नीति आयोग
National Institution for Transforming India

ATAL INNOVATION MISSION

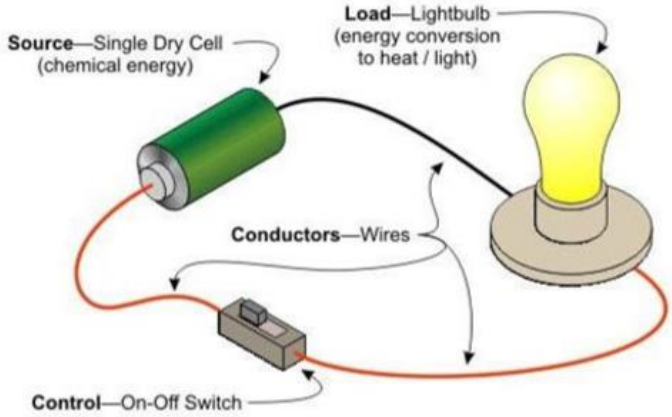
# COMPUTATIONAL THINKING

# UNDERSTANDING CIRCUITS

# WHAT IS CIRCUIT ?

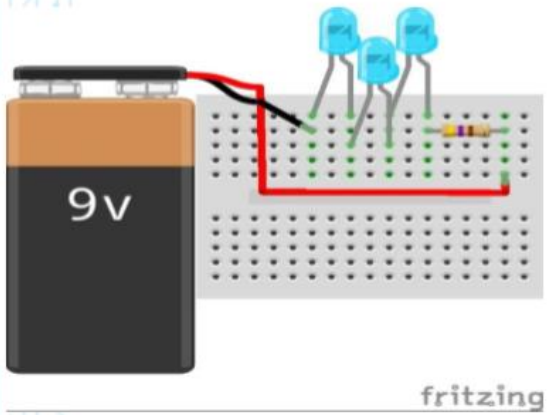
An electronic circuit is a complete course of conductors through which current can travel. Circuits provide a path for current to flow. To be a circuit, this path must start and end at the same point. In other words, a circuit must form a loop.

An electronic circuit and an electrical circuit has the same definition, but electronic circuits tend to be low voltage circuits



