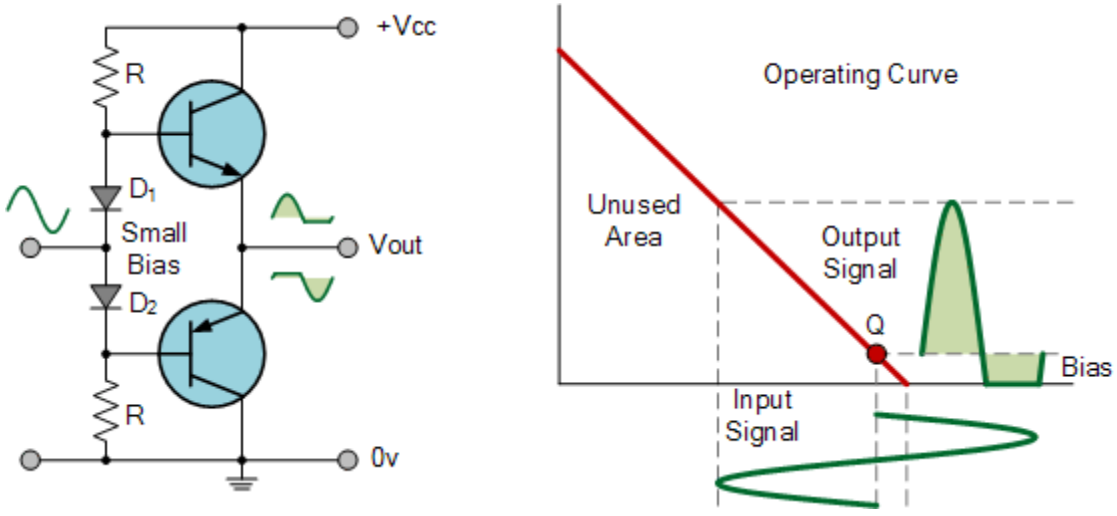

Fig 1.4

CLASS C AMPLIFIEERS:

These amplifiers have great efficiency when compared to above classes, but in case of linearity is very low because other is linear amplifiers. In this class output current is zero for half of the input signal. The efficiency is nearly equal to 80%.

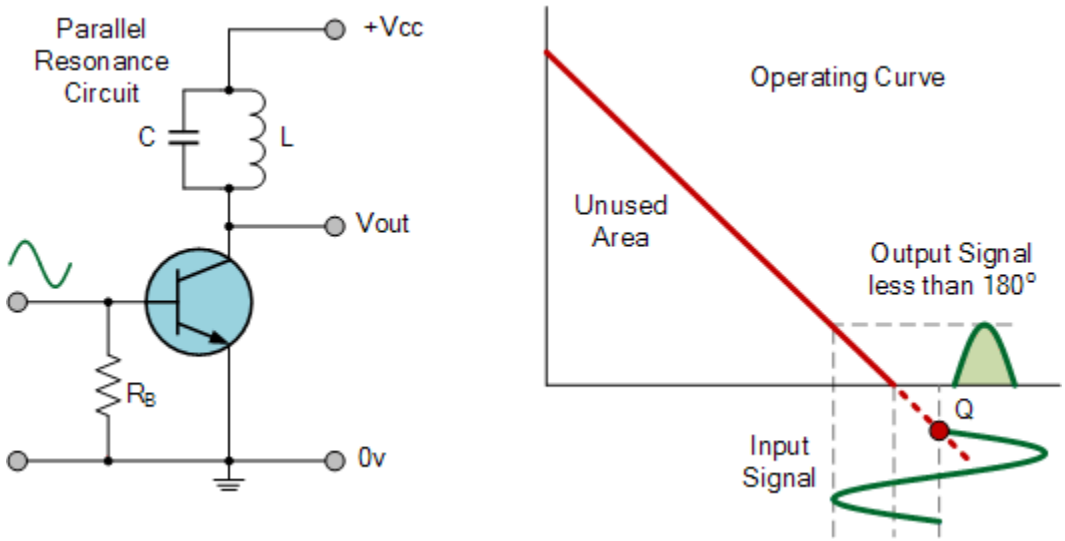

Fig 1.5

There are so many other classifications also but these are good.

