kinia

Age:
10+

Activity Guide

Build Your Own Remote-Controlled Car!

Category: **STEAM**
Topic: **Maker**
Level: **Hard**
Duration: **120 mins**

Activity Description

This exciting project allows children to build their own remote-controlled car while learning the principles of wireless control, basic mechanics, and practising hands-on motor skills. It's a fun and educational way to introduce young learners to the world of electronics and engineering.

Learning Outcomes

- Understand the basics of electricity and how it powers the remote-controlled car.
- Apply design thinking to construct a functional remote-controlled vehicle.
- Explore circuitry and how it enables wireless control.
- Learn about conductivity and its role in completing the electrical system.

21st-Century Skills Developed

- **Collaboration:** Work in teams to build and test the remote-controlled car, sharing ideas and responsibilities.
- **Communication:** Develop verbal and non-verbal communication skills by explaining ideas and troubleshooting during the project.
- **Creativity and Innovation:** Customise the car's design and develop innovative solutions during the build.
- **Critical Thinking and Problem-Solving:** Analyse and solve technical challenges related to the car's mechanics and electronics.

How to Use This Activity Guide

For Educators

- Use the learning outcomes and competencies to help build programme plans, logic models, sessions, and lesson plans.
- Refer to the equipment list to ensure you have all the materials and resources needed for the activity.
- Share the guide with colleagues and volunteers to help them learn how to effectively facilitate the activity.

For Everyone

- Print out the guide, starting with the **Step-by-Step Instructions**, for young people to follow along. This allows you to focus on deepening their understanding and engagement with the activity.
- Use the **Glossary of Terms** to help build young people's technical and science vocabulary as they progress through the activity.

Follow-On Activity

- Explore additional information provided for upskilling or for more advanced activities to extend the learning experience.

Equipment

Components/Technical

- Laptop/PC with speakers

Arts & Crafts Materials

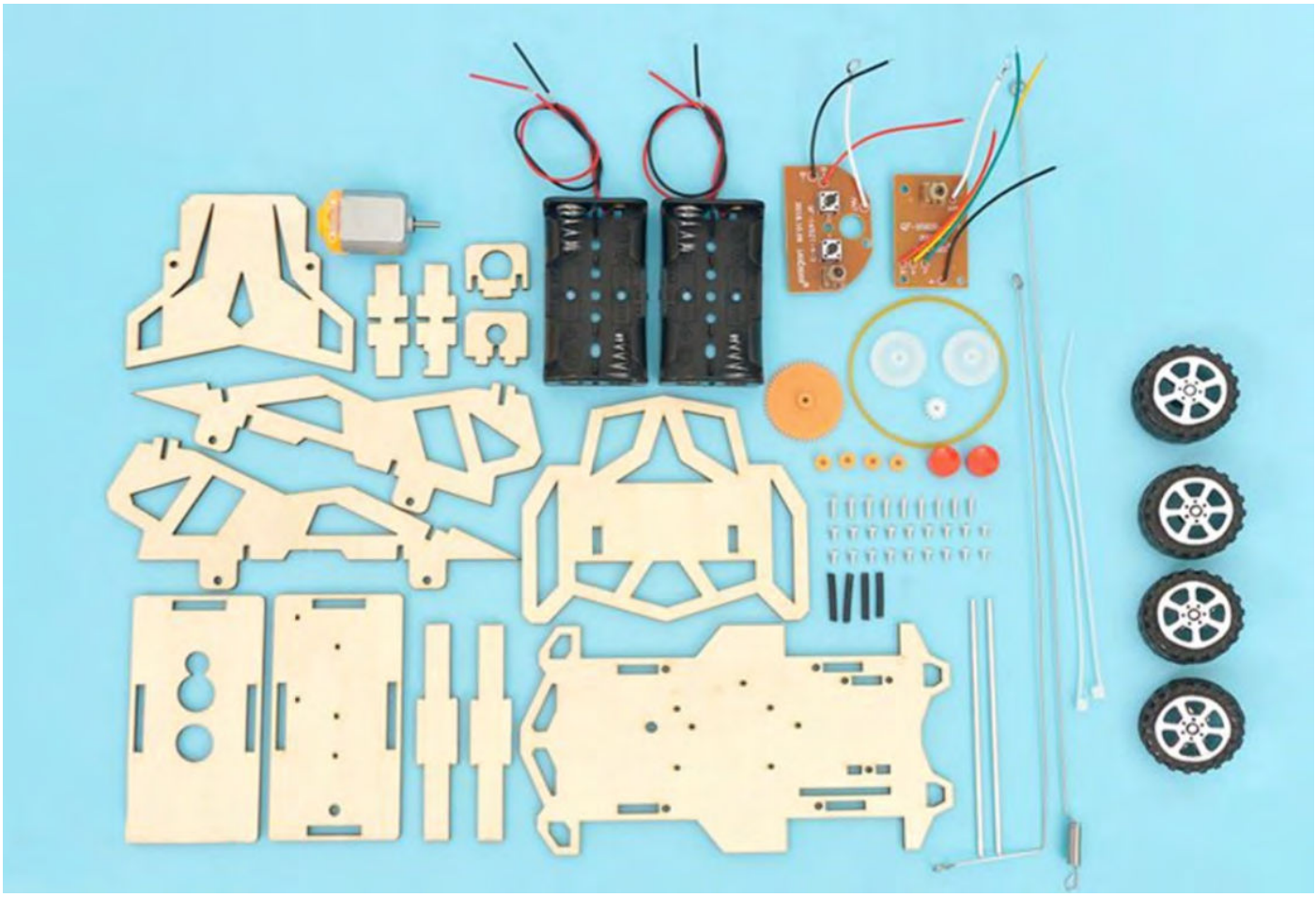
- small screwdriver
- a small pair of scissors
- a lighter
- four AA batteries

Instructions

- The production process requires screwdriver to install screws, scissors to trim materials, lighters to strip wires, and batteries to make the model work properly after the production.

