A MINI PROJECT REPORT ON

Using Op-Amp Design a variable Square wave, Triangular wave, Pulse and add any two signals with adder circuit

Submitted in the partial fulfilment of the requirements for the award of degree of

BACHELOR OF TECHNOLOGY

In

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

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Under the esteemed guidance

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE, New Delhi& affiliated to JNTU Kakinada)

1-378, ADB Road, Surampalem, Near Peddapuram, E.G District-533437

2018-2022

CERTIFICATE

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This is to certifying that the Mini-project titled as "Using Op-Amp Design avariable Square wave, Triangular wave, Pulse and add any two signals with adder circuit", that is being submitted by

ALLADA PAVANKUMAR

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In partial fulfilment of the requirement for the award of the Degree of Bachelor of technology in ELECTRONICS AND COMMUNICATION ENGINEERING of PRAGATI ENGINEERING COLLEGE is record of bonafide work carried out by me .

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With regards

ALLADA PAVANKUMAR

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INDEX

CONTENTS

1. **Introduction**
2. **Power supply**
3. **Circuit Diagram**
4. **Circuit Components**
5. **Working of the Circuit**
6. **Advantages**
7. **Applications**
8. **Conclusion**
9. **Result**
10. **References**

INTRODUCTION

An Operational Amplifier or op-amp is a voltage amplifying device designed to be used with e xternal feedback components such as resistors and capacitors between its output and input term inals. It is a high-gain electronic voltage amplifier with a differential input and usually a single-ended output. Op-amps are among the most widely used electronic devices today, being used in a vast array of consumer, industrial, and scientific devices.

However, an op-amp is just one type of differential amplifier. Other includes,

- A fully differential amplifier which is like an op-amp, but with two outputs.
- The instrumentation amplifier which is usually built from three op-amps,
- The isolation amplifier which is like an instrumentation amplifier, but with tolerance to common-mode voltages that would destroy an ordinary op-amp
- A negative-feedback amplifier which is usually built from one or more op-amps and a resistive feedback network.

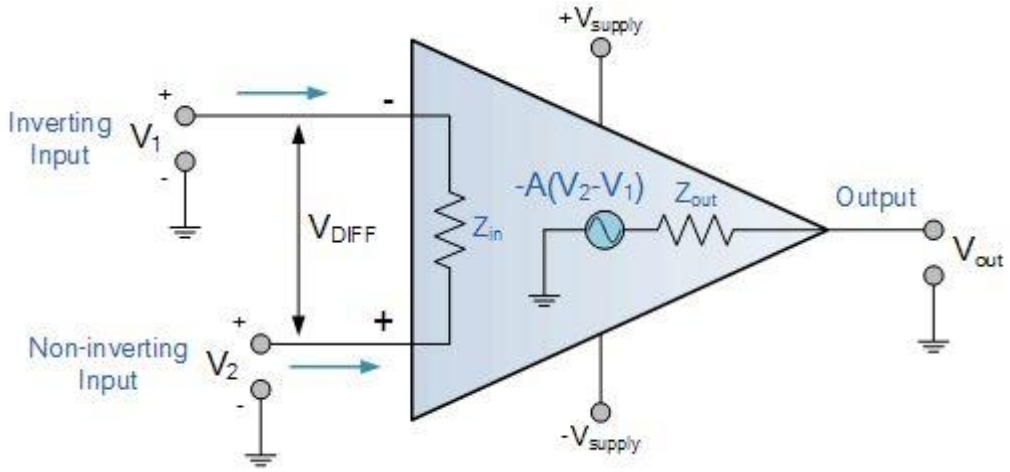


FIGURE 1.1

Op-amp operation

The amplifier's differential inputs consist of a non-inverting input with voltage (V+) and an inv erting input with voltage (V−). Ideally, an op-amp amplifies only the difference in voltage betw een the two, also called differential input voltage. The output voltage of the op-amp V_{out} is give n by the equation,

$$V_{out} = A_{OL}(V_{+} - V_{-})$$

where A_{OL} is the open-loop gain of the amplifier.

In a linear operational amplifier, the output signal is the amplification factor, known as the amp lifiers gain (A) multiplied by the value of the input signal.