EFFICIENCY OF ALL THE CLASSES:

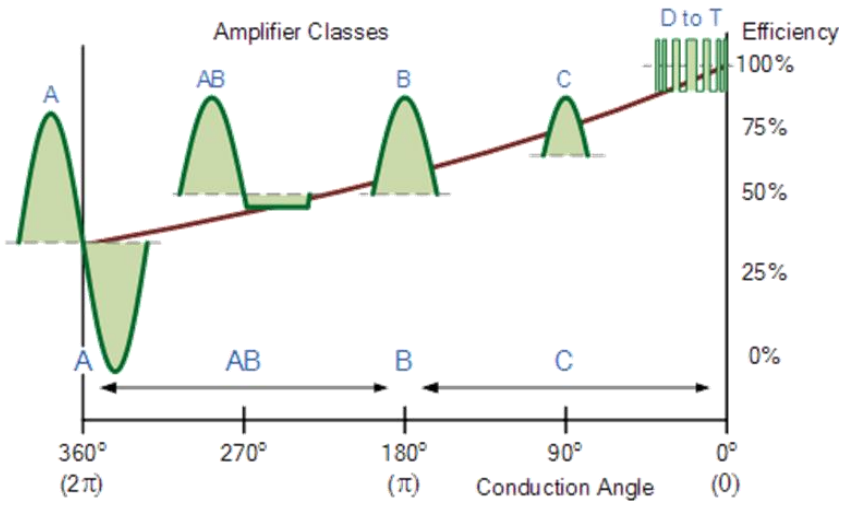

Fig 1.6

CHAPTER 2

LITERATURE SURVEY

As our topic is concerned, we know that an audio amplifier is one which strengthen low power. let’s know about it in depth. In an audible electronic audio signals such as signal from radio chapter.

A literature review is represented to place this into context of available knowledge.

Most commonly used for audio amplifier application's is which has limited use in this digital amplifier. Which can be of main basis necessity as we know it's nothing but

a. Voltage

b. Circuit and current

These are the main importance of power amplifier or an audio amplifier are not which appears in the technical literature at least if we should analyses about it as it's helps in our technical project skills. Let's make an effort to take and hit the essential points. To be appropriate about the content the efficiency of an audio amplifier is hardly important in systems. So here the point of second review is it draws a range of information concerning the salient characteristics about out topic that's LM386.

So, let's know in detail about the power amplifier designed so called LM386.

The main advantage of this LM386 is it uses low voltage and most importantly audio amplifier are limited in terms of power supply.

So, this covers our half of the content of literature review which includes understanding all theoretical literature brochure declaration of design guides. Because of this reason the amplifier

and its related topics shows the output power supply voltage equal.

So, we can approx. or roughly 200% of maximum output signal is expected as concerned to it.

So, it's intended for usage of a class AB audio amplifier. We should be thankful as it buys 10 channels 1000-watt professional powered mixer amplifier.

This completes the starting phase of completion regarding to our audio amplifier. By our two reviews it made us to know that how the Audio amplifier circuit actually amplifies the signal out between output project.

This audio amplifier are important circuits in the number of sensor readout systems. Here, it’s required to amplify small differential signals in presence of large common mode interference. Let's take an application like EIT it's absolutely necessary to measure bioimpedance over a wide frequency range. Henceforth it's needed to design of very small size, wide band mainly with low power consumption. The important parameters that matters audio amplifier are CMRR, Bandwidth, input common mode range and power consumption as well as area of a chip which we have used in our project. In this content different topologies had been used to design IC LM386.

As we are using the topology of three op amp. Because of the symmetry of this configuration common mode errors in input amplifier. if they are tracked, then they are tending to be cancelled out by the output stage subtractor. This gives totally inclusion about the errors such as common mode rejection verses frequency. Due to this phenomenal feature makes this configuration popular as such.