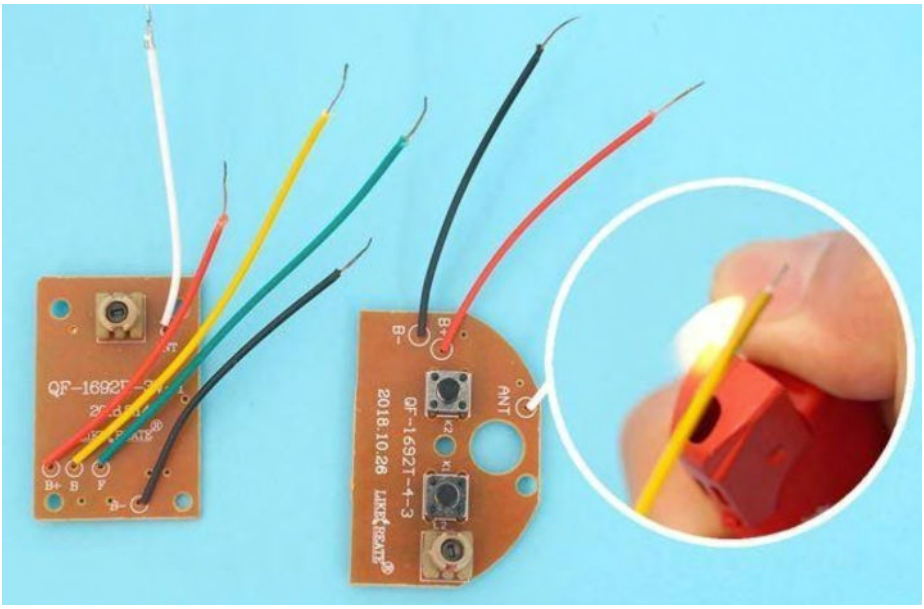
Step-by-Step Instructions

Step 1:
Layout all assembly parts.



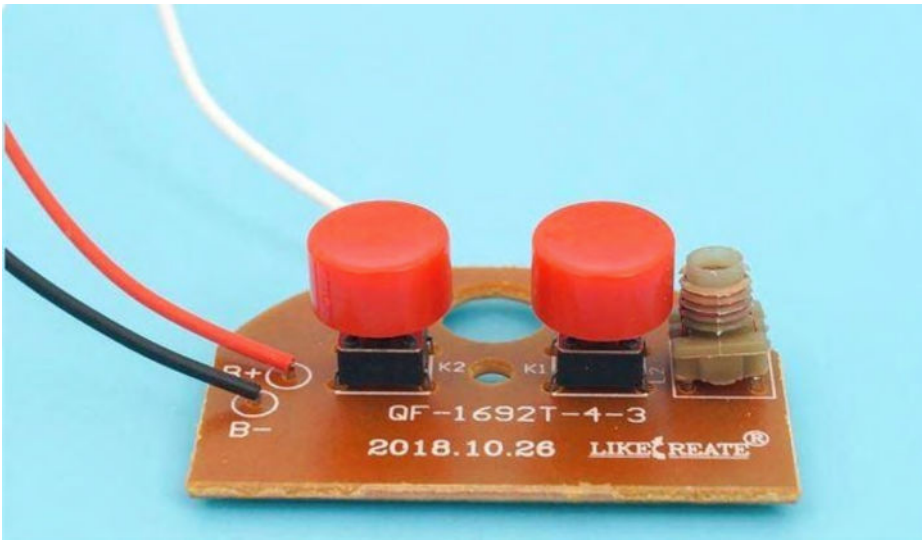
Step 2:

First, peel off the red, black, green and yellow wires of the board with a lighter and leave a 1cm core. Wire peeling method: first burn the soft wire leather with a lighter, and then quickly hand peel off the burned soft plastic.



Step 3:

Install two red key caps on the keys on the remote control panel.

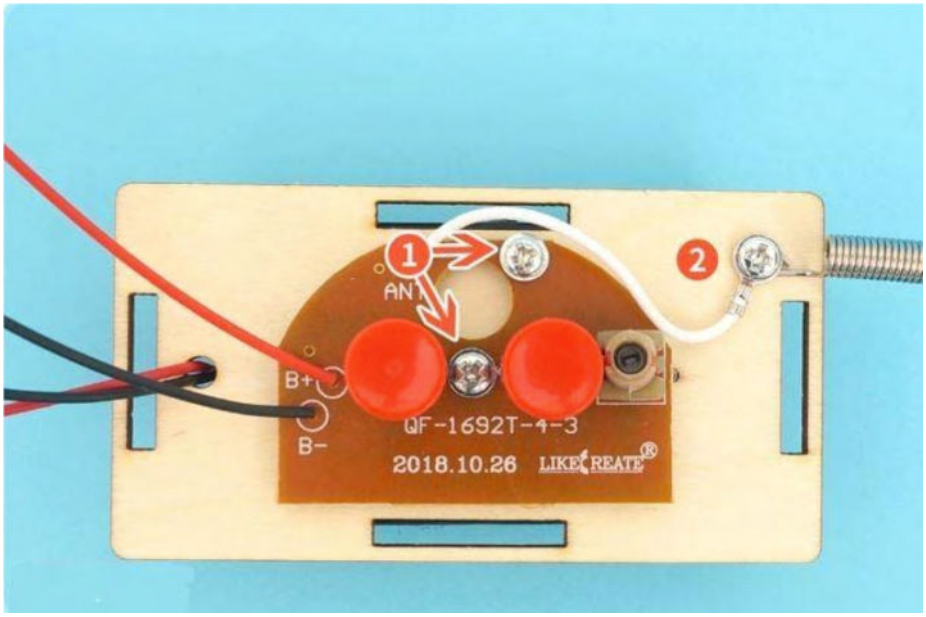


Step 4

1. Locate the appropriate accessories and place them with reference to the picture on the right.
2. First pass the wire of the battery box through the round hole of the wood, and then install the battery box on the wood with a 4mm screw.

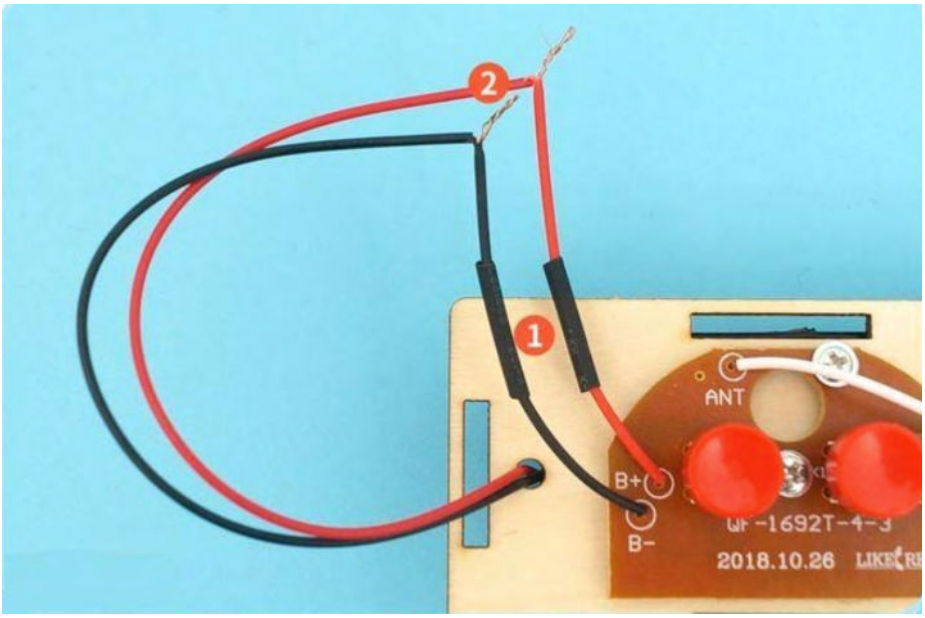
Step 5:

1. Attach the remote control panel to the board with 4mm long screws.
2. Install the L-shaped antenna with a 4mm screw (antenna mounting sequence: wood-L-shaped antenna -antenna wire - screws).



