VISVESVARAYA TECHNOLOGICAL UNIVERSITY

MINI PROJECT REPORT ON

"MUSIC OPERATED LED'S"

SUBMITTED BY:

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled "MUSIC OPERATED LED, s" carried out by **G.Reshma(1NH18EC037)** bonafide 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 (Mrs.Thanuja I.K)	HOD ECE (Dr.Sanjeev Sharma)
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External Viva

Name of Examiner	Signature with Date
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Abstract:

The last few years showed us that science and technology have made a huge impact on our day -to-day lives. We have seen tremendous advancements in electronics in all walks of life. This mini project involves the application of semiconductor devices in the field of Entertainment and Advertisement.

In science we know that most of the devices are made for our requirements in daily life like electronic devices such as tube light, fan, air conditioner etc. These are operated by movement of charges under the application of electric field.

The music operated LED operates by the electric field that is applied through an audio signal. It can be used for celebrations like wedding anniversary, birthday, festivals, etc. It is composed of few electronic components like resistors, Capacitors, LED, power supply, microphone and transistor.

This circuit is made up of 4 LED's (3v) and their flashing is controlled by means of an audio signal. The LED's are connected to collector of each transistor and thus they glow alternatively.

ACKNOWLEDGEMENT

The satisfaction that accompany the successful completion of any task would be, but impossible without the mention of the people who made it possible, whose constant guidance and encouragement helped us succeed.

We thank **Dr. Mohan Manghnani**, Chairman of **New Horizon Educational Institution**, for providing necessary infrastructure and creating good environment.

We also record here the constant encouragement and facilities extended to us by **Dr.Manjunatha**, Principal, NHCE and **Dr. Sanjeev Sharma**, head of the department of Electronics and Communication Engineering. We extend sincere gratitude to them.

We sincerely acknowledge the encouragement, timely help and guidance to us by our beloved guide **Ms. Thanuja I.K** to complete the project within stipulated time successfully.

Finally, a note of thanks to the teaching and non-teaching staff of electronics and communication department for their co-operation extended to us, who helped us directly or indirectly in this successful completion of mini project.

G Reshma (1NH18EC037)

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CHAPTER 1

INTRODUCTION

We have seen in carnivals and temples where the audio is played and serial lights are lit up to celebrate the festive occasion. In this mini project we have integrated the audio with the LED lights. The illuminations of LED's are controlled by the audio that is played. The lights turn ON and OFF according to the beats of the music. These lights glow according to the length and pitch (volume) of music beats, basically these are designed to pick the high intensity sound like bass sound. So these lights follow the high pitch beats in music like drum beats, and Turn ON and OFF according to music pattern. However the sensitivity of the circuit can be increased to pick the low notes too.

Some of the other approaches previously adopted are the LED's which would just follow a set pattern and we can only control the speed. Now we are taking this to next level, where the LEDs will flash according to music, just like Disco light, as discussed above. This musical LEDs circuits based on transistor BC547. This circuit is very simple and easy to build. It just requires few basic components and it looks very compact.

CHAPTER 2

LITERATURE SURVEY

1. www.google.com/4LED

The circuit and the related information was acquired from this web site.

2. **www.wikipedia.com/4LED**

A similar circuit, its working and explanation was referred from this source.

3. "A summary of LED lighting impacts on health", Cosmin Ticleanu Paul Littlefair, International Journal of Sustainable lighting, Issue June 2, 2017.

4. Chen Jie, at el, 2013 in this paper the heat dissipation of LED is taken into account. This is done by CFD simulation software that gives a model. Some of the factors taken into consideration are thermal resistance, thermal emissive values, conductivity and load. With these factors the measurements are analysed and the dissipation is computed. After analysis the ideal LED working temperature is optimized. This can improve the LED lamp lifetime effectively. This also has more importance in the future LED design process.

5. Zeng Dehuai, Liu Yuan, at el in their work , the critical parameter for determining the device performance and reliability is based on heat removal in high power light emitting diode devices. This is important to lower the junction temperature to extend the LED lifetime. Thermal performance of LEDs is crucial since low junction temperatures extend the LED's lifetime. This increases the brightness without increasing the allowable maximum temperature. The thermal characteristics are improved by using phase change heat sink. A novel phase change heat sink is developed with 3-D integral fin boiling structure. Two different fin structures were obtained with chopping ploughing-extrusion compound Forming technology and it is observed by scanning electron microscope (SEM). In this way

the junction temperature of LED is lower than the one with copper rod. A novel high-power LED package phase change heat sink is analyzed and 3D integral fin boiling structures for high-power LED is developed that reduces the thermal resistance.