There are two alternatives are available for constructing this op amp instrumentation amplifiers. That is by using bipolar or FET based operational amplifiers. These FET op amps have very low bias current and are generally well suited for use with high source impedance i.e,10^6 ohms.

All these above contents are reviewed in this section are based on op amp topology with resistive feedback.

During the year 2011, Manish Goswami presented a paper on "DC suppressed high gain active CMOS instrumentation amplifier". For biomedical application his content made circuit that it has so many interesting characteristics regarding low noise with simple design.

Made his idea unique and technical that's because he has preferred voltage was of 22nV/√Hz, gain of 45 dB, bandwidth of 5.8 kHz, CMRR in range of 75 dB and power consumption is about 280uw.

Which is absolutely good for biomedical signal processing application? These sort of technical ideas and logic made his project worth and successful as far as the content is concerned.

Taking a step forward in the same year of 2011, Apisai workpiece designed a CMOS IA with 90 dB, CMRR at 2 MHz using capacitive neutralization this circuit is intended for wide range of bioimpedance spectroscopy application in medical imaging.

This was also known for local current feedback in this paper presentation the mismatch mechanism that effect CMRR performance from low to high frequencies are analyzed. These systematic mechanisms which effects CMRR over useful frequency range was capacitive mismatch due to current mirror load at input stage.

This point of mismatching had been minimized using a capacitive neutralization at input stage. This local current feedback was designed, simulated, fabricated using 0.35 um Austria microsystems CMOS process technology made his presentation the better version compared to first topology. Which has been used for the purpose of Audio amplifier.

Henceforth above review of few papers mentioned have been employed direct or indirect current feedback in terms of different topology as far as our project is concerned.

Subtopics which are involved in audio amplifier based on the survey is power capability, power consumption, power efficiency, power matching for desired power and few classifications of PA's which all comes under the application of power amplification. The application which here it's used as to transmit side of RF circuit and typically to drive antennas with high power in this upcoming scenario the scaled-up version of small signal amplifier is used in low power low frequency the circuits of CMOS are actually incapable of high frequency.

In adding of efficiency and linearity these kinds of approaching factors makes power amplications to be determined fastly only by limited supply voltage and heat generation this is real challenge because in which these factors lead to discrete power amplications designs or integration separates from the RF circuit. In the model Vdd is the voltage supply which is basic knowledge we should be knowing.

RL is load and here the inductor is so large that it can sustain constant current throughout the drain compare to some design inductors it can be replaced by the finite one. Because of the reason if it's form of output filter then it includes harmonic tuning and wave shaping as passive circuitry should be involved.

Now, coming to the point of power capability the task which has been of power amplifications application in which its main intention is to deliver a power into the respective load. However, this power is determined by the power supply voltage and the load given.

Secondly, power consumption which is very important quantity in power amplification design it's used for especially for the battery powdered portable devices in the name itself says the consumption of current is drawn from the voltage supply over a period of time.

Thirdly, power efficiency this is the measure of performance of power amplification so power amplification will be higher if and only if power amplification is as better and enhances the required output so all these does matters. So, this overall efficiency proves that the ratio of output power is to the sum of input power and DC input power

These all above few applications of audio amplifier does matters these are commonly used in RF electrons which is been transferred by means of conjugate matching only through the theorem of maximum power transfer. In order to get correct impedance, it has already fixed values in order to get the desired output. The survey has been said in this desired power.

Here’s, the classification of power amplification which has been divided into several categories in which they have grouped bases on two main types:

1) one is of Broadband

2) next is narrowband amplifiers.

The most important of these power amplifications is to grouping according to the nature of their voltage of power amplification classes which reflects the incapability of any single circuit

in order to satisfy the requirements for linearity, power gain, output power and efficiency. However, each class has been designated with the combination of alphabet the following classes are A, B, C, AB, C, D, DE, E, F so on. Common examples which can be given to this above classes are inverse class C, class F etc... these all comes under the real-life application which still makes interesting about these beneficial classifications. The performance needed to justify and satisfy above conditions is that to have efficiency higher. Class G and H amplifier are one which is used in our literature survey of our project audio amplifier with limited use in digital telephony at low megahertz frequencies. This shows the presence of proper class amplifier must be used for our needed approach.