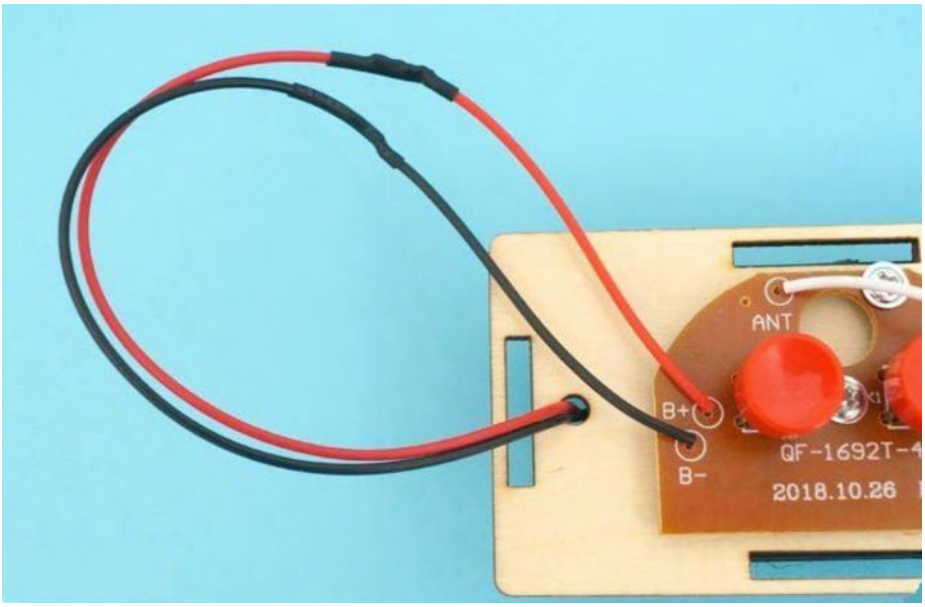
Step 6:

1. Put the black heat-shrinkable tube on the wire,
2. connect the wire core with the color, leave the cores 1cm long, and cut off the excess with scissors.



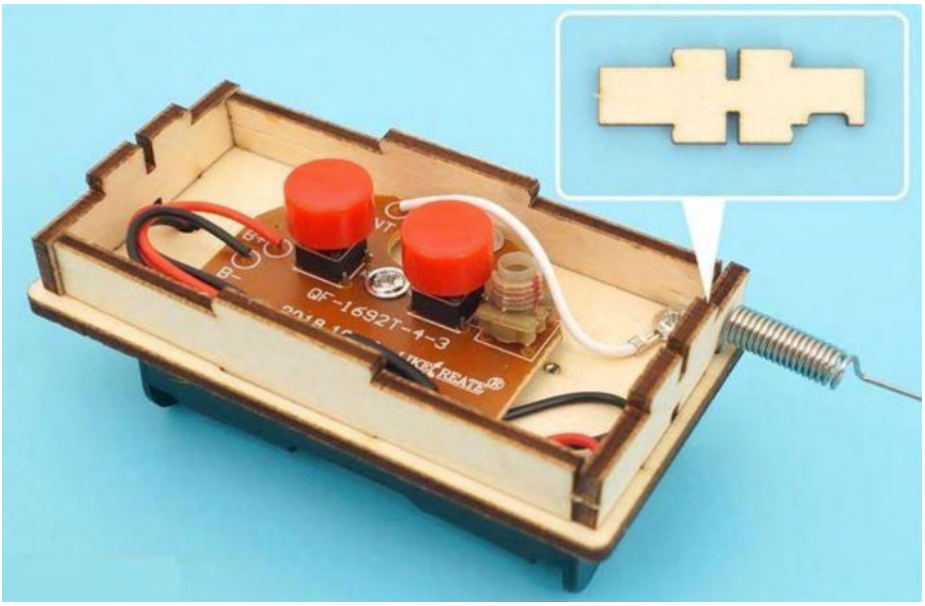
Step 7:

Move the black heat-shrinkable tube to the wiring position and cover the wire core. Then heat the black heat-shrinkable tube with a lighter for shrinkage sealing.



Step 8:

Carefully refer to the figure above, find the corresponding side plate and install it. The growing wire is stuck in the gap between the remote control plate and the side plate.

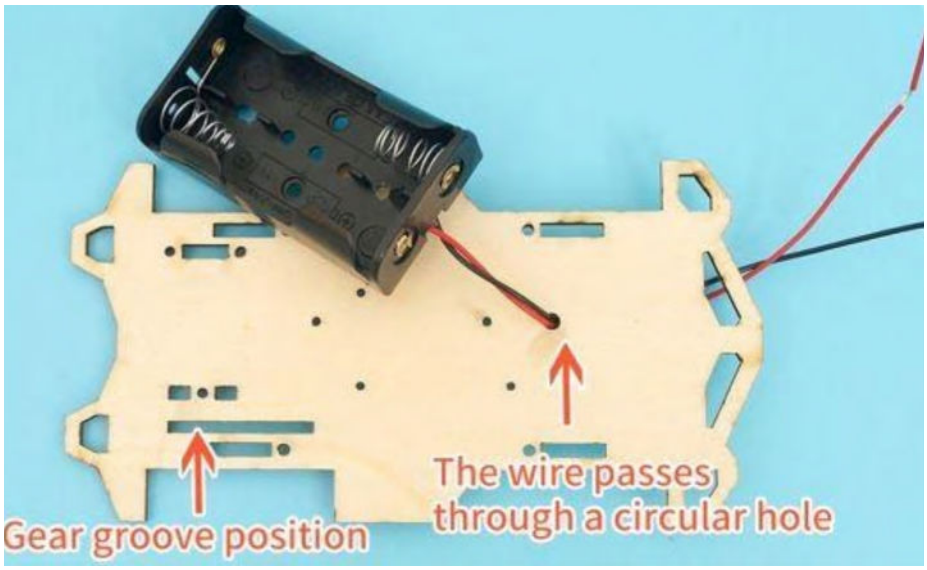


Step 9:

Refer to the figure on the right, first install the top cover of the remote control, and then fix the top cover from both sides with a 4mm screw (both sides of the back battery box also need to be fixed with a 4mm screw).