CHAPTER 3

PROPOSED METHODOLOGY

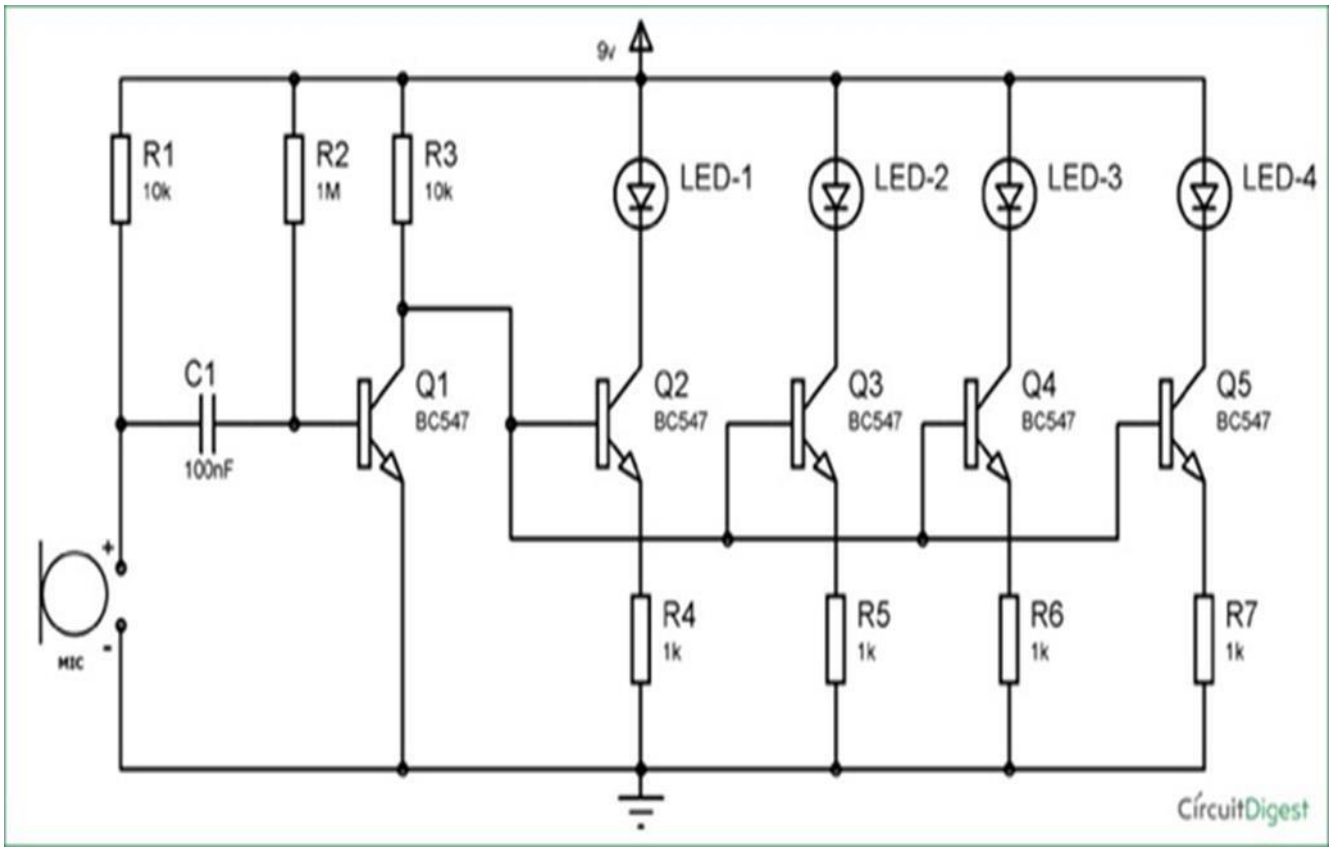


Fig 1

In this audio controlled flashing of LED the condenser microphone picks up the sound signals and converts them into voltage levels. These voltage signals are fed into RC filter or high pass filter (R2 and C1) to eliminate the low frequency noise from the sound. An NPN transistor (Q1- BC547) is used to amplify the signals from the high pass filter. These music signals are given to the array of four transistors that works as amplifier, and glows the four LEDs according to the sound pattern. This generates a very interesting sequence of flashing LEDs which follows the beats as per their intensity or pitch. We can also add more LEDs with transistor to make it more attractive.

COMPONENTS REQUIRED

S.No.	Components required	Remarks	Quantity
1	Condenser MIC		1
2	LED's	Low Power	4
3	Transistor	BC547 NPN transistor	5
4	Resistor	0.5amp	10k(2) 1k(4) 1M(1)
5	Capacitor	Ceramic	1
6	Battery	9V	100nF
7	Breadboard		
8	Connecting Wires		

CHAPTER 4

PROJECT COMPONENT DESCRIPTION

Condenser Microphones: Condenser means capacitor and it is an electronic component which stores energy in the form of an electrostatic field. The term condenser is actually obsolete but as stuck as the name for this type of microphone, which uses a capacitor to convert acoustical energy into electrical energy.

