

Sikaru Saathi

[Understanding Components]



A little background for this lesson:

- Welcome to Lesson 2 of the Sikaru Saathi bootcamp! Today, we will be delving into the basics of electronics, including how LEDs work, how to make LED motor connections, and how to use a breadboard.
 - Before we start, we want to emphasize the importance of reusing and repairing materials. As you know, electronic waste is a growing problem, and it's important that we find ways to give new life to old materials.
 - **That's why we've asked our facilitator to prepare all the materials for today's class from e-waste.**
 - We hope that by using these reclaimed materials, we can inspire a sense of reuse and repair culture among our participants. Let's learn together and explore the possibilities of electronic waste recycling.

Materials Required

Component Name	Number
Universal	
Projector (Optional) (To share images of different components)	1
Speaker system (Optional) (Using this to play music when participants are working in stations)	1
<u>Normal Wire (red and black)</u>	1 Meter
Cardboard	6
Cutting Station with (paper cutter and scissors)	2
<u>Screw Driver set</u>	3

Per Group	
A4 papers	2
<u>Leds</u>	5
<u>9v Motors</u>	2
<u>Alligator Clip</u> (They are usually not attached to battery cap so teacher need to make sure to attach before the class or at least teach participants on how to fix it with battery cap)	1 pair
<u>9V Batteries</u>	1
<u>Battery cap</u>	
<u>Capacitor</u>	3
<u>PCB plates</u> (These are old PCBs taken from e-wastes)	2
<u>On/Off Switches</u>	2

Curiosity

[Curiosity is an essential element of learning, and in this section, we will aim to engage participants with questions that encourage curiosity and critical thinking about e-waste.]

- Why Dismantling: Repair, Reuse, Recycle
 - This will encourage participants to think about the benefits of dismantling e-waste, such as identifying reusable components, which can be repaired or recycled to reduce environmental impact.
- What is the importance of a culture of repairing and dismantling?
 - This will encourage participants to think about the potential for reusing electronic components, reducing the need for new materials, and minimizing e-waste.
- Can you identify the components of a circuit board?
 - What is their function, and what elements are used in their construction?
- What are the hazardous elements found in e-waste?
 - How can they harm human health?
- What are the safety precautions that should be taken when dismantling e-waste?
 - Encourage participants to think about the importance of personal protective equipment, appropriate tools, and safe disposal methods.

Activities

Energizer

- Pick a fun game that will allow participants to get to know each other and play it with the participants. We recommend games that require physical movement so that the participants get energized.
- **Students will play a game named count to 20 as an energizer. (Option)**
 - Ask the participants to gather around and form a circle. Make sure that everyone can see and hear each other clearly.
 - Explain the rules of the game:
 - The first student will say the number 1, and then the next student will say 2, and so on, until the group reaches the number 20.

- Remind the participants that they cannot skip any numbers or say them out of order. Each number must be said in sequence.
- Start the game by having a random student say the number 1.
- If two or more participants say the same number at the same time, the group must start over from the beginning, with the first student saying the number 1 again.
- Ensure that the participants don't start counting in order by being part of the group and disrupting the participants if they start counting in sequence
- Encourage the participants to say the numbers quickly and keep the energy level high. This game is meant to be a quick and fun energizer, so keep it moving!
- Keep playing the game until the group successfully counts all the way to 20 without any mistakes or repetition of numbers.

