3D Light Up Worlds

Activity overview description:

Have you tried paper circuits? Ever thought about how far you could take a paper circuit? Then it is the guide for you! This is a 3D paper circuit that requires soldering and some use of new components such as resistors, transistors, and LDR (light dependent resistor). Resistors basically create resistance in the flow of electricity. So if you have a 9v battery and an LED, the battery is too powerful so it will burn the LED out and that's why you need a resistor. Transistors regulate the current and have three legs (terminals) acting as a switch for signals of the electronic variety.

The paper street once constructed will have street lights that light up when it is dark and dim down when it is light.

Learning outcomes:

Young people will:

- Brainstorm ideas for the design of the paper world
- Develop a plan and rough design of their paper world
- Learn advanced circuitry and how to solder
- Explore how to integrate circuits in to cool craft projects
- Learn how to troubleshoot issues and problem solve

Skills & Competencies

- Young people will develop:
- Critical thinking and problem-solving skills
- Creativity and innovation skills
- Communication skills

Equipment:

- 9v Battery & Battery Case
- 6 LEDs
- Red and black copper cable
- LDR (light dependent resistor)
- Transistor BC547
- Resistor 47K
- Paper & Cardboard
- Markers
- Paper Straws
- Masking and insulation tape
- Hot Glue Gun & Glue Sticks
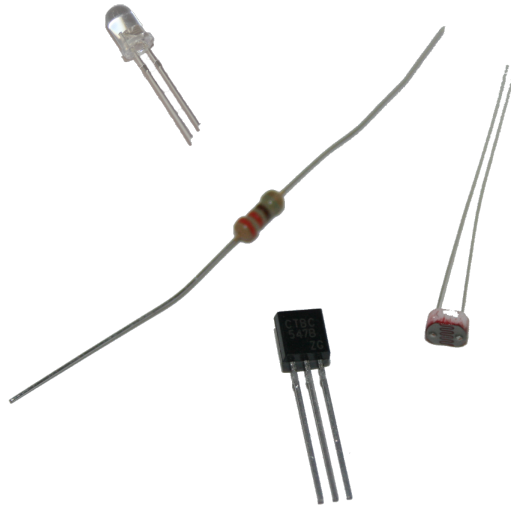
Step-by-step Instruction

Step 1: Build the Street

Cut a piece of flat card the measurements aren't too important but as a guide, you can follow these: 84 x 42 cm. You can build one house or many houses by gluing flat panels of card together to create a box. Each wall is 18 x 25cm, you can wrap your house in a nice card or paint it. Then glue it to the base. Use some black card to create a road on the street.

Step 2: Build Street Lamp

For this step, you will need an LED, paper straw, red and black cable about 25 cm long striped on both sides. Solder your cable to the led. Red cable always connects to the plus side of the battery and black to the minus. Use your insulation tape to wrap around the legs of the LED so that they aren't touching each other. Run the other end of the cables through the straw so that the LED is poking out one end.
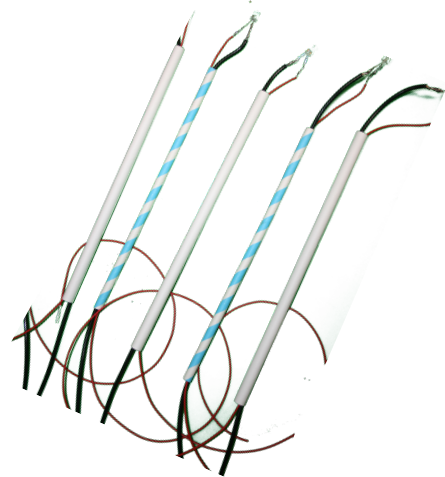
Step 3: Solder Circuit
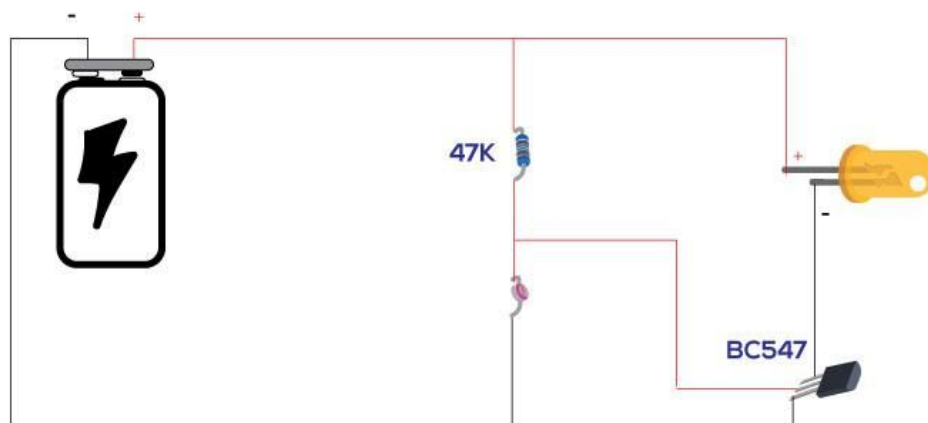
This is the trickiest part. You can connect your cables to the resistor, transistor, LDR and the power pack using crocodile clips to test once you are sure that everything is working, swap the crocodile clips with the red and black cable and solder.