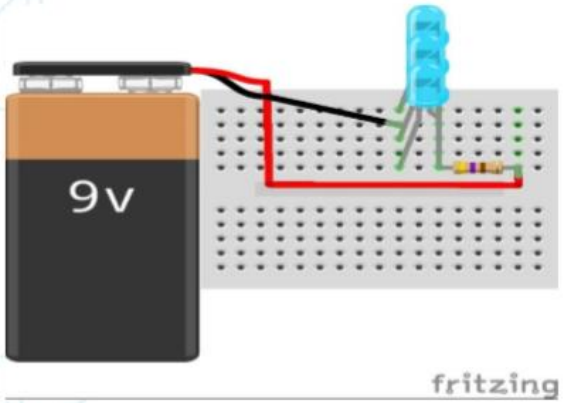
# CONNECTION TYPES

## Series




3 LEDs are connected in series along with a resistor with 9V power supply

## Parallel

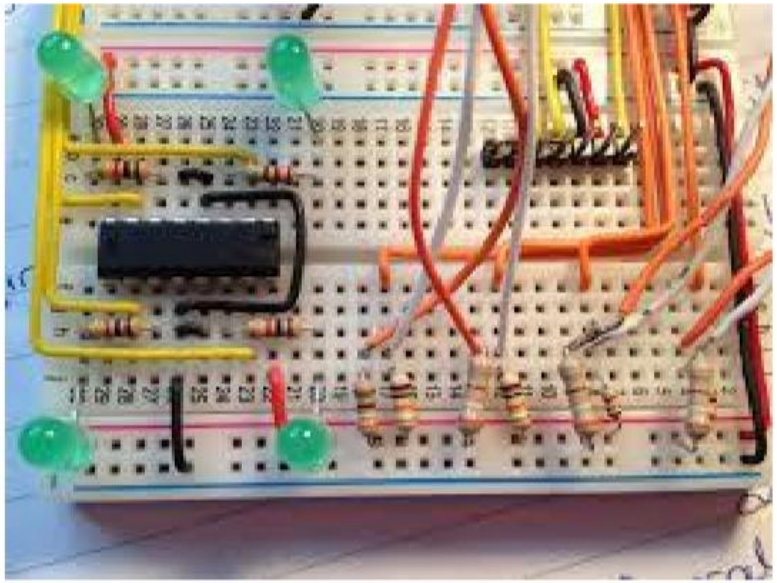


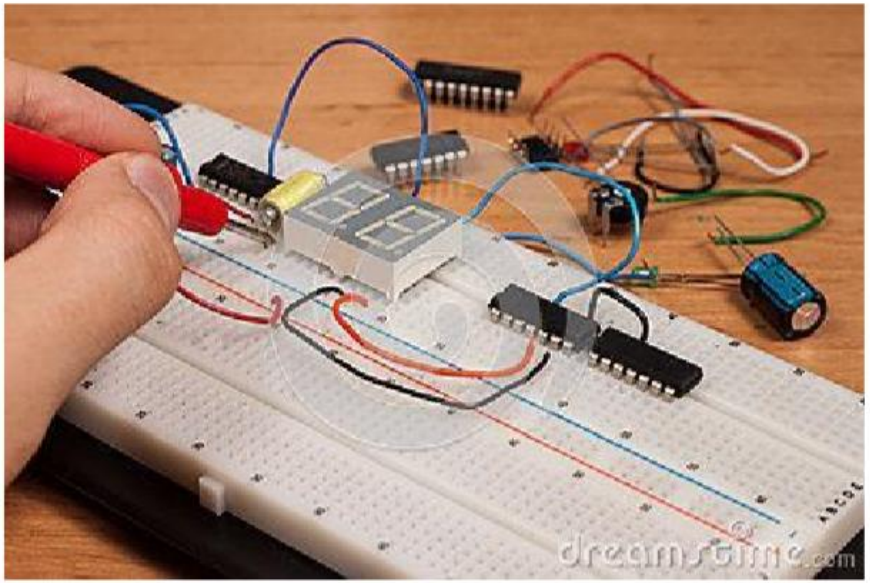

3 LEDs are connected in parallel along with a series resistor with 9V power supply

# APPLICATION OF CIRCUITS

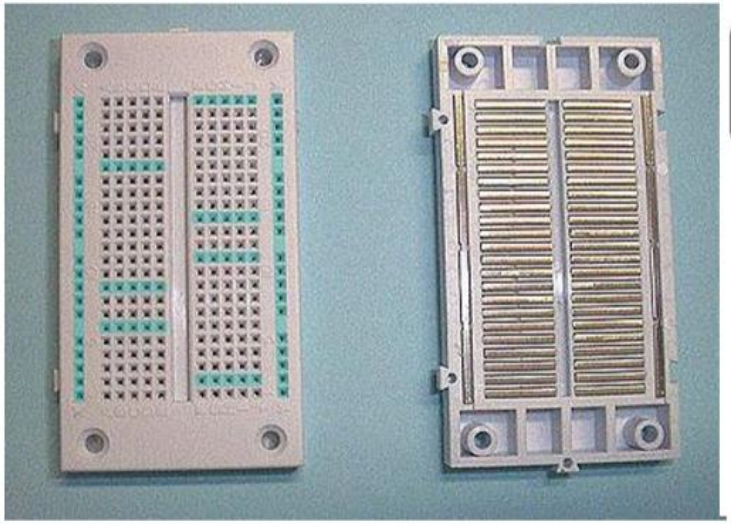
- Electronics circuits are used to make modern electronic devices
- Electronic technology help devices and machines to become mobile and compressed
- Nowadays, all the electronics devices like laptops, tablet, smartphone are made up with semiconductor circuit
- There is lots of demand and growth of electronic industry