COMPONENTS REQUIRED

1. IC LM386
2. Resistors
3. Capacitors
4. Audio amplifier
5. Speaker
6. Connecting wires
7. Bread board
8. voltage source
9. Stereo Jack 3.5mm

RESISTORS:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

In this project we are using 10 ohm ,1k ohm resistors.

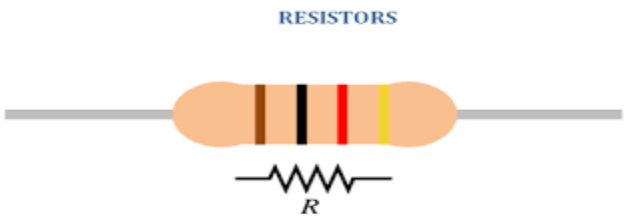

Fig2.1

CAPACITORS:

A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals.

In this project we are using three types of capacitors they are:

*ceramic capacitor

*Electrolytic capacitors

*Bypass capacitor

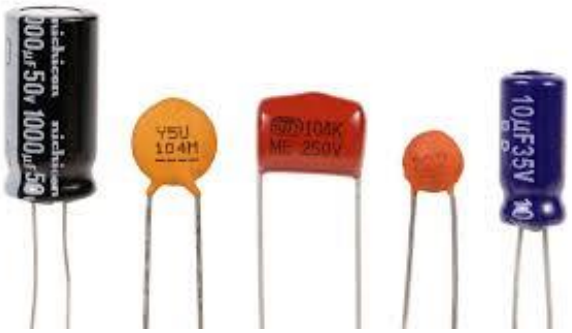

Fig 2.2

Ceramic capacitors:

These are the capacitors which are having the fixed value of capacitance. Ceramic capacitors do not have any polarity. The composition of ceramic material defines the applications and behavior. ceramic capacitors can store only small amount of capacitance.

Here we are using 0.05uf and 100pf ceramic capacitors.

Electrolytic capacitors:

large value of capacitance. These capacitors use an electrolyte to store the large capacitance.

Here we are using 220uf,10uf and 220uf capacitors.

Bypass capacitors:

A bypass capacitor filters the signal. If you want to send an ac signal it may contain some of the dc in it if use bypass capacitor it allows only ac signal and stops the dc signal. It is a ceramic capacitor.

Here we are using 100pf bypass capacitor.

LM386 IC:

This IC is having 8 pins where pin-1 and pin-8 are gain control pins. Pin-2 and pin-3 are non-inverting and inverting pins. Pin-4 is ground pin, pin-5 is output pin, pin-6 is connected to vice, pin-7 is bypass pin. The main use of this IC is in the audio amplifying circuits. This is IC utilizes low power.

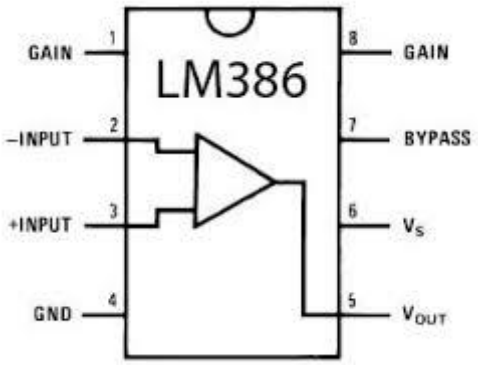

Fig 2.3

Electrical Characteristics of LM386 IC

The voltage gain of this LM386 amplifier can be fix from 20 to 200 with a range of voltage supply 4volts to 12volts or 5volts to 18 volts based on the model. There LM386N-1, LM386N-3, & LM386N-4 are the three models of the amplifier available.

For LM386N-1: 4V is Minimum voltage, 12V is Maximum voltage is , 250mW is the Minimum o/p power and 325mW is typical o/p power .