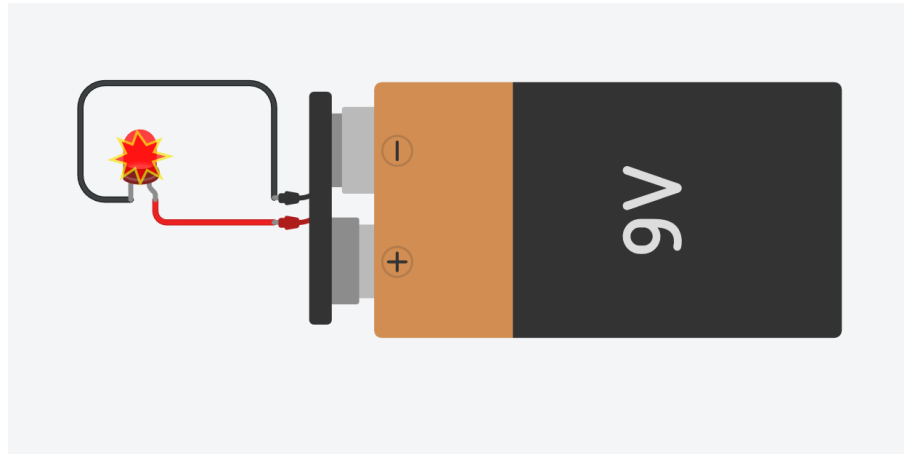
Recap of previous class

- In the previous class, we learned about e-waste and the proper way to dismantle it. We discussed the importance of safely disposing of electronic waste to avoid environmental damage and health hazards.
- We also learned about the proper way to dismantle e-waste. The facilitator explained that we should wear protective gear such as gloves and goggles, and use appropriate tools to dismantle electronic devices. The components should be sorted and disposed of separately according to their type.
- As a homework assignment, participants were asked to do a small research on e-waste in the context of Nepal. They were also asked to identify any steps that have been taken to minimize e-waste in Nepal.
 - Ask participants to share 2 new things they learned about e-waste.
- Finally, participants were asked to choose an electronic device from their household that usually gets damaged and try to find its lifetime and reusability in terms of dismantling and reusing any components. This exercise should help participants understand the potential of reusing and recycling components of electronic devices to reduce electronic waste.

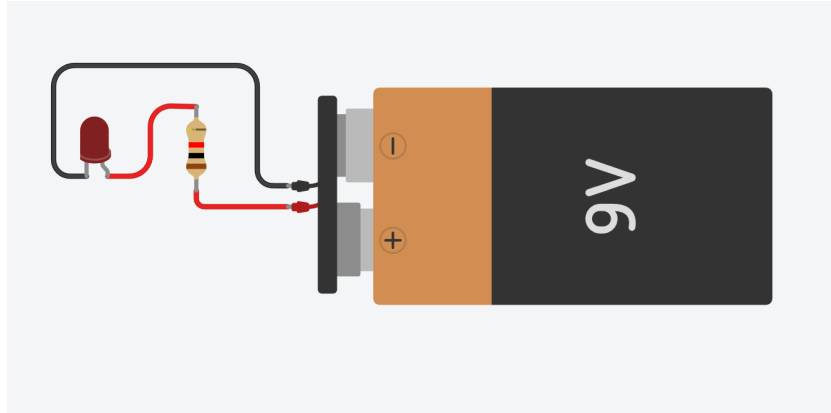
Understanding Components

- **Lighting up the LEDs**

- Facilitator gives the participants a 9 V battery, alligator clips and LED, and gives them 5 minutes to figure out how to light the LED. Students share their observations afterwards.
 - **Note to facilitator:** Ask the participants what they have observed in LED and batteries before trying to light up the LED. The participants are expected to blow up the LED

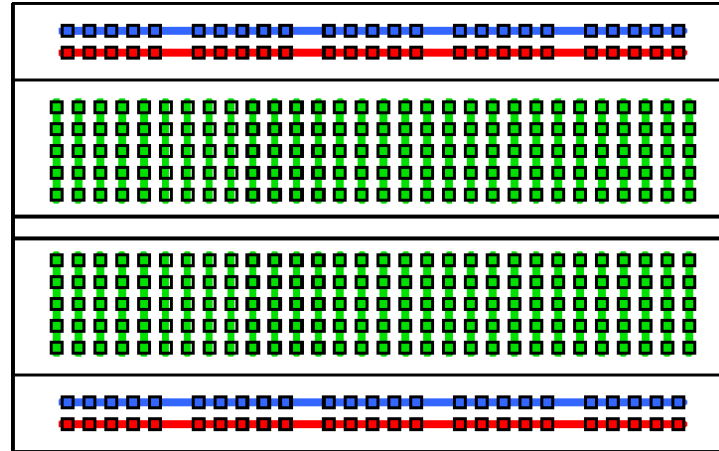


- Introduce the concept of **resistors** and ask them to redo the activity where they are suppose to light the LED
 - **Note to facilitator:** Use different analogies like taps limiting the flow of water to explain that resistors help limit the flow of current in the circuit. It is important to stress that resistors resist the flow of current. Common misconceptions that arise among participants are that resistors limit power, voltage etc.
 - **Note to facilitator:** Also stress the fact that participants are expected to use resistors each time they connect LEDs in the future.