Condenser microphones require power from a battery or external source. The resulting audio signal is stronger signal .Condenser also tend to be more sensitive and responsive than dynamics, making them well-suited to capturing subtle nuances in a sound. They are not ideal for high- volume work, as their sensitivity makes them prone to distort.

How Condenser Microphone Work

A capacitor has a pair of plates with a voltage applied between them. In the condenser mic, one of these plates is made up of very light material and acts as the diaphragm. The diaphragm vibrates when struck by sound waves, changing the distance between the two plates and therefore changing the capacitance. Specially, when the plates are closer together, capacitance increases and a charge current occurs. When the plates are further apart, capacitance decreases and a discharge current occurs.

A voltage is required across the capacitor for this to work. This voltage is supplied either by a battery in the mic or by external phantom power.

Cross-Section of a Typical Condenser Microphone

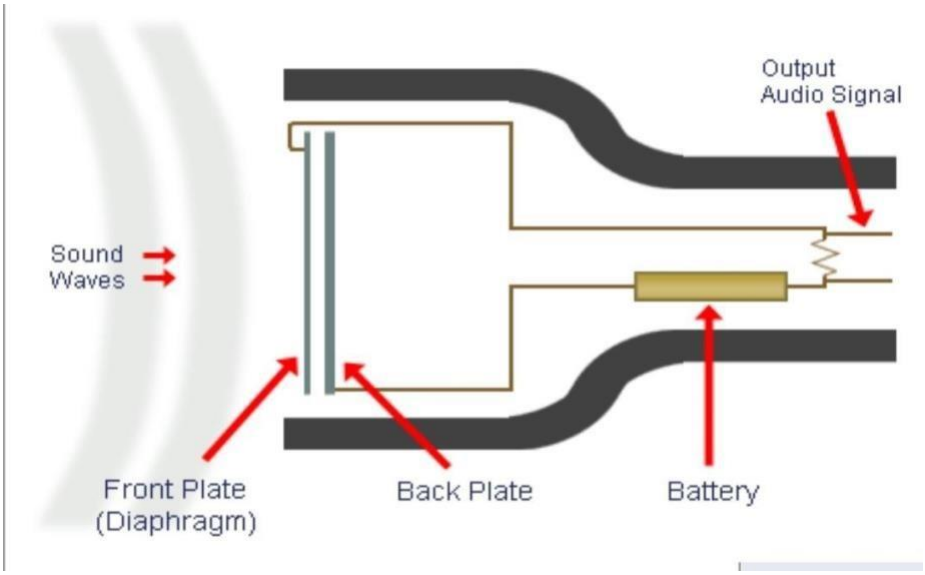


Fig 1.1

Condensor Microphone

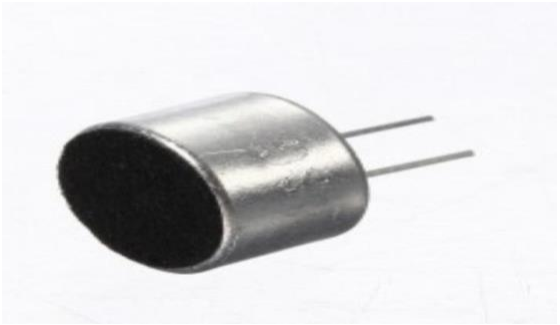


Fig 1.2

Superior Sound Quality

Due to low mass, the diaphragm of a condenser microphone follows the sound waves more accurately than that of a dynamic microphone with a heavy moving coil attached. Condenser microphones, offers superior sound quality. Among all the microphone types, condenser microphone have the widest frequency response and the good transient response (transients are fast more amount of energy, e.g. the attack of a drum in the pick an acoustic guitar). These kind of microphones have more amount of sensitivity and lower amount noise than other kind of microphones.

Types of Microphones

There are two kinds of microphone

1) Dynamic Microphone

2) Condenser Microphone.

3) Ribbon Microphone

Dynamic Microphones

Fig 1.3

- This kind of microphone can be used for vocals.
- It does not require a power supply.
- Low cost.

Condenser Microphone

Fig1.4

- It is good for recording vocals and acoustic guitars.
- Perfect for precision recording and capturing suitable nuances on pianos or acoustic guitars.
- There is no need of power supply.
- They are sensitive to breathing.

Ribbon Microphone

- It is a Sensitive microphone.
- It is used for vocals, choirs, piano, strings, and woodwind.
- Perfect for recording multi-instruments in studio.
- It is quite expensive.

The Shure SM57 microphone is an industry standard mic that is a must-have in studio.