For LM386N-3: 4V is Minimum voltage , 12V is Maximum voltage , 500mW is Minimum o/p power and 700 is typical o/p power .

For LM386N-4: 5V is Minimum voltage , 18 V is maximum voltage , 500 mW is Minimum o/p power and1000mW is typical o/p power .

The inputs of the amplifier are referenced by ground whereas the output routinely biases toward one half of the voltage supply. The low static current of the amplifier is 4mA and the harmonic distortion will be up to 0.2%

Features of IC LM386

The main features of LM386 chip are as following.

IC LM386 is obtainable in the package of 8-pin MSOP

Exterior components are very less

Operation of Battery

Low static power drain- 4mA

The range of supply voltage is wide which is ranges from 4Volts to 12Volts or 5Volts to 18 Volts.

Input is referenced by ground

Distortion is less 0.2%

Self-centering o/p static voltage

The voltage gain range will be from 20 to 200

SPEAKER:

It is used to deliver the amplified input signal. It is an electronic transducer which converts electric audio signal to a corresponding sound.

Fig 2.4

VOLTAGE SOURCE:

A voltage is a device which is having two terminals and it is maintained at a fixed value. It is the dual if current source. It delivers electric power to respective connected circuit.

Fig 2.5

Audio Jack Male Connector:

Audio jack male connector is used to give or receive the input or output signal.

Fig 2.6

CONNECTING WIRES:

If you want connect a circuit connecting wires plays a main role. In a circuit there will be so many parts which are need to be connected to make the circuit complete. These wires act as medium to connect from one point to another point.

Fig 2.7

BREAD BOARD:

In order to design circuit bread board is the fundamental basic part. It is used to make temporary design of circuits. By inserting the leads of the components into the holes we connect the circuit by using wires instead of soldering. When compared to soldering working with bread board is very use full.