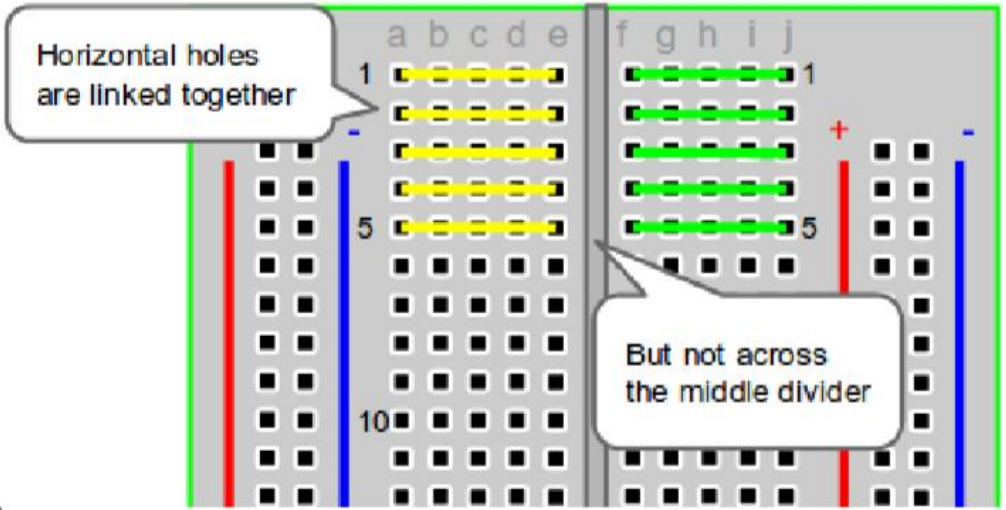
# CIRCUIT ON BREADBOARD



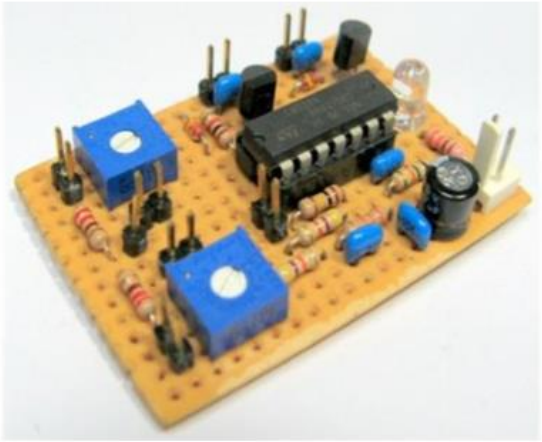


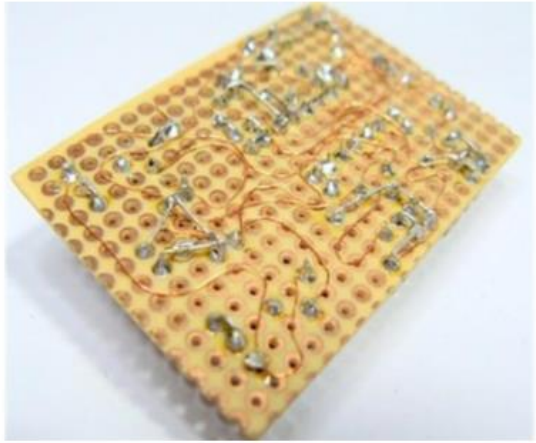
# BREADBOARD

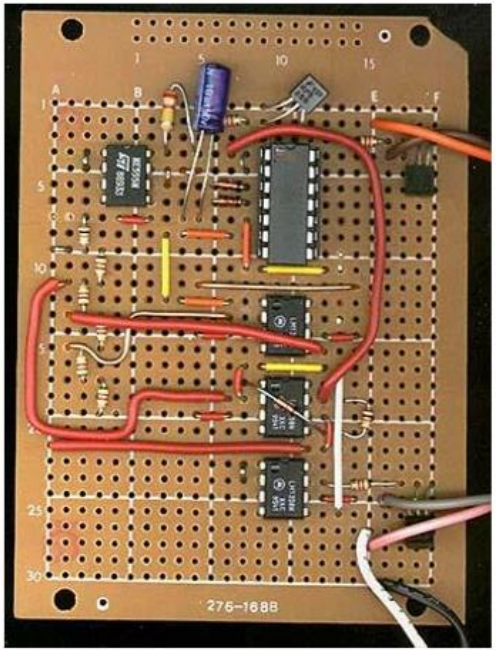



Horizontal holes
are linked together
a b c d e
f g h i j
1
5
10
1
5
-
+
-
But not across
the middle divider

# CIRCUIT ON PROTOBOARD







# ELEMENTS AND COMPONENTS OF CIRCUIT

**Diode:** A semiconductor device with two terminals, typically allowing the flow of current in one direction only

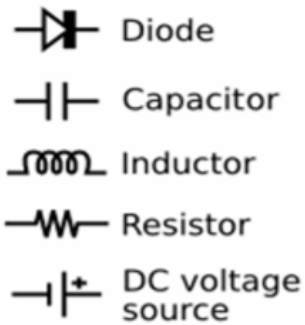
**Capacitor:** A device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator

**Inductor:** An inductor, also called a coil or reactor, is a passive two-terminal electrical component that stores electrical energy in a magnetic field when electric current is flowing through it

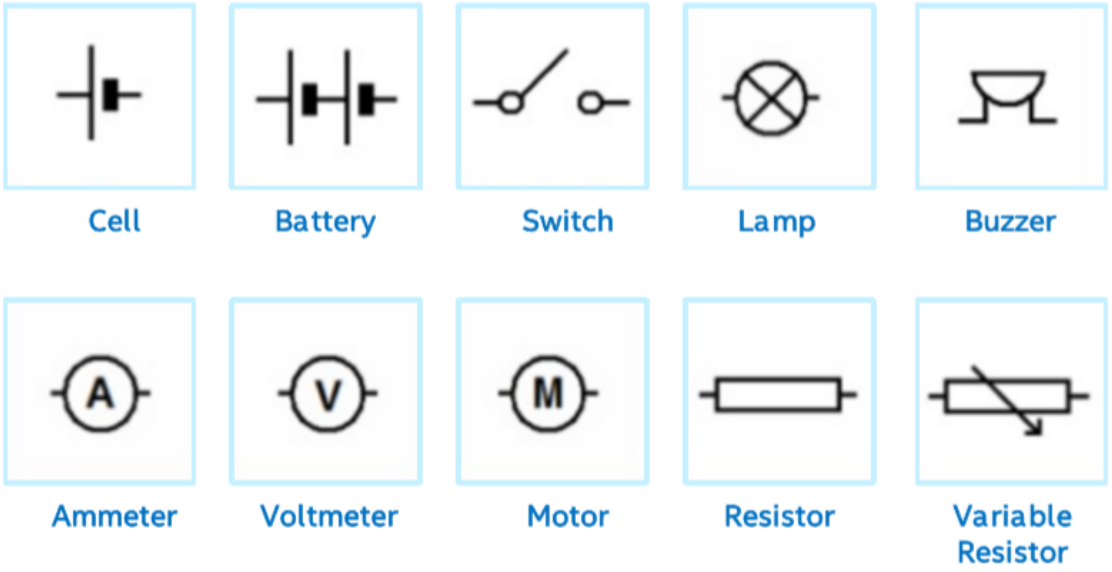
**Resistor:** A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element

**DC voltage source:** A voltage source is a two terminal device which can maintain a fixed voltage. An ideal voltage source can maintain the fixed voltage independent of the load resistance or the output current