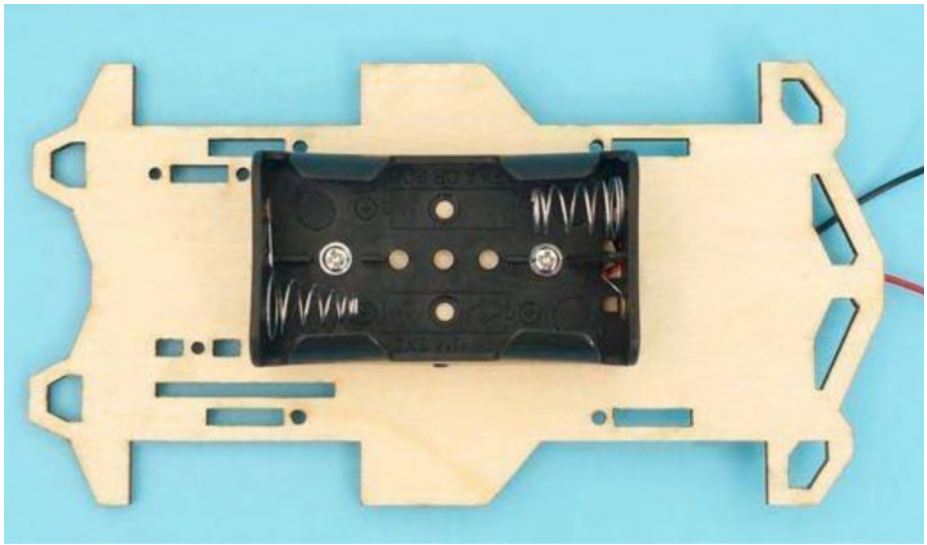
Step 10:

First lay the chassis flat, with the gear groove positioned downward to the left, and then run the battery pack wire through the round hole in the chassis.



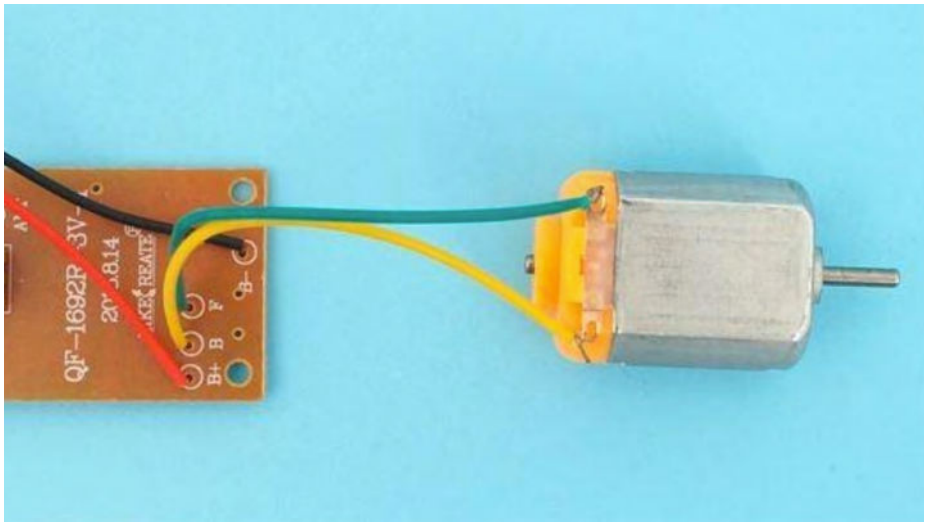
Step 11:

Secure the battery case with a 4mm screw.



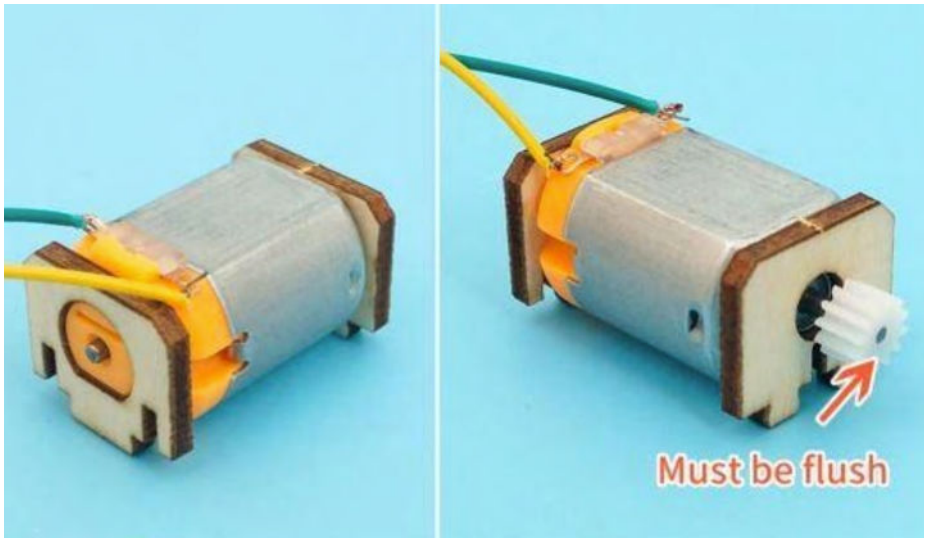
Step 12:

Connect the green wire of the remote control board to the copper piece above the motor, and connect the yellow wire of the remote control board to the copper piece below the motor. Wiring method: first screw the metal wire core into a spiral shape, then screw the metal wire core through the small hole of the copper piece of motor wiring, and then screw it 3-4 times.