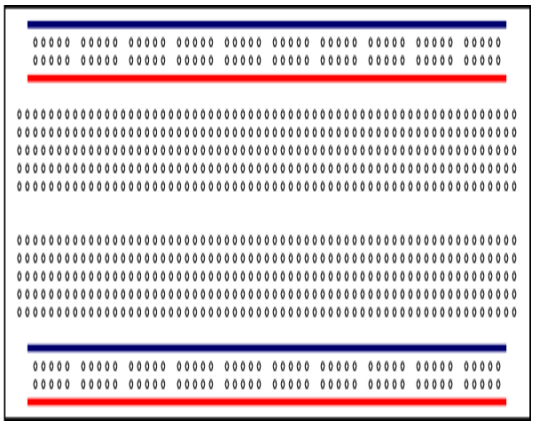

Fig 2.8

CHAPTER 3

Block Diagram

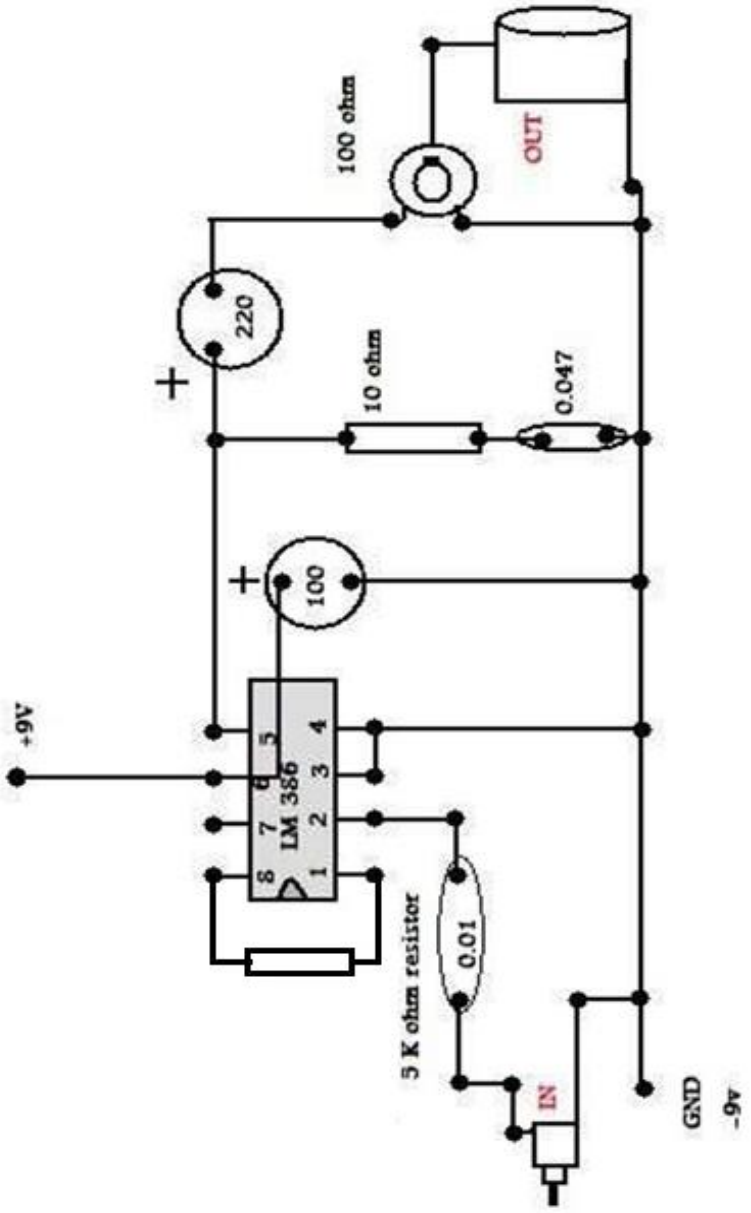

Fig 3.1

Pin 1 and 8 are connected parallelly with a 5k ohm resister.

Input signal is given to pin number 2 in series with 0.01uf capacitor.

Input ground is connected to ground of voltage supply.

Input voltage is given to pin number 6 and 100uf electrolytic capacitor(+ve).

(-vet) terminal is connected to ground.

Pin 5 connected to 220uf capacitor(+ve) and 10ohm resister.

100ohm resistor is connected to 0.047uf capacitor.

0.047uf capacitor is connected to ground.

-(vet) terminal of 220uf capacitor is connected to 100ohm variable capacitor.

Other terminal is connected to ground.

Output terminal of variable resister is connected to a speaker.

And speaker ground terminal is connected to ground.

CHAPTER 4

Proposed methodology

WORKING:

Pin 1 and 8 are used to control the gain output of IC LM386.Here we are using a variable resistor in between pin 1 and 8 in order to adjust the gain.

Pin 2 is meant for providing negative input.

Pin 3 is meant for positive input and here we are grounding the positive input.

Pin 4 is ground pin and pin 3 and 4 are being shorted.

Pin 6 is the power supply of IC LM386.

Pin 5 is the output pin of the IC. Here we will obtain the signal which is half of the supply voltage. Hence, in both half of the signal we will get the full swing of the provided signal.

Pin 7 is usually not required in this audio amplifier as this pin (BYPASS) allows to access the un-amplified signal in case if needed.

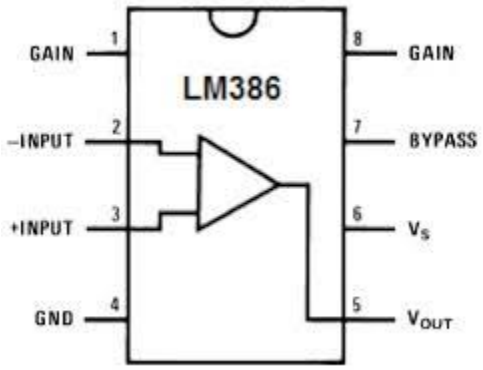

Fig 4.1

Pin Number	Pin Name	Function
1	Gain	Gain Setting Pin
2	Input –	Inverting Input
3	Input +	Non – Inverting Input
4	GND	Ground
5	Vout	Output
6	Vs	Power Supply Voltage
7	Bypass	Bypass decoupling path
8	Gain	Gain Setting Pin