**A few circuit element symbols:**



# ELEMENTS AND COMPONENTS OF CIRCUIT

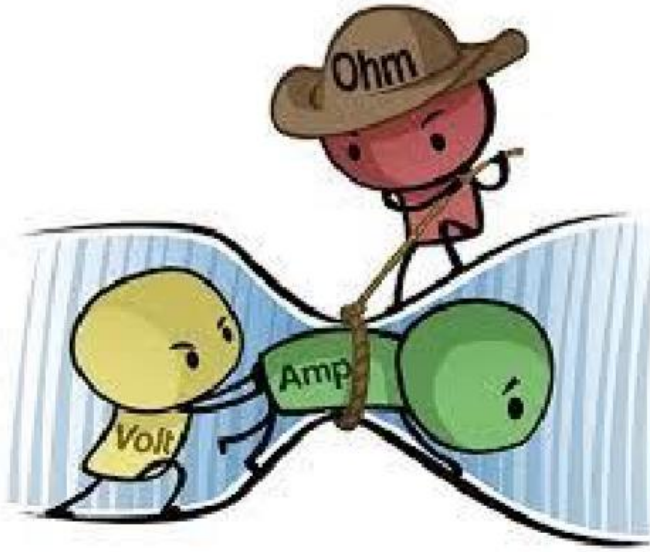


# CURRENT, VOLTAGE RESISTANCE

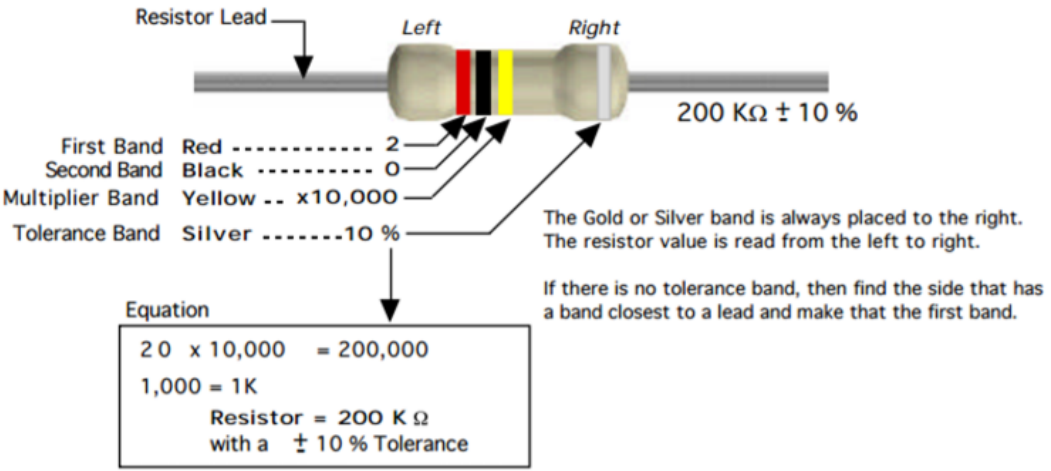
**Current:** Current is a flow of electrical charge carriers, usually electrons or electron-deficient atoms

**Voltage:** The voltage / potential difference between two points is equal to the work done per unit of charge against a static electric field to move the charge between two point

**Resistance:** The tendency for a material to oppose the flow of electrons

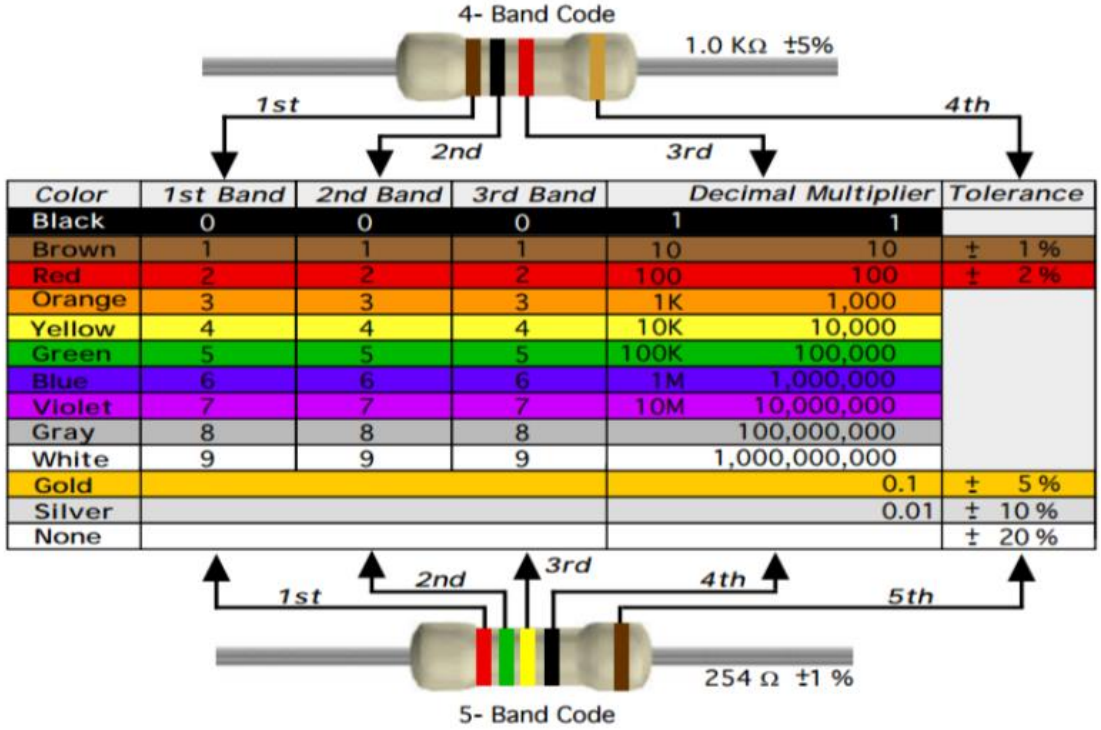


# CALCULATING RESISTANCE VALUE




How to read the resistor code: First find the tolerance band, it will typically be gold ( 5%) and sometimes silver (10%). Starting from the other end, identify the first band - write down the number associated with that color; in this case Red is 2. Now 'read' the next color, here it is Black so write down a 0 next to the two. (you should have '20' so far.) Now read the third or 'multiplier' band and write down that number of 10000. In this example, the 'multiplier' band is Yellow so we get 200,000 Ω or 200KΩ