- **Challenge: Ask the participants to create a tester circuit that tests whether an object is conductor or not (Hint: When testing a conductor the LED should light up)**
- **Solving the Breadboard Mystery:**
 1. Facilitator handouts a breadboard to participants and ask them to discuss about how breadboard might work
 2. Facilitator can encourage participants to experiment on a breadboard by using a battery and LED to check how it might work.
 3. Ask the participants to figure out the connection of breadboard using the tester circuit that they just built
 4. Students are challenged to recreate a circuit to light up 3 LEDs using the breadboard

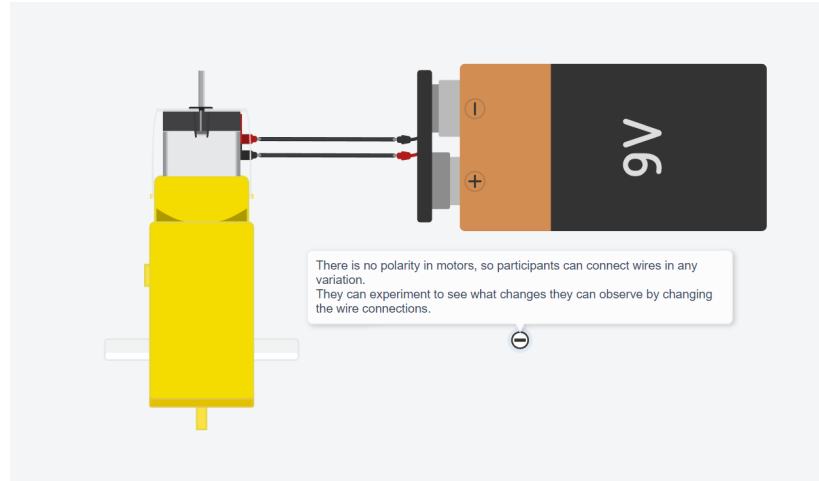
Note to the facilitator: It is a board for making an experimental model of an electronic circuit. All the holes in each line are connected together with a strip of metal in the back. The two corner sections of the board are vertically connected and the middle two sections are horizontally connected.



- **Battery and Motor:**

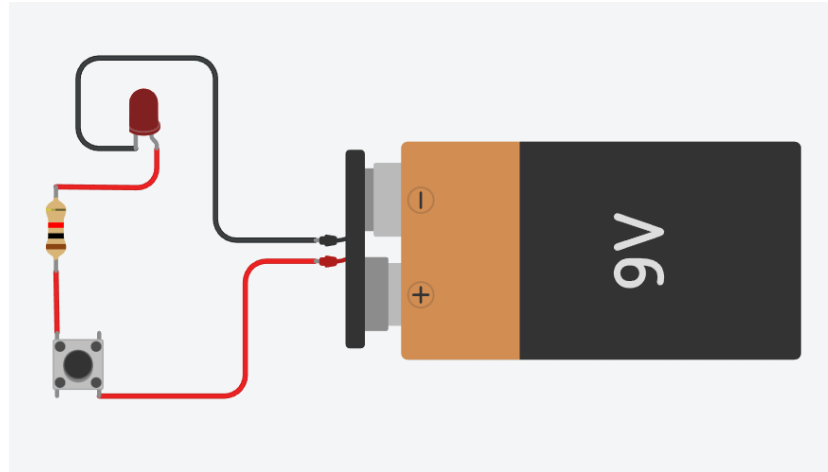
1. Teacher hands out a battery and asks them to observe it. Have a discussion on what they observed. E.g. 9V, +ve and -ve side
2. Give participants a motor, a wheel, a battery. Students are asked to make the motor rotate with the battery and observe. Then they are asked to switch the orientation of the battery to observe what they see.
3. Teacher asks what you observe with the terminal switch. It's important for participants to come up with the conclusion that when battery terminals are reversed, the motor rotates in opposite direction

Note to teacher: A battery is a device that provides power to other electrical devices. It has two terminals +ve and -ve.



- **Other materials for participants to explore**

- **Jumper wires:** Facilitator says jumper wires are used to connect the flow of current in the breadboard.
- **Switch:** Facilitators tell us we are going to use push to one button switch and it is diagonally connected. Teacher can explain by drawing a picture on board.



- Revise the components participants explored that they might encounter after dismantling an electronic device
 1. LEDs
 2. Wires
 3. Breadboard
 4. Motors
 5. Switches
 6. Resistors

Building your own toy

- Divide participants into groups of 3 and challenge them to build a small toy for 5 year olds with the stuff that they learned. They will only have 30 mins to come up with the idea and complete the project.
 - Students share the toys that they have made within 30 mins.
- Students will now present their work to the class and get/give feedback to other participants.
- Students will be using WWW (What Went Well) and EBI (Even Better If) i.e. they will share what they like about the project through WWW and then what can be improved through EBI

Reflection

- Reflection exercise (Use paper or sticky notes to get participants to write these down)
 - What do you **KNOW** about circuits?
 - What do you **WANT** to know about the circuits?
 - What did you **LEARN** about the circuits?