T 4.1

Functionally, the IC LM386 can be divided into 3 major parts; gain control; Power; Output, Bypass. For making the connections. Firstly, connect the pin 4 to power supply and ground the pin 6. After that we should connect the input for that any audio source can be connected for example microphone or mobile phone. Here we are giving input from a mobile phone using stereo jack of 3.5mm connector. Stereo jack has 3 connections such as right audio, left audio and ground. As the IC is a simple audio amplifier, we need to connect either of the right audio or left audio including the ground connection. a capacitor can be connected in series with the input to filter out the DC components. The gain of the IC LM386 is 20 internally.

Now, For the output connection, first of all we will connect a capacitor and a resistor of value o.047uF and 10 ohms respectively in series in between output pin 5 and ground. This will make a Zobel network. Zobel network comprising of a resistor in series with a capacitor. This is used in order to fix the input impedance of the driver.

At last we will do connection for speaker. IC LM386 audio amplifier can drive any speaker in the range of 4 ohm to 32 ohm and here we are using 8ohm speaker through a 10K variable resistor. This helps in filtering out the excessive DC signals.

CHAPTER 5

RESULTS AND APPLICATIONS

Result:

The working model of the Audio Amplifier is made. And the output is can be listened from the 8ohm speaker. When we sent the low frequency sound through the audio jack using mobile the sound gets amplified and increases its frequency and sound with more frequency comes out from the speaker.