They are extremely durable and are perfect for recording high volume and percussive.

Instruments such as snare drums, guitar amplifiers and even vocals are very safe.

Fig 1.5

Another industry standard microphone comes in the form of the SM58 microphone. It is Ideal for musicians who travel and those who record frequently. The mesh grille, windshield and sturdy construction makes this very strong and reliable.

Operation on Microphones

The Basics

It is a type of transducer which converts energy from one form to another. The microphones convert sound waves into electrical energy. There are different types of microphones which converts energy but all share one thing in common: The diaphragm. This is a thin piece of material (such as paper, plastic or aluminum) when it is struck by sound waves it vibrates. In typical hand-held mic like the one below, the diaphragm is located in the head of the microphone.

Fig 1.6

When the diaphragm vibrates, it causes other components in the microphone to vibrate. These

Vibrations are converted into an electrical current which becomes the audio signals.

Other Types of Microphone

There are different types of microphones and the difference can be divided into two areas:

(1) The type of conversion technology they use.

This refers to the technical methods the microphone uses to convert sound into electrical. The most common technologies are dynamic, condenser, ribbon and crystal. Each has advantages and each are generally more suited to certain types of application.

(2) The types of application can be for general use and can be used effectively in many different situations.

Others are very specialized and are only really useful for their intended purpose. The characteristics of such microphones include directional properties, frequency response and impedance.

Microphone Level & Line Level

The electrical current generated by a microphone is very small. It is referred to as microphone level. This signal is typically measured in mV. Before it can be used for the signal needs to be amplified, usually to line level. This strong signal is used by audio processing equipment and common domestic equipment such as CD player, tape machines, VCRs, etc.

These amplifications are achieved in one or more of the following ways:

1) Some microphones have tiny built-in amplifier which boost the signal to a high mic level

Or line level.

2) The microphone can be fed through a small boosting amplifier, often called line amp.
3) Sound mixers have small amplifier in each channel.
4) Attenuators can accommodate microphone of varying levels and adjust them all to an even line level.
5) The audio signals are fed to power amplifier-a specialized amp which boosts the signal enough to be fed to loudspeakers.

LED Working

The light emitting diode (LED) is a two-lead semiconductor diode. In 1962, Nick Holonyk came up with an idea of light emitting diode and he worked for the general electric company. The LED is a special type of diode and they have the characteristics of a PN junction diode. In PN junction diode the energy is dissipated in the form of heat. In LED the energy is dissipated in the form of light. Therefore the LED allows the current to flow in forward direction when it is forward biased and current is blocked the reverse direction when it is reverse biased. The LED occupies a small area which is less than the $1mm^2$.

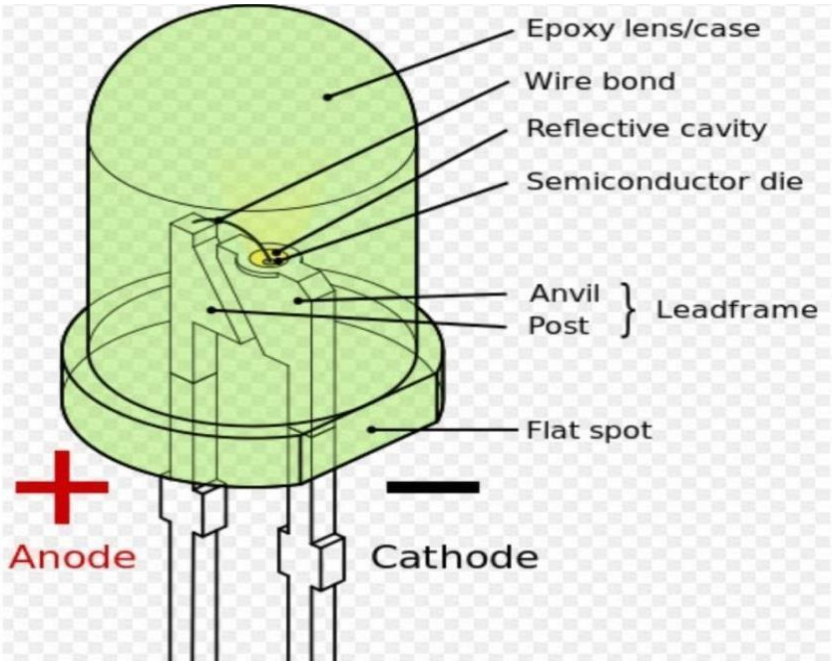


Fig 2.1

Light Emitting Diode

In LED, when the diode is forward biased, then the electrons and holes are moving fast across the junction and they are combining constantly. Soon after the electrons moved from the n-type to the p-type silicon, it combines with the holes, then it disappears. Hence it makes the complete atom more stable and it gives the little burst of energy in the form of a tiny packet or photon of light.