# RESISTOR COLOR CODING




| Color | 1st Band | 2nd Band | 3rd Band | Decimal Multiplier | Tolerance |
|---|---|---|---|---|---|
| Black | 0 | 0 | 0 | 1 | 1 | |
| Brown | 1 | 1 | 1 | 10 | 10 | ± 1 % |
| Red | 2 | 2 | 2 | 100 | 100 | ± 2 % |
| Orange | 3 | 3 | 3 | 1K | 1,000 | |
| Yellow | 4 | 4 | 4 | 10K | 10,000 | |
| Green | 5 | 5 | 5 | 100K | 100,000 | |
| Blue | 6 | 6 | 6 | 1M | 1,000,000 | |
| Violet | 7 | 7 | 7 | 10M | 10,000,000 | |
| Gray | 8 | 8 | 8 | | 100,000,000 | |
| White | 9 | 9 | 9 | | 1,000,000,000 | |
| Gold | | | | | 0.1 | ± 5 % |
| Silver | | | | | 0.01 | ± 10 % |
| None | | | | | | ± 20 % |

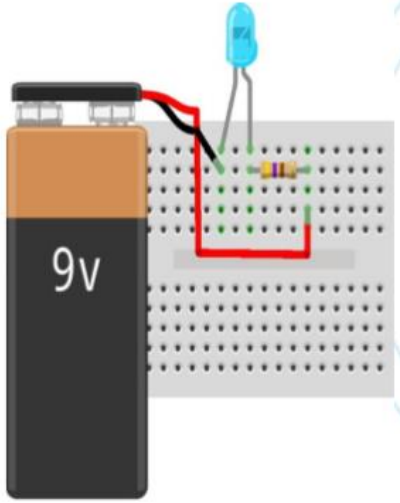
# SIMPLE CIRCUIT

## Components required

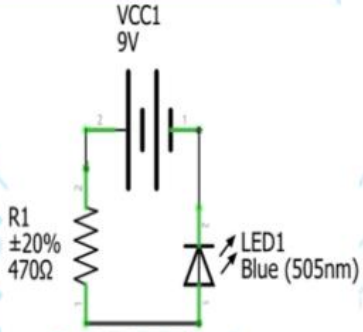
- LED
- 9V DC power supply
- 470 Ω resistor
- Connecting wires
- PCB (6 cm x 6 cm)

We start by connecting LED circuit in series with a resistor. You must make some calculations to figure out the resistor value, depending on voltage power supply, LED voltage drop and desired current

- Source Voltage = 9 volts
  Voltage Drop = 3.1 volts typical for a blue or white LED
  Desired Current = 13 milliamps
- So the resistor we need is:
  (9 – 3.1) / ( 13 / 1000 ) = 452 ohms so we will use a 470 Ω resistor



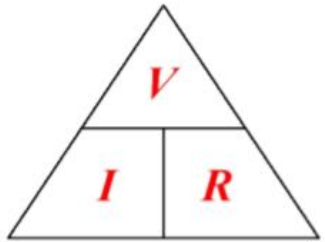

Check the circuit before connecting the power supply!!



# OHM'S LAW

**Ohm's law** states that the current through a conductor between two points is directly proportional to the potential difference across the two points:

$$V = I\,R$$




$$I = \frac{V}{R} \qquad R = \frac{V}{I}$$

# INTEGRATED CIRCUITS

Integrated circuits (ICs) are a keystone of modern electronics. They are the heart and brains of most circuits. They are the ubiquitous little black “chips” you find on just about every circuit board

An IC is a collection of electronic components – resistors, transistors, capacitors, etc. – all stuffed into a tiny chip, and connected together to achieve a common goal. They come in all sorts of flavors: single-circuit logic gates, op amps, motor controllers, microcontrollers, microprocessors, FPGAs

# MICROCONTROLLER

A microcontroller is a self-contained system with peripherals, memory and a processor that can be used as an embedded system. Most programmable microcontrollers that are used today are embedded in other consumer products or machinery including phones, peripherals, automobiles and household appliances for computer systems

Another name for a microcontroller is embedded controller. Microcontrollers are used in automatically controlled devices including power tools, toys, implantable medical devices, office machines, engine control systems, appliances, remote controls and other types of embedded systems

# THANK YOU

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