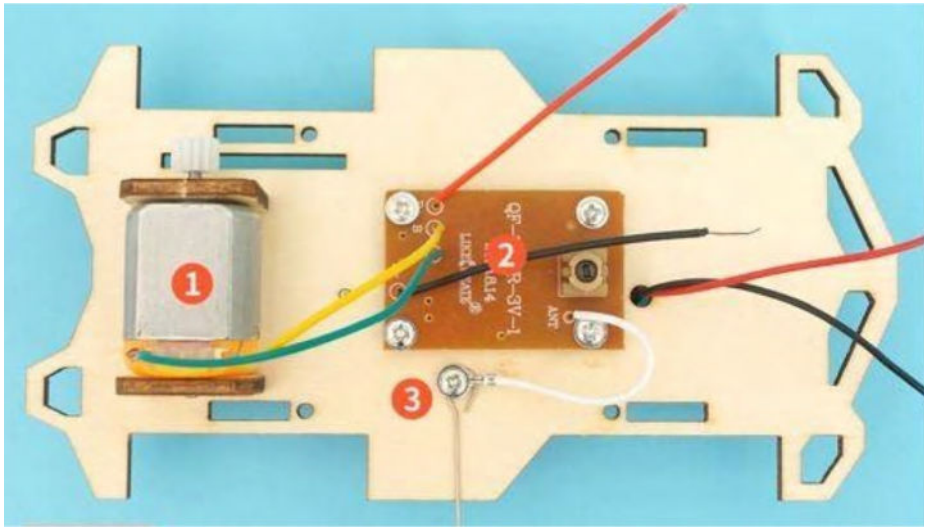
Step 13:

First install the front and rear shapes of the motor corresponding to the motor clips on the motor, and then install the white gear on the motor's rotating shaft. The gear must be flush with the rotating shaft.



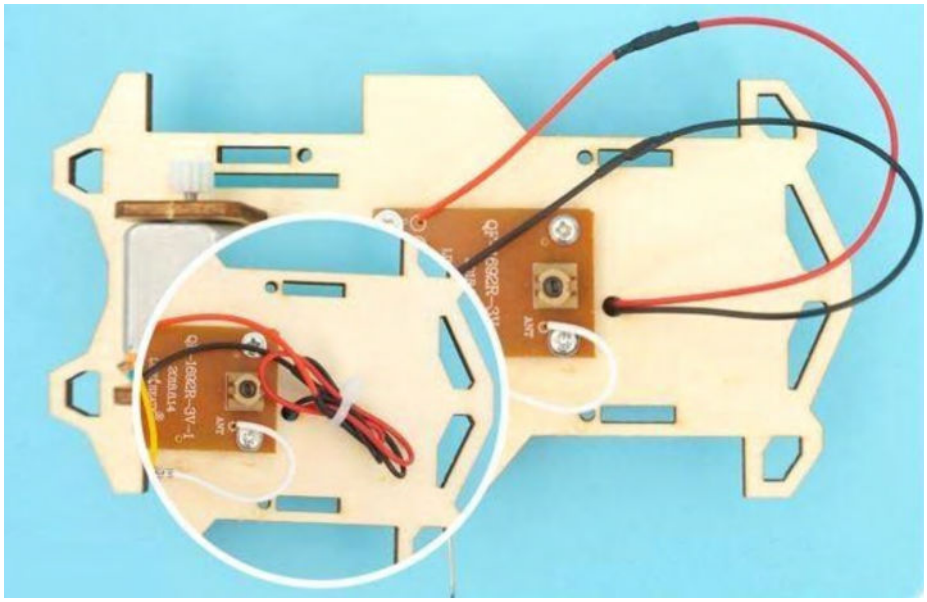
Step 14:

1. Install the motor module on the chassis.
2. Fix the receiving plate on the chassis with a 4mm screw (screw cannot be screwed too tight, too tight will cause the receiving plate.
3. Install the L-shaped antenna with a 4mm screw (antenna mounting sequence: chassis -L-shaped antenna - antenna guide - screw).



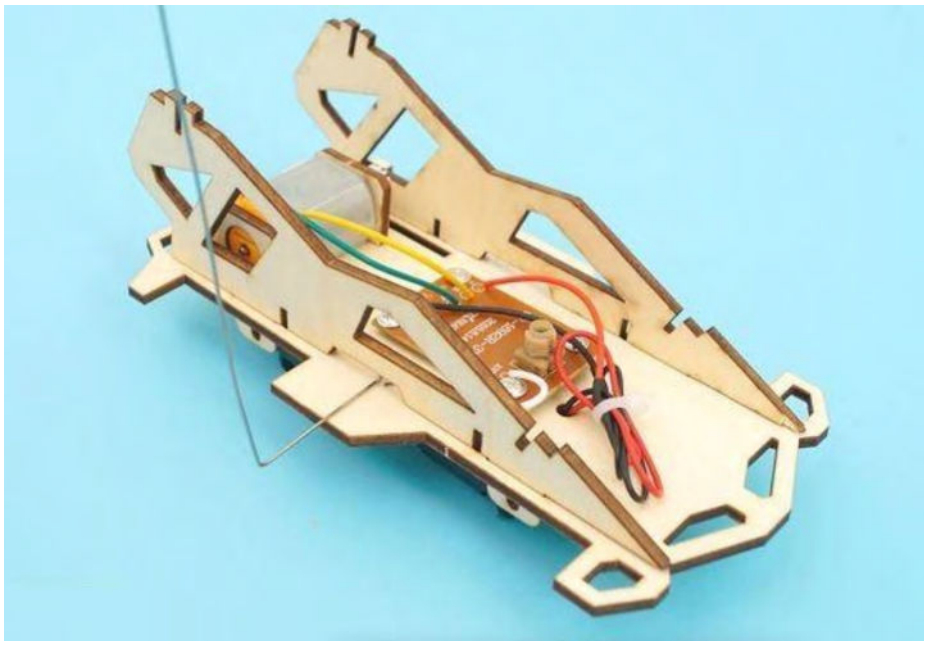
Step 15:

Refer to the wiring method of STEP6 and STEP7, connect the black-red wire of the battery box with the black-red wire of the receiving board, and arrange the growing wire with the tie