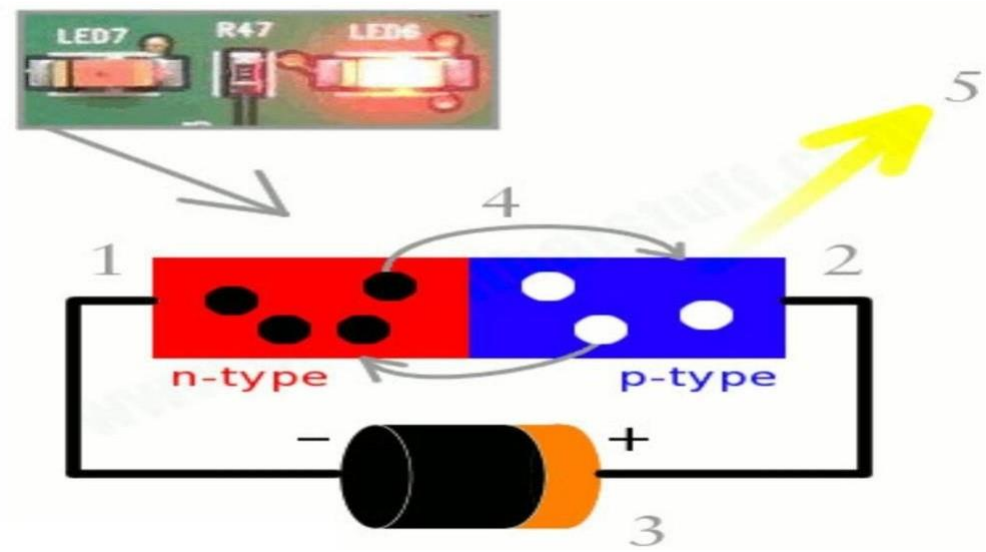


Fig2.2

Working of Light Emitting Diode

The above diagram shows how the light emitting diode works and the step by step process of the diagram.

- From the figure, we can observe that the N-type silicon is in red color and it contains the majority carrier electrons which are indicated by the black circles.
- The P-type silicon is in the blue color and it contains majority carrier holes, which is indicated by the white circles.
- When it is forward bias i.e power supply across the p-n junction is applied and pushing of the electrons from n-type to p-type takes place and pushing the holes in the opposite direction.
- The electron and holes at the junction are combined.
- During recombination the energy is given out in the form of photons.

TRANSISTOR

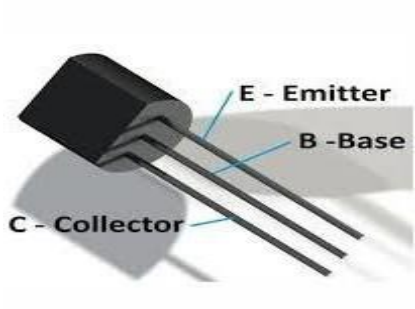


Fig 3.1

TRANSISTOR AS AN AMPLIFIER

A transistor behaves as an amplifier by increasing the strength of a weak signal. The applied DC voltage at the base keeps the transistor in forward bias. Therefore, a small input voltage results gives a large output voltage, in this way transistor works as amplifier.

What is a Common Emitter Amplifier?

The common emitter amplifier is basic single stage Bipolar junction transistor amplifier . The input of this amplifier is given to the base terminal, the output is taken from the collector terminal and the emitter terminal is common for both the input and output. Here we use a common emitter configuration.

Working of Common Emitter Amplifier

The circuit diagram shows the working of the common emitter amplifier circuit. It consists of voltage divider circuit that is used for biasing. Biasing stabilizes the Q point. The voltage divider biasing has a voltage divider with two resistors that are connected in a way that the midpoint is used for supplying base bias voltage.