Step 4: Attach Lamp to the Street

Before you connect your lamps to the circuit you can use your hot glue gun to attach your lamp to the road (base) card.

Step 5: Connect Circuit to the Lamps

You should have a red and black cable poking out at the bottom of your street lamps. This is where you join it to the circuit.

Step 6: Test

Before you go any further, test that it is working still. Sometimes connections can come loose when you are gluing things down and fiddling about.

Step 7: Build an enclosure for your circuit

The enclosure can be a small shed at the side of a house on your street. Just be sure to leave the rook detached so that you can remove the lid (roof) to let the light in on the LDR. What should happen is that your street lights should go out or dim and when the LDR is covered or you are in darkness the street light will come on.
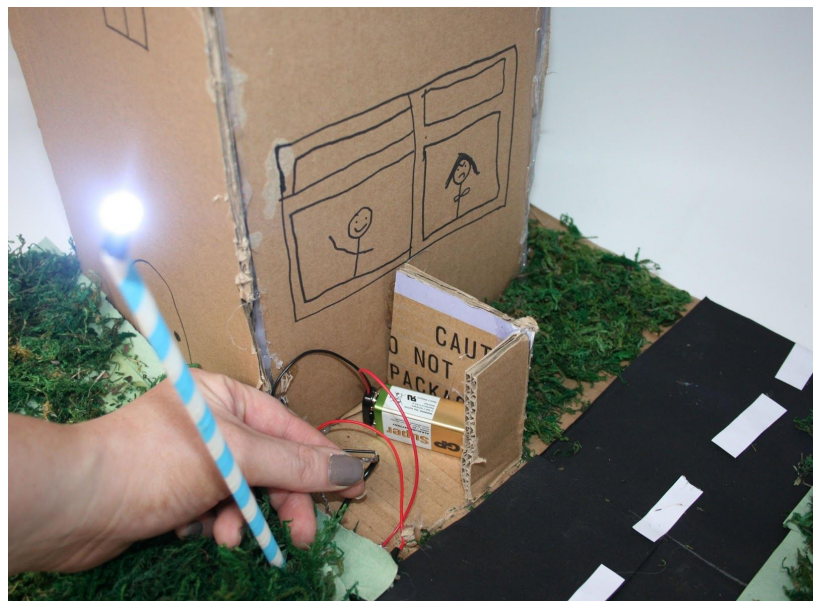
Step 8: Tidy up any loose cables

Once you know all your cables are connected correctly and everything is working as it should. You can glue your circuit into the shed and any cables left on the road can be taped down with insulating tape so that it blends with the road. Or you could use some fake grass to cover it up!

Step 9: Enjoy!

The shed's function is to control the light that is on the LDR, however, natural daylight will do this too so if you put your street into a darkened room it will light up!