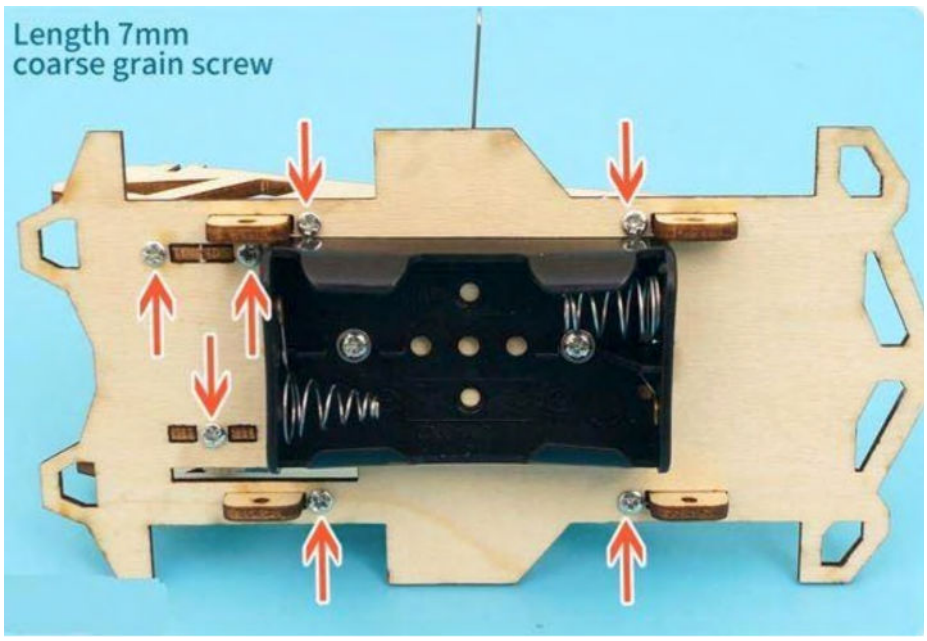
Step 16:

Install two side panels on the frame.



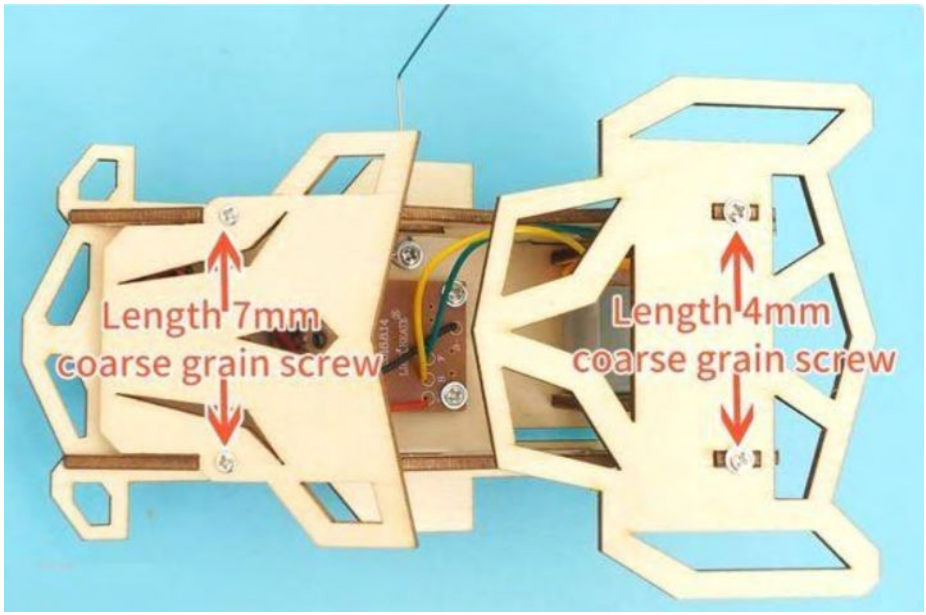
Step 17:

Fix the side plate and motor module from the bottom of the chassis with a 7mm screw.



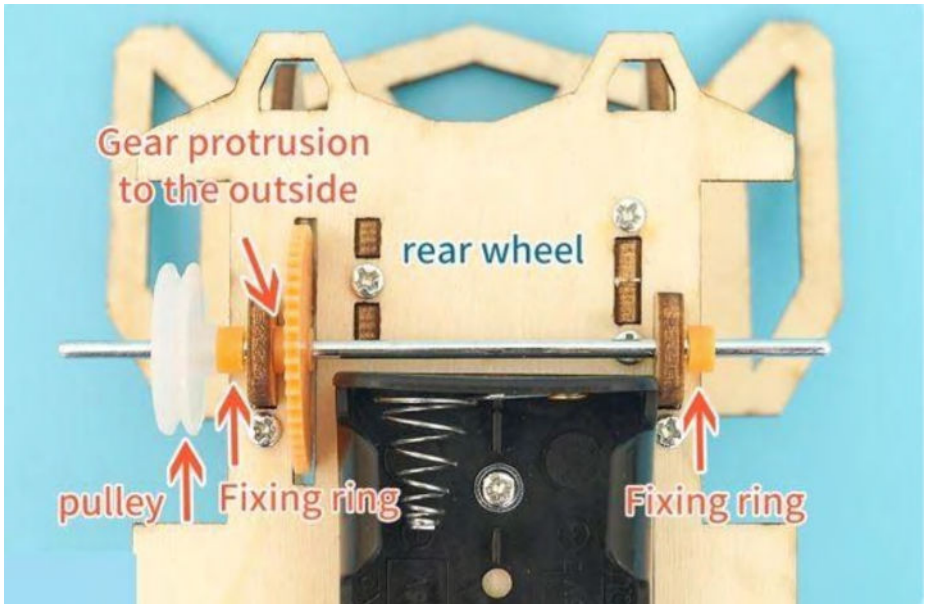
Step 18:

First, install the front cover with a 7mm screw, and then install the tail wing with a 4mm screw.



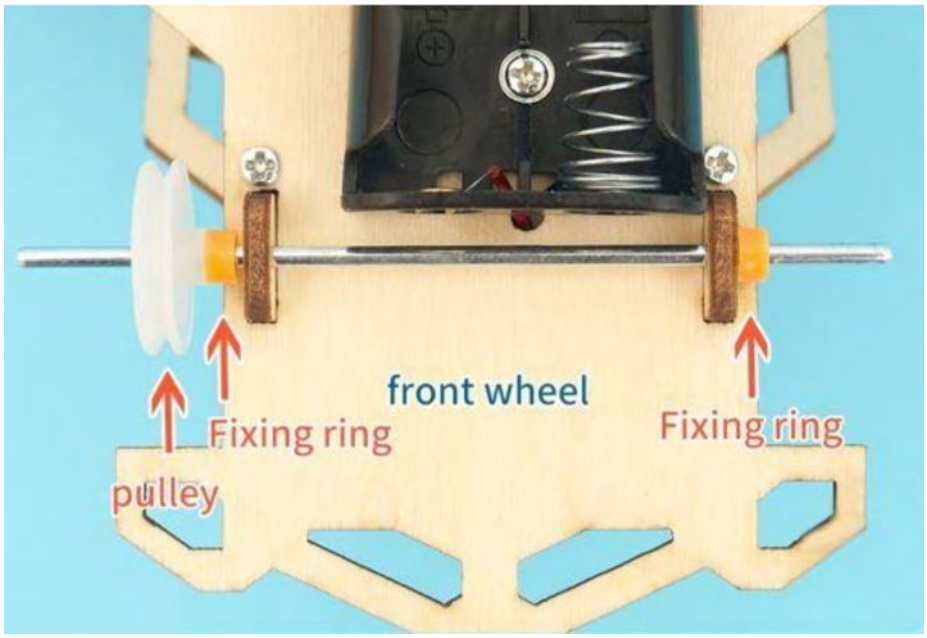
Step 19:

First, put the orange gear in the gear groove, then pass the wheel shaft through the frame round hole and the gear hole, and finally cover both sides of the shaft with orange fixed ring and white belt pulley, the belt pulley protruding part towards the orange fixed ring (the belt pulley is installed on the left side)



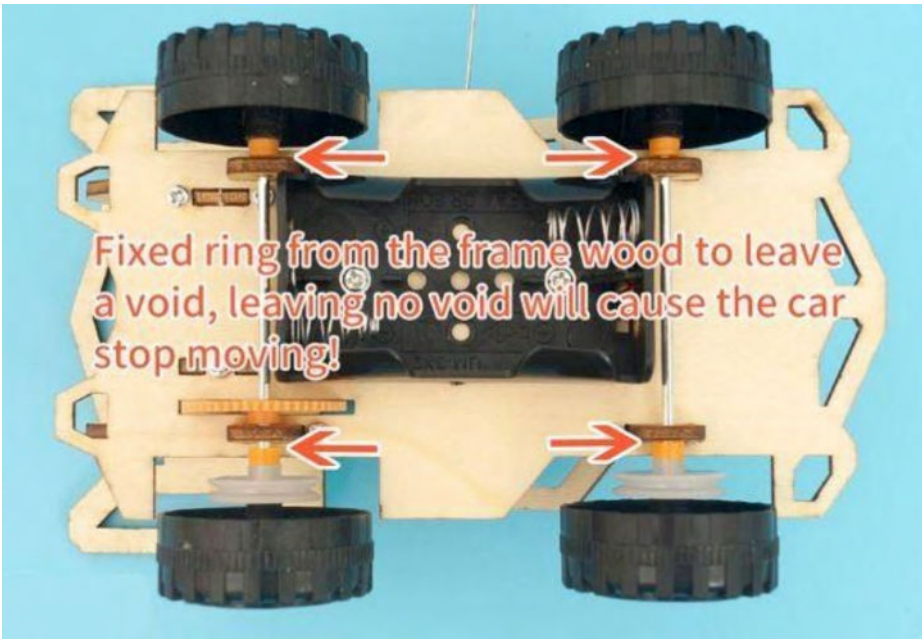
Step 20:

First pass the axle through the frame hole, then cover both sides of the axle with orange fixing ring and white belt pulley. The belt pulley protruding towards the orange fixing ring (the belt pulley is installed on the left



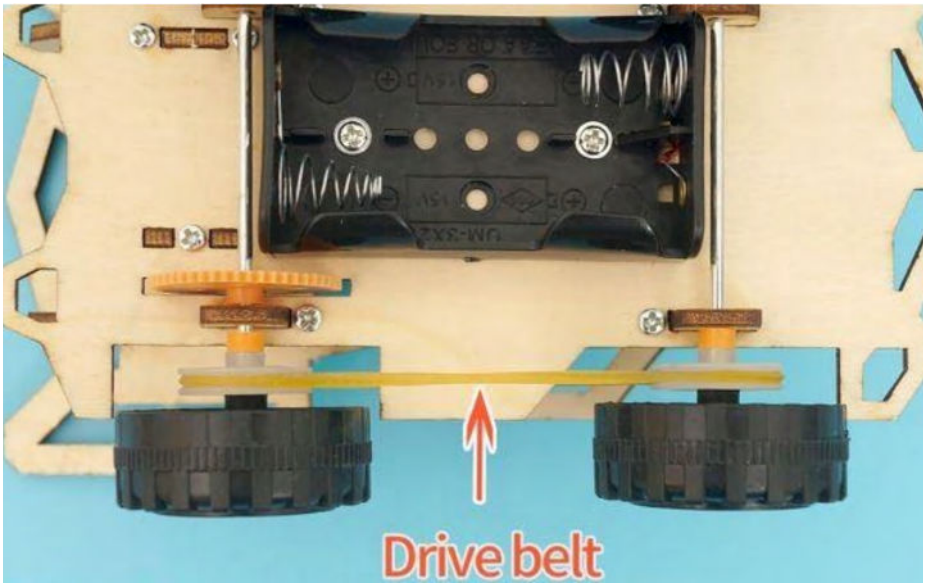
Step 21:

Install the wheel on the axle. After the wheel is installed, check the rotation resistance. If it is too tight, loosen the wheel until it can rotate easily.



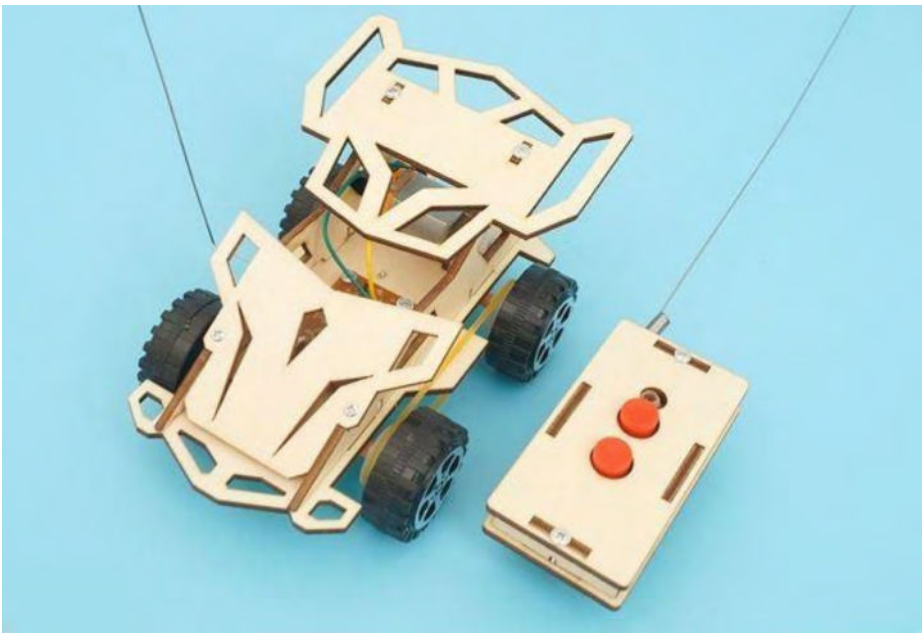
Step 22:

Install the transmission belt on the white belt.