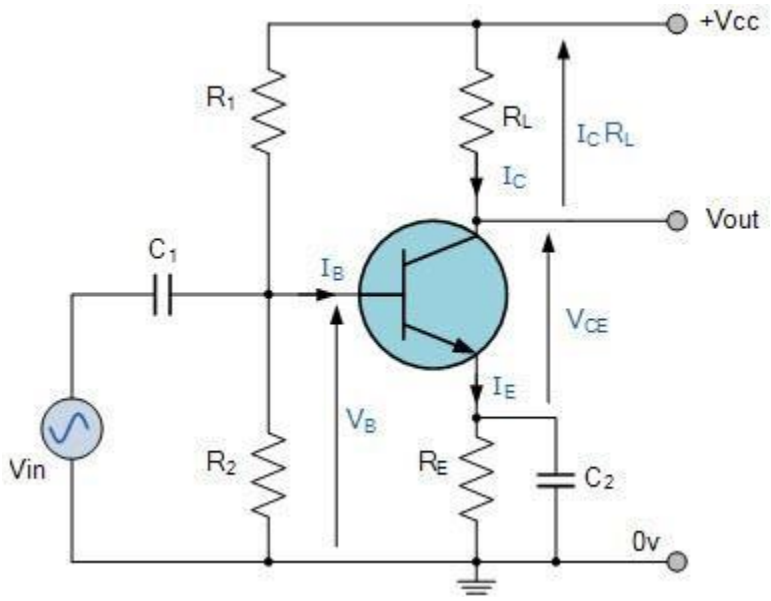


Fig 3.2

Common Emitter Amplifier Circuit

- R1 resistor is used for the forward bias.
- R2 resistor is used for the development of bias.
- RL resistor is used at the output it is called as the load resistance.
- The RE resistor is used for the thermal stability.
- The C1 capacitor is used to separate the AC signals from the DC biasing voltage and the capacitor is known as the coupling capacitor.
- If R2 is increased, then forward bias increases and R1 and bias are inversely proportional to each other.

WORKING

When small voltage is applied at the base terminal, the small amount of the current flows to the base. Then large amount of current will flow in collector with the help of resistor at the collector

terminal. Hence there is a large amount of current present at collector. Due to transistor action there is a phase reversal of 180 degrees. In this way common emitter circuit acts as an amplifier.

CHARACTERISTICS

- The voltage gain of common emitter amplifier is medium
- The power gain is high in the common emitter amplifier
- There is a phase relationship of 180 degrees in input and output
- In the common emitter amplifier, the input and output impedance are medium

DATA SHEET OF A TRANSISTOR BC547

SL NO	CHARACTERISTIC	SYMBOL	RATING	UNIT
1	Collector-Base voltage	V_{CBO}	50	V
2	Collector-Emitter voltage	V_{CEO}	45	V
3	Emitter-Base Voltage	V_{EBO}	6	V
4	Collector Current	I_c	100	mA
5	Base Current	I_b	20	mA
6	Emitter current	I_E	-100	mA
7	Collector Power Dissipiation	P_C	400	mW
8	Junction Temperature	T_J	150	^{O}C

RESISTOR

A resistor is passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, they are used to reduce current flow, divide voltage, bias active elements, and terminate transmission lines, etc. As a part of motor controls, High-power resistors that can dissipate many watts of electrical power as heat, in power distribution systems. Resistance will change with respect to temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, forces, or chemical activity.

Fig 4.1

Resistors are common elements of electrical and electronic circuits and practical resistors such as discrete components can be composed of various compounds and forms. They are also implemented within integrated circuits. The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance falls within the manufacturing tolerance, indicated on the component.

CAPACITOR

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

Fig 5.1

The property of a capacitor is known as a capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor is generally known as condenser.

The capacitors were created in the 1740's when European experimenters discovered that electric charge cloud be stored in water-filled glass jars that is known as Leyden jars. In 1748, Benjamin Franklin connected a series of jars together to create electrical battery, from their visual similarity to a battery of cannon, which became that English term electric battery. The capacitor allows alternating current to pass and blocks direct current. In analogue filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems, they stabilize voltage and power flow. The property of energy storage in capacitors was exploited as dynamic memory in early digital computers.

FILTERS

1. LOW PASS FILTER

A low pass filter is a filter which passes only low frequency signals and blocks high-frequency signals.

Low-frequency signals have a less resistance and high-frequency signals have a much harder getting through, which is why they are known as low pass filter.

They can be constructed using resistors and capacitors and even inductors. A low pass filter consisting of a resistor and a capacitor is known a low pass RC filter. And a low pass filter with a resistor and an inductor is known a low pass RL filter.

Low pass RC filter

A Low pass RC filter is composed of a resistor and capacitor which passes through low-frequency signals, and blocks high frequency signals.

The resistor is placed in series to the input signal and the capacitor is placed in parallel to the input signal to create a low pass RC filter, such as shown in the circuit below:

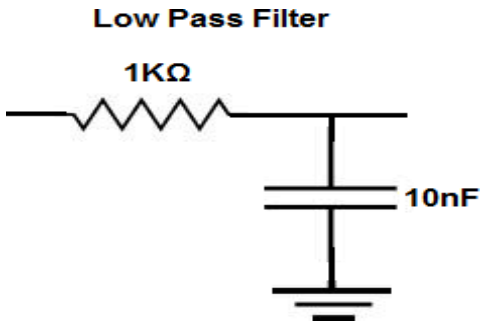


Fig 5.2

2. HIGH PASS FILTER

A High Pass Filter is exact opposite to low pass filter circuit as the two components have been interchanged with the filters output signal now being taken from across the resistor.