An op-amp only responds to the difference between the two voltages irrespective of the individ ual values at the inputs. External resistors or capacitors are often connected to the op-amp in m any ways to form basic circuits including Inverting, Non-Inverting, Voltage Follower, Different ial, Integrator and Differentiator type amplifiers. Op-amp is easily available in IC packaging, th e most common os whom the μA-741.

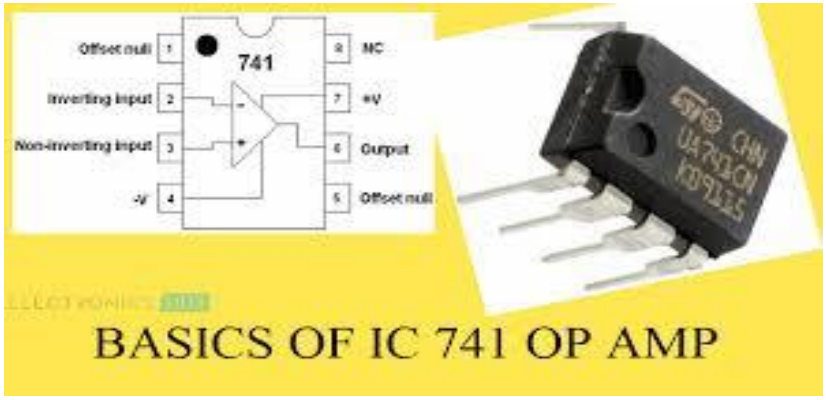


Fig.2.2

- Open-loop gain is the gain without positive or negative feedback. Ideally, the gain should be infinite, but typical real values range from about 20,000 to 200,000 ohms.
- The bandwidth of an ideal operational amplifier is infinite and can +amplify any

frequency signal from DC to the highest AC frequencies.

POWERSUPPLY

Figure 3 .3

Power supply components:

- **Diodes**
- **Transformer**
- **Capacitors (10uf,0.1uf)**
- **Regulators(LM7805,LM7809,LM7812,LM7912)**

DIODES:

A *PN Junction Diode* is one of the simplest semiconductor devices around, and which has the c haracteristic of passing current in only one direction only. However, unlike a resistor, a diode d oes not behave linearly with respect to the applied voltage as the diode has an exponential curre nt-voltage (I-V) relationship and therefore we cannot described its operation by simply using a n equation such as Ohm's law.

CAPACITOR:

A capacitor is a passive electronic component that stores energy in the form of a electrostatic fi eld**.** The capacitor is a component which has the ability or "capacity" to store energy in the for m of an electrical charge producing a potential difference (*Static Voltage*) across its plates, muc

h like a small rechargeable battery.In its simplest form, a capacitor consists of two conducting p lates separated by an insulating material called the dielectric. The capacitance is directly propor tional to the surface areas of the plates, and is inversely proportional to the separation between t he plates. Capacitance also depends on the dielectric constant of thesubstance separating the pla tes.

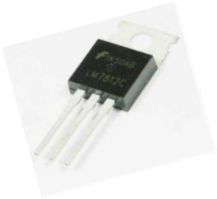
Transformer:

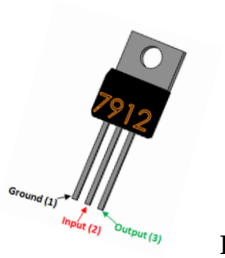
A transformer is a static electrical device that transfers electrical energy between two or more c ircuits. A varying current in one coil of the transformer produces a varying magnetic flux, whic h, in turn, induces a varying electromotive force across a second coil wound around the same c ore. Electrical energy can betransferred between the two coils, without a metallic connection be tween the two circuits.

REGULATOR:

Every electrical and electronic device that we use in our day-to-day life will require a power su pply. In general, we use an AC supply of 230V 50Hz, but this power has to be changed into the required form with required values or voltage range for providing power supply to different ty pes of devices

LM7805,LM7809,LM7812,LM7912 regulators consists of three pins Vinput, Voutput, and Vad justable .we give input to the Vinput and the voltage can be adjusted by Vadjustable .the output is taken at the Voutput.For -12v we use LM7912





LM7805 **LM7809**

LM7812 **LM7912**

A LM7805 voltage regulator is a voltage regulator that output +5 volts pin 3(output pin) is reg ulated 5 volts DC in pin 1 which is input pin it makes ic positive unregulated voltage is given i n regulation and pin 2 for ground.