Step 23:

The Remote Control 4 Wheel Drive race car is done! Install the battery, press the remote button, and the car is ready to go!!



Potential Troubleshooting

Why doesn't it move when it's complete?

1. Remote control is required (hold down the remote control button with your hand), the hand cannot touch the antenna when remote control is in progress.
2. Check whether the battery is low and try a new battery.
3. Check whether the manual wiring is properly connected and whether there is short circuit or broken wiring in the wiring place.
4. Check that the wheels are not too tight against the wood and that they cannot turn
5. Check if the gears fit too tightly, which may cause the car to freeze.

The remote control panel uses a common frequency radio signal and will spin when it receives a signal of the same frequency, which is normal.

Science Tips

What is the maximum distance of the remote control?

The remote control distance of this wireless remote control car is 4-5 meters.

Can multiple remote control cars be controlled separately from one another?

This model uses a universal frequency remote control board, remote control cars of the same frequency can not be used together at the same time, will interfere with each other.

How do Remote Controls Work?

Remote controls work by sending signals through the air to control devices like TVs, cars, or toys. The system has three main parts: the **transmitter**, the **receiver,** and the **actuator**. Here's how they work together:

1. **Transmitter** (the remote itself)
   The transmitter is in the remote and is responsible for sending signals. When you press a button on the remote, it generates a specific signal, or code, that represents a command (like changing the channel). This signal is a low-frequency electrical signal, but it needs to be sent as a higher-frequency signal (called a "carrier") so it can travel through the air. This process is called modulation—it's like "attaching" the message to the carrier wave.

2. **Receiver** (inside the device you're controlling)
   The receiver is located in the device you're trying to control, like a TV. It has an antenna that picks up the signal sent by the transmitter. The signal that the receiver gets is a mix of the message (the command) and the carrier. The receiver uses a process called **demodulation** to remove the carrier and focus on just the command.

3. **Actuator** (makes the device do something)
   Once the receiver decodes the signal, it sends the command to the actuator, which is responsible for carrying out the action. For example, the actuator could be a circuit that turns on the TV, changes the volume, or moves a motor in a toy.

Key Concepts:

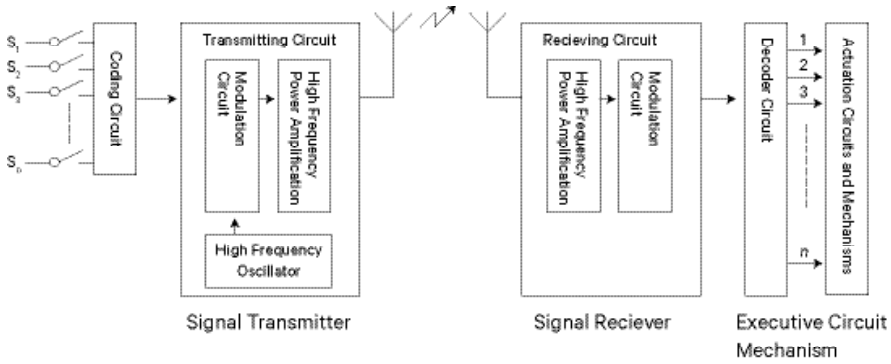
The remote control distance of this wireless remote

- **Coding:** When you press a button, the remote creates a coded message that corresponds to that button. Each button has a different code.
- **Frequency:** Frequency is how often the signal repeats in a second, measured in Hertz (Hz). High-frequency signals help the message travel longer distances.
- **Modulation:** Modulation is when the remote "loads" the command onto the carrier wave, so it can travel through the air.
- **Demodulation:** This is the reverse of modulation. The device receiving the signal removes the carrier to get just the command.

Why Remote Controls Work Over Long Distances:

Remote controls can work over long distances because they use radio waves or infrared light, which can travel far. Some remote controls can work over hundreds or even thousands of kilometres if they're using special technology (like satellite signals).
In simple terms: the remote sends a coded message, the device receives it, decodes it, and then acts on it. The whole process happens super fast, so it feels almost instant when you use a remote control.

Schematic diagram of wireless remote control



Glossary of Terms

Battery (Button or Coin Cell)	Button batteries, also referred to as coin cells, are circular non-rechargeable batteries. Due to their size they are used to power electronic devices. Standard domestic applications include watches, scales, remote controls and calculators. They can be found in greeting cards, and are used to power small LEDs or speakers within the card (RS Online).
Conductor	Allows heat or electricity to pass through it.
Electrical Charge	Light emitting diode. LEDs have only two wires. One wire is the anode (positive) and another is the cathode (negative). The two wires have different names because LEDs only work in one direction and we need to keep track of which pin is which. One goes to the positive voltage and the other goes to the negative voltage.
Polarity	In physics, polarity is an attribute with two possible values - an electric charge can have either positive or negative polarity - a voltage or potential difference between two points of an electric circuit has a polarity, describing which of the two points has the higher electric potential. - a magnet has a polarity, in that it has two poles described as “north” and “south” pole.

Battery type
Only use Zinc Chloride Cell batteries while using this kit.

Warning! Battery Box:

1. The supply terminals are not to be short-circuited
2. Insert batteries with the correct polarity
3. Remove batteries when not in use
4. Do not use rechargeable batteries
5. Different types of batteries of new and old are not to be mixed
6. Only use Zinc Chloride Cell Batteries

Battery Safety Warning

Batteries, such as the AA batteries used with this teaching kit, are a source of electrical energy and must be handled with care. To ensure your safety and the proper functioning of your STEM activities, please adhere to the following guidelines:

Keep Away from Heat

Avoid exposing the battery to direct heat sources or prolonged sunlight, as excessive heat can affect its performance and safety.

Avoid Short Circuits

Do not connect the battery box terminals to each other, as this can cause the battery and wire to become extremely hot. Always use the designated connectors and components. Always use the provided connectors, wires, or components as intended.

Polarity

Ensure that you insert the battery with the correct polarity, aligning the positive (+) and negative (-) terminals accordingly.

Dispose of Properly

When your battery is no longer in use, dispose of it in accordance with your local regulations and guidelines for battery recycling.

Inspect for Damage

Before use, carefully inspect the battery for any visible damage, such as leaks, dents, or corrosion. Do not use a damaged battery.

Adult Supervision

Always have an adult supervise your use of batteries and electrical components.