Whereas the low pass filter only allowed signals to pass below its cut-off frequency point, the passive high pass filter circuit as its name implies, only passes signals above the selected cut-off point , consider the circuit below.

High pass RC filter

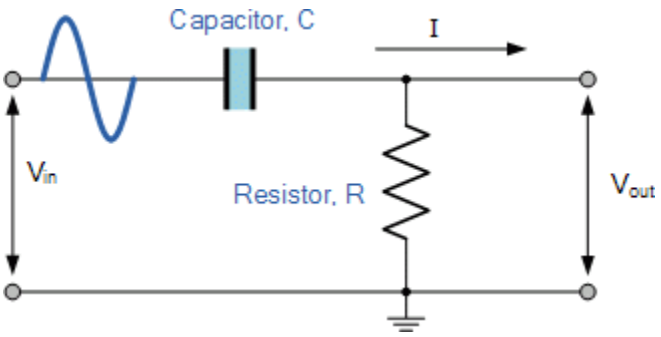


Fig 5.3

We have seen that the passive high pass filter is the exact opposite to the low pass filter. This filter has no output voltage from DC (0Hz), up to a specified cut-off frequency (fc) point. This lower cut-off frequency point is 70.7% of the voltage gain allowed to pass.

CIRCUIT DIAGRAM

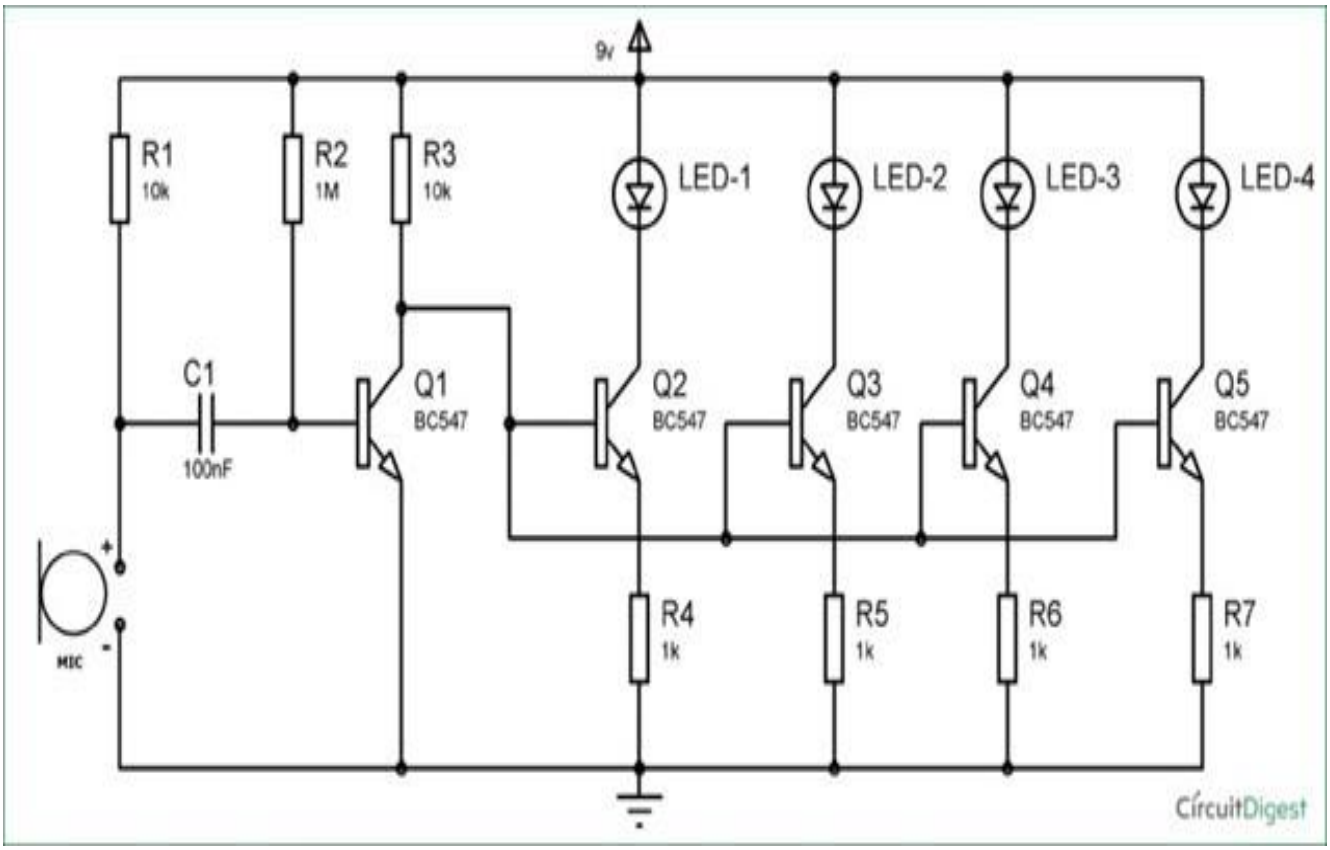


Fig 6

WORKING

In this audio controlled flashing of LED the condenser microphone picks up the sound signals and converts them into voltage levels. These voltage signals are further fed into RC filter or high pass filter (R2 and C1) to eliminate the noise from the sound. An NPN transistor (Q1- BC547) is used to amplify the signals from the high pass filter. These music signals are given to the array of four transistors. Transistor in this array works as amplifier, and glows the four LEDs according to the sound pattern. This generates a very interesting sequence of flashing LEDs which follows the beats as per their intensity or pitch. We can also add more LEDs with transistor to make it more attractive.