CIRCUIT DIAGRAM

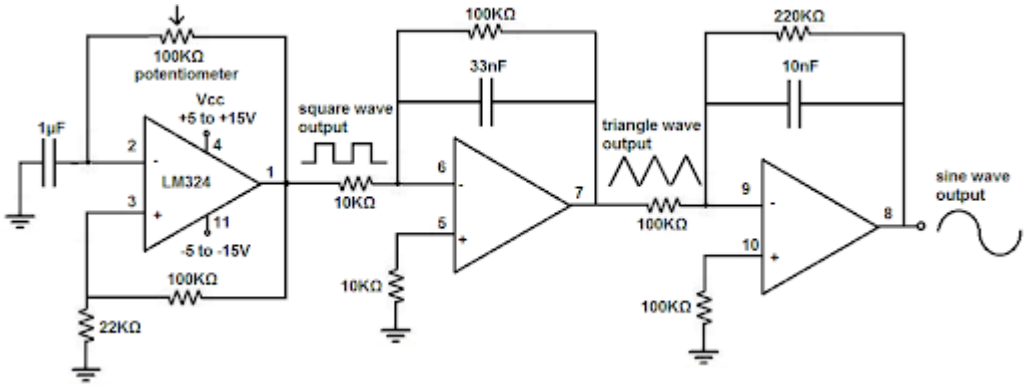


Figure 4.4

From the output of above figure 4.4 , we can add any two signals to adder circuit

Adder circuit:

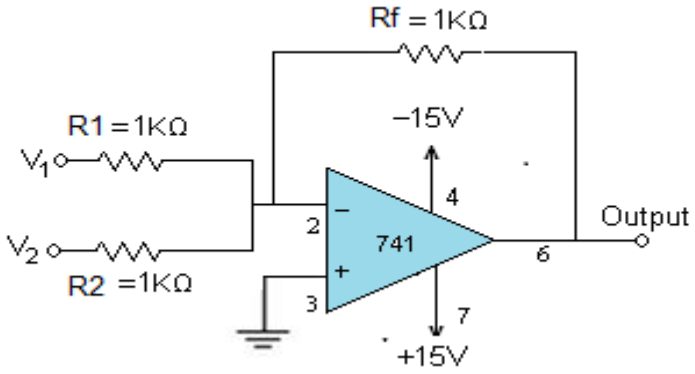


Figure 5.5

We have added square and triangle therefore resultant output is tripizoidal

CIRCUIT COMPONENTS

COMPONENTS:

- **IC-741**
- **Resistance(10K,100K,22K)**
- **Capacitor(0.1uF)**
- **Potentiometer(100k)**

RESISTANCE:

The electrical resistance of an object is a measure of its opposition to the flow of electric curren t. The inverse quantity is electrical conductance, and is the ease with which an electric current p asses. Electrical resistance shares some conceptual parallels with the notion of mechanical fricti on. The SI unit of electrical resistance is the ohm (Ω), while electrical conductance is measured in Siemens(S).

The resistance of an object depends in large part on the material it is made of—objects made o f electrical insulators like rubber tend to have very high resistance and low conductivity, while objects made of electrical conductors like metals tend to have very low resistance and high con ductivity. This material dependence is quantified by resistivity or conductivity. However, resist ance and conductance are extensive rather than bulk properties, meaning that they also depend on the size and shape of an object.

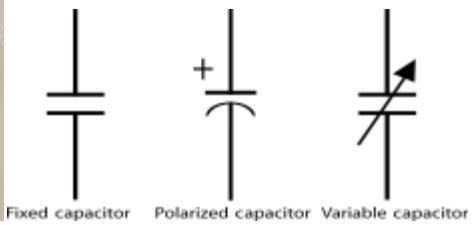
Capacitor:

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

The effect of a capacitor is known as capacitance. While some capacitance exists between any t wo electrical conductors in proximity in a circuit, a capacitor is a component designed to add ca pacitance to a circuit. The capacitor was originally known as a condenser or condensator. This

name and its cognates are still widely used in many languages, but rarely in English, one notabl e exception being condenser microphones, also called capacitor microphones.