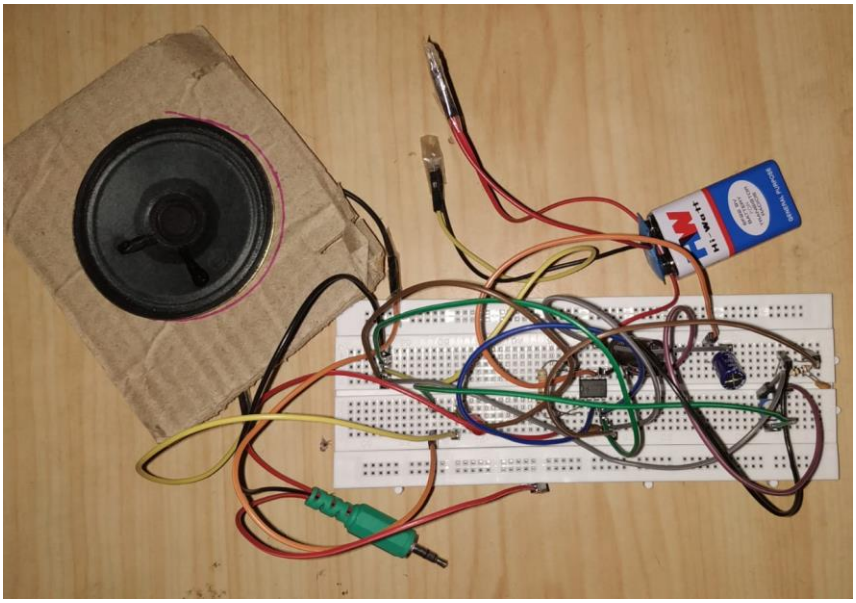

Fig 5.1

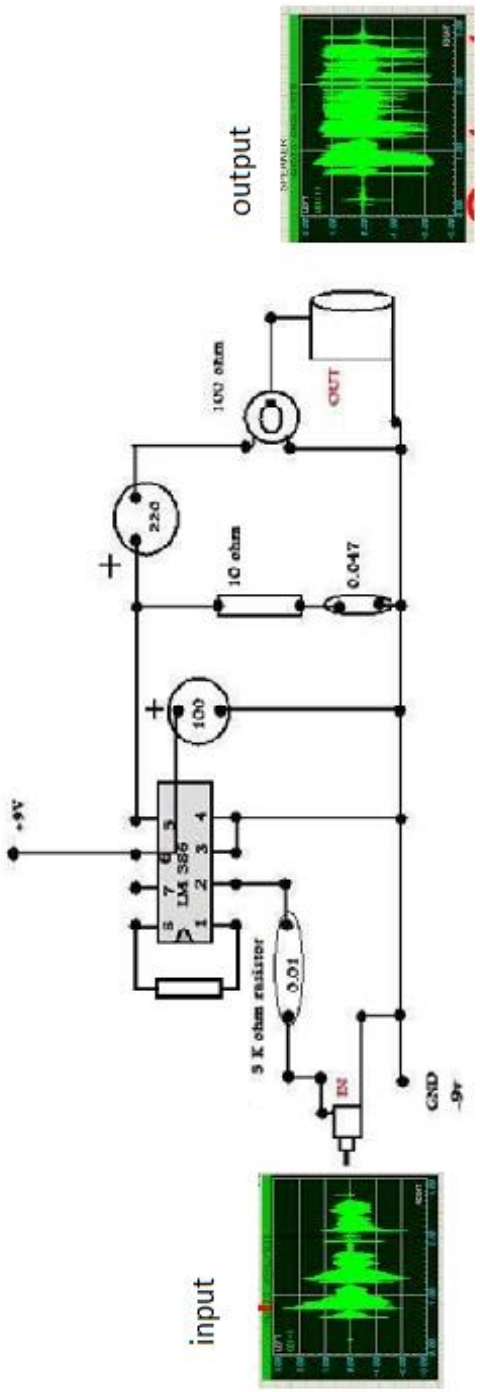
output
100 ohm
OUT
220
10 ohm
0.047
100
+9V
LM 386
5 K ohm resistor
0.01
IN
GND
-9v
input

Fig 6.2

APPLICATIONS OF AUDIO AMPLIFIERS:

There are so many applications of audio amplifiers. But the main are

1. In public address amplifier system.
2. Tape recorder.
3. TV, VCR and CD player.
4. Stereo amplifiers.
5. RC coupled amplifiers are basically voltage amplifiers.
6. It is used to record the voice from microphones.
7. It is used in small speakers that are operated with a battery in FM radio devices.
8. They are also used in line divers, servo divers, TV sound systems, ultrasonic divers.
9. It is used to strengthen the low audio signal to make strong signal.
10. In radio amplifiers, especially in AM and FM..
11. Portable audio players.
12. In TV sound systems.
13. Line drivers.
14. Ultrasonic drivers.
15. Servo drivers.
16. Power converters.

Advantages:

1. It has wide frequency response as well as large bandwidth.
2. It is most convenient and cheap amplifier.
3. It provides high audio fidelity.
4. It has a very low amplitude distortion.
5. It provides a very low frequency distortion as well.

Disadvantages:

1. It has a tendency to become noisy with more use especially in moist climate.
2. The voltage gain reduces at low as well as high frequencies.
3. It provides poor impedance matching and hence it cannot be used as a final stage of an amplifier.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

Conclusion:

Hence, we can see how a low frequency audio signal which is given through an audio jack is converter in to high frequency audio signal which can be listened by our ears at high volume using voltage source.

Future Scope:

In radio amplifiers, especially in AM and FM, Portable audio players, In TV sound systems, Line drivers, Ultrasonic drivers, Servo drivers, Power converters, it can be used to listen songs in a single room.

Right now in the world of live event audio our amplifiers are already pretty advanced.

The amplifiers we use have built in DSP (digital signal processing) that allow us to control a whole array of things from EQ and phase to signal limiting and time delay. The amplifiers we use (L-Acoustics) are also designed to be paired with other products from the same brand and have settings for each speaker type to make sure that you have the proper power output, etc. The amplifiers also have monitoring technology so that I can see in real time what is happening with the amplifier and I can know right away if, say for instance, a voltage spike happens or a fan stops working.

The main advancements I see are definitely more about how to get the same SPL out of speakers using less power. The inefficiency in amps is given off as heat, so the more efficient the amps gets, the less power we need and the less they heat up. A lot of the things we are seeing today are definitely more in the realm of signal control, etc though and the efficiency is also down to how each individual engineer or tech sets up the amp.

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