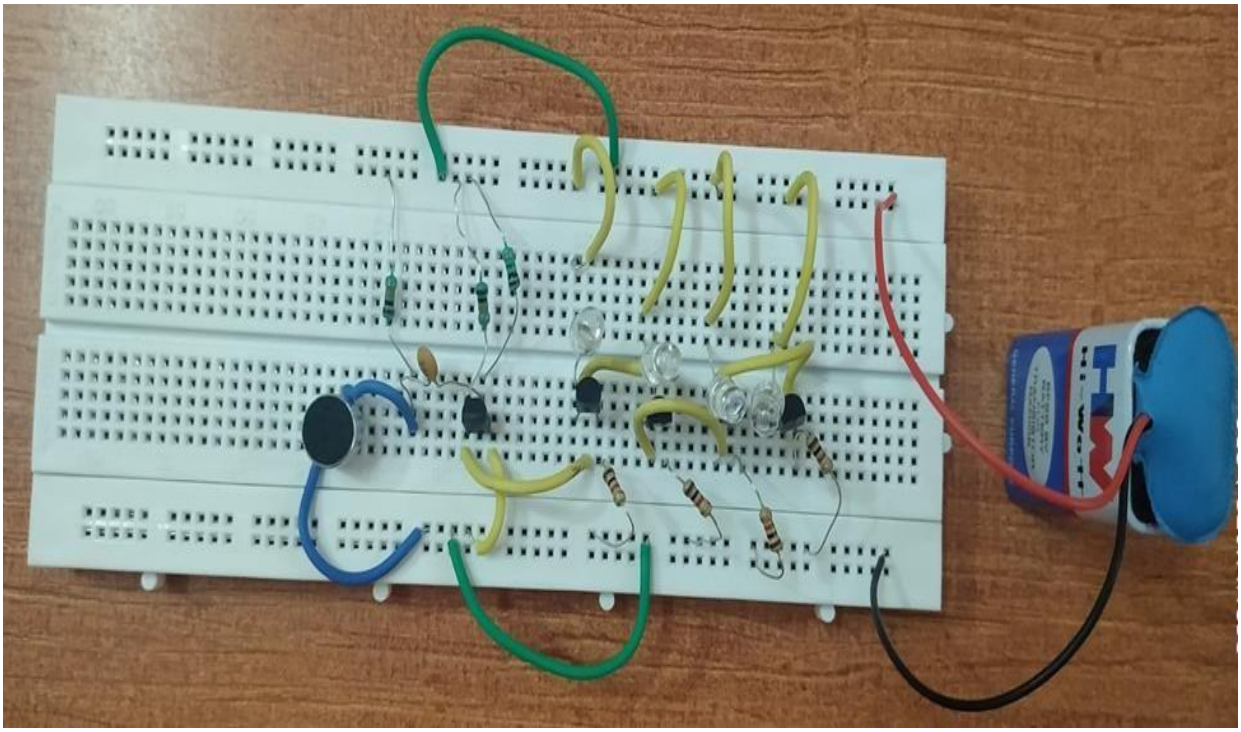
We can adjust the sensitivity of microphone by changing the value of R2 and C1, by using the formula for R-C filter:

$F = 1/ (2\pi RC)$

F is the cut off frequency and it allows only the frequency greater than F. It can be easily deduced that higher the value of RC lesser the cut off frequency and higher the sensitivity of microphone. And higher the sensitivity of circuit implies that the microphone can pick low volume sounds and hence LEDs can glow on low pitch music also. So by adjusting its sensitivity we can make it less sensitive to react only on high note beats or we can also make it more sensitive to react on every little beat in the music. Here we have set its sensitivity at moderate level.

CHAPTER 5

Result



CHAPTER 6

CONCLUSION AND FUTURE SCOPE

- The music operated LED circuit can be used for any visual signification in highways.
- It can be used in advertisement hoarding to display products with audio facility.
- It can be used for signalling purpose.
- It can be used in as flashing beacon.

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