The physical form and construction of practical capacitors vary widely and many types of capa citor are in common use. Most capacitors contain at least two electrical conductors often in the form of metallic plates or surfaces separated by a dielectric medium. A conductor may be a foil, thin film, sintered bead of metal, or an electrolyte. The non conducting dielectric acts to increa se the capacitor's charge capacity. Materials commonly used as dielectrics include glass, cerami c, plastic film, paper, mica, air, and oxide layers. Capacitors are widely used as parts of electric al circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dis sipate energy, although real-life capacitors do dissipate a small amount. (See Non-ideal behavio ur) When an electric potential, a voltage, is applied across the terminals of a capacitor, for exa mple when a capacitor is connected across a battery, an electric field develops across the dielect ric, causing a net positive charge to collect on one plate and net negative charge to collect on th e other plate. No current actually flows through the dielectric. However, there is a flow of charg e through the source circuit. If the condition is maintained sufficiently long, the current through the source circuit ceases. If a time-varying voltage is applied across the leads of the capacitor, t he source experiences an ongoing current due to the charging and discharging cycles of the cap acitor.



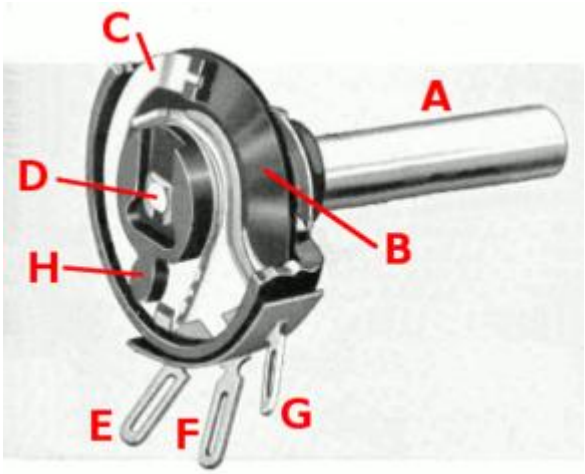
Potentiometer:

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adju stable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variabl e resistoror rheostat.

The measuring instrument called a potentiometer is essentially a voltage divider used for measu ring electric potential (voltage); the component is an implementation of the same principle, hen ce its name.

Potentiometers are commonly used to control electrical devices such as volume controls on aud io equipment. Potentiometers operated by a mechanism can be used as position transducers

Figure 6.6 Potentiometer



A shaft, (*B*) stationary carbon composition resistance element, (*C*) phosphor bronze wiper , (*D*) shaft attached to wiper, (*E, G*) terminals connected to ends of resistance element, (*F*) terminal connected to wiper. A mechanical stop (*H*) prevents rotation past end points.

The relationship between slider position and resistance, known as the "taper" or "law", is contro lled by the manufacturer. In principle any relationship is possible, but for most purposes linea r or logarithmic (aka "audio taper") potentiometers are sufficient.

A letter code may be used to identify which taper is used, but the letter code definitions are not standardized. Potentiometers made in Asia and the USA are usually marked with an "A" for log arithmic taper or a "B" for linear taper; "C" for the rarely seen reverse logarithmic taper. Others , particularly those from Europe, may be marked with an "A" for linear taper, a "C" or "B" for l ogarithmic taper, or an "F" for reverse logarithmic taper.The code used also varies between diff erent manufacturers. When a percentage is referenced with a non-linear taper, it relates to the re sistance value at the midpoint of the shaft rotation. A 10% log taper would therefore measure 1 0% of the total resistance at the midpoint of the rotation; i.e. 10% log taper on a 10 kOhm poten tiometer would yield 1 kOhm at the midpoint. The higher the percentage, the steeper the log cur ve.

WORKING OF THE CIRCUIT

Working:

In my project I used to perform the operation of function generator using operational Amplifier ,Usually it is used to generate different types of waveforms over a wide range of frequencies

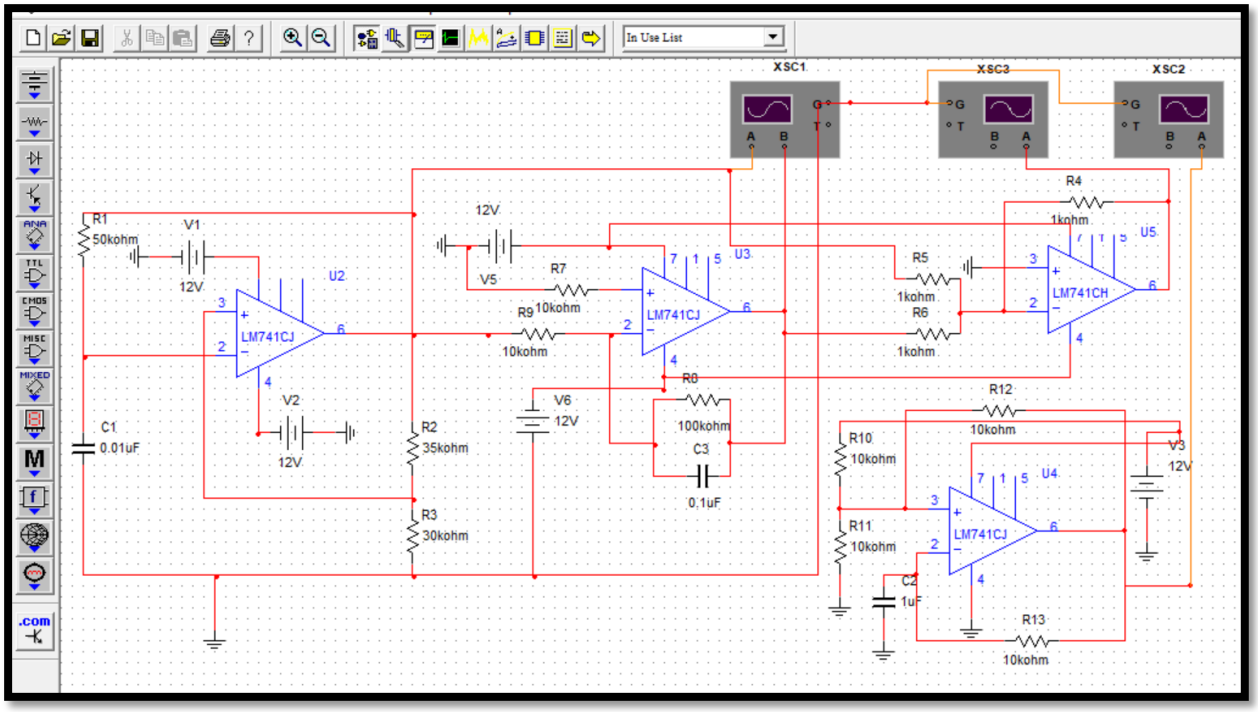
The waveforms generated by my circuit are square , triangular, pulse

Using Astable operation op-amp square wave is generated .For generation of triangular wave w e need an input wave along with an integrator which is active .for this ,we are using square wav e as input .this is based on the fact square wave on integration gives triangular wave .A triangul ar wave is that it has equal rise and fall times .The sine wave is generated by varying the potenti ometer.

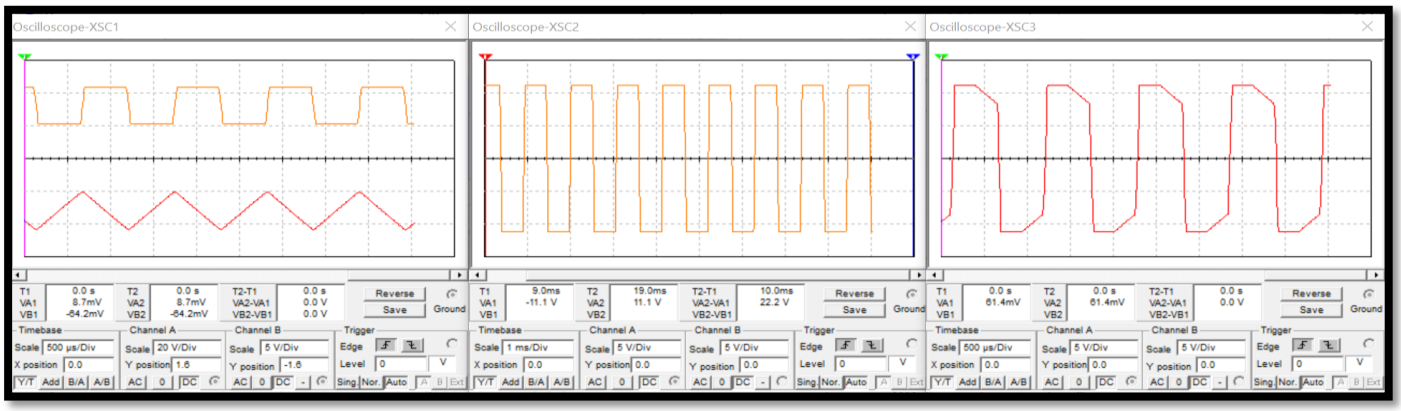
There is no option to control the parameters like frequency, distortion ,duty cycle of these wave forms. This circuit needs a power supply from +15v to -15v and the waveforms are generated o ne after the other based on the input given.

Lastly ,I add two signals through adder circuit which is similar to inverting amplifier .the ampli tude is modified to some extent and the ic pins should be proper to prevent the damage and to p roduce waveforms.

Simulation Circuit Diagram



Output and Wave forms



Square and Triangular wave

Pulse wave

Pulse wave

ADVANTAGES :

- These are easy to use and generates waveforms easily
- It has a large operating range i.e., uptomhz frequency generated
- This is more flexible and avoids noise

DISADVANTAGES :

- These are usually not suitable for applications that need low distortion or stable frequency signals
- The waveforms generated will tend to be more complex when frequency reaches above 20Mhz
  .
- External signals may not be applied to this circuit & amplitude must be fixed.

APPLICATIONS:

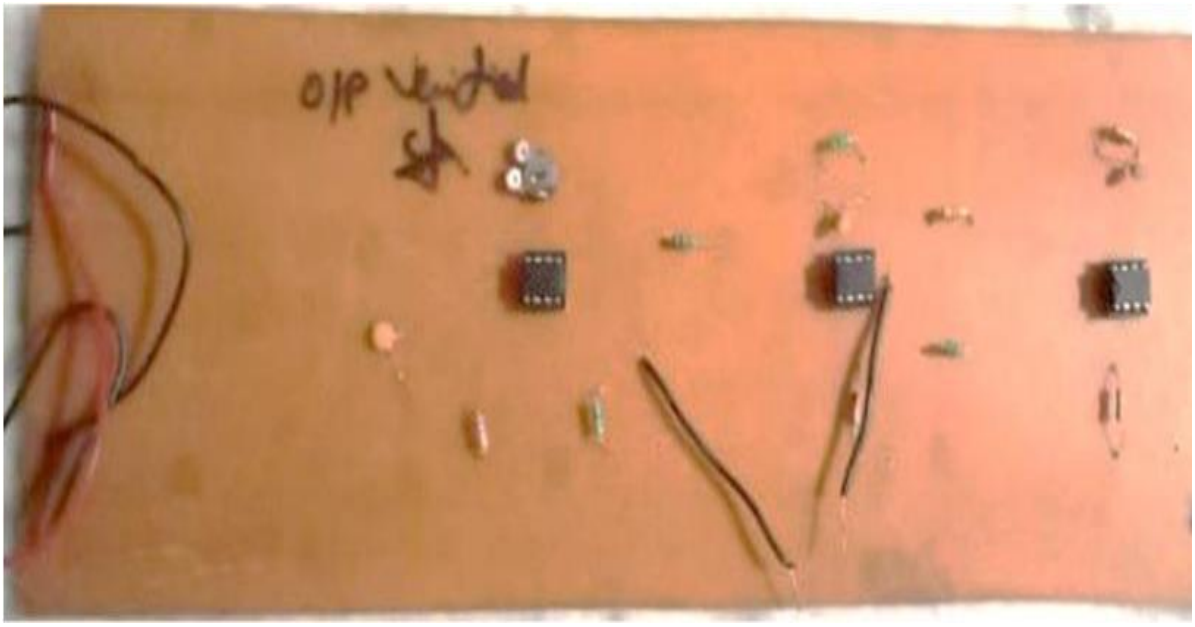
- These are used in development, testing and repair of electronic equipment e.g as a signal source to test amplifiers
- It generates signals to send to integrator or differentiation circuits to test their outputs.
- It works as a timer and trigger pulses.

CONCLUSION

Therefore I conclude this project is suitable for generating the waveforms and useful for all. He re the signals produced can be of very high quality and is similar to function generator and the a pplications are also same. using op-amp the design of the circuit is flexible and by means of ele ctronic students it is more convenient to use.

RESULT

We constructed the circuit as per the circuit diagram and we verified the waveforms based on th e given values. Lastly we added two signals through adder circuit .



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