Quadcopter



Do you know what this is?







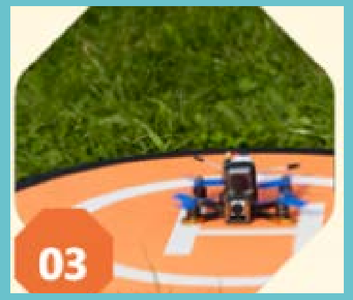
A quadcopter, also known as a quadrotor aircraft or quadrotor helicopter, is a type of multirotor aircraft. It is also called a quadrotor drone. It can perform aerial maneuvers such as vertical takeoff and landing and hovering, and is highly maneuverable and controllable. It is therefore suitable for carrying out specific flight tasks in complex or dangerous environments, and can also be used for recreation. Quadcopters are widely used in aerial photography, crop protection, monitoring, inspection, logistics, passenger transport, and many other fields.



Components of a Quadcopter
A quadcopter consists of four rotors, a body, and a control system. Each rotor is driven by its own motor.



How a Quadcopter Works
By adjusting the speeds of the four rotors, the aircraft can rise, descend, move forward or backward, move left or right, and rotate.



Applications of Quadcopters
Quadcopters are widely used in aerial photography, agricultural monitoring, search and rescue, environmental monitoring, and other fields.

Development History

In 1907, the French Breguet brothers built the first quadrotor helicopter. In 1924, Oemichen's quadrotor helicopter achieved a vertical flight of 1 km. In the 1990s, developments in microelectromechanical systems (MEMS) and the successful application of inertial navigation systems made automatic control of multirotor aircraft possible. However, a truly stable multirotor autopilot did not appear until 2005. In recent years, advances in microelectromechanical control technology have brought stable quadcopters widespread attention. In 2024, Beihang University's Reliable Flight Control Team made progress in drone fault-tolerant control technology, designing a unified passive fault-tolerance control algorithm that enabled safe quadrotor flight even when a large proportion of the rotors had completely failed.

Materials

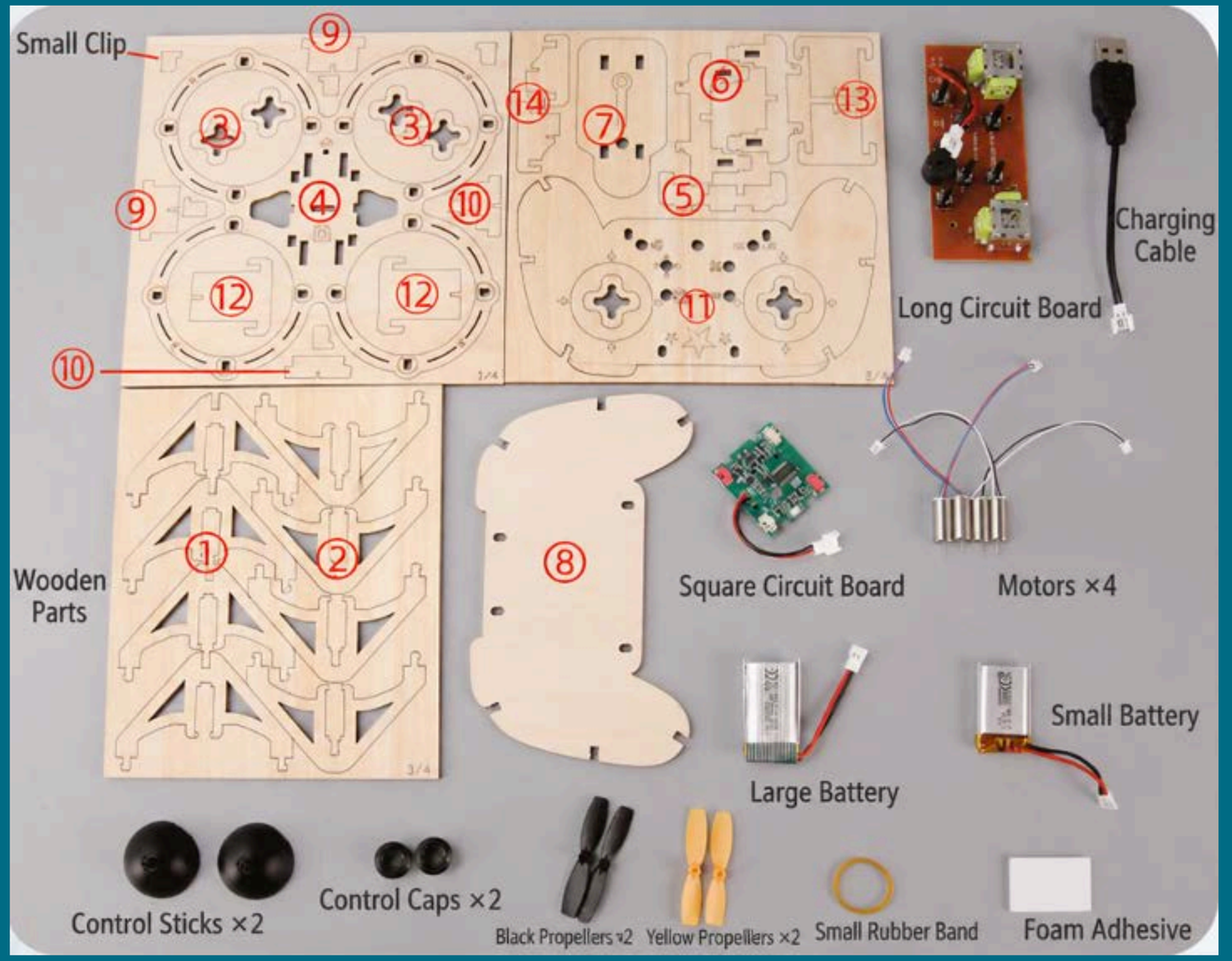
Wooden Parts, Foam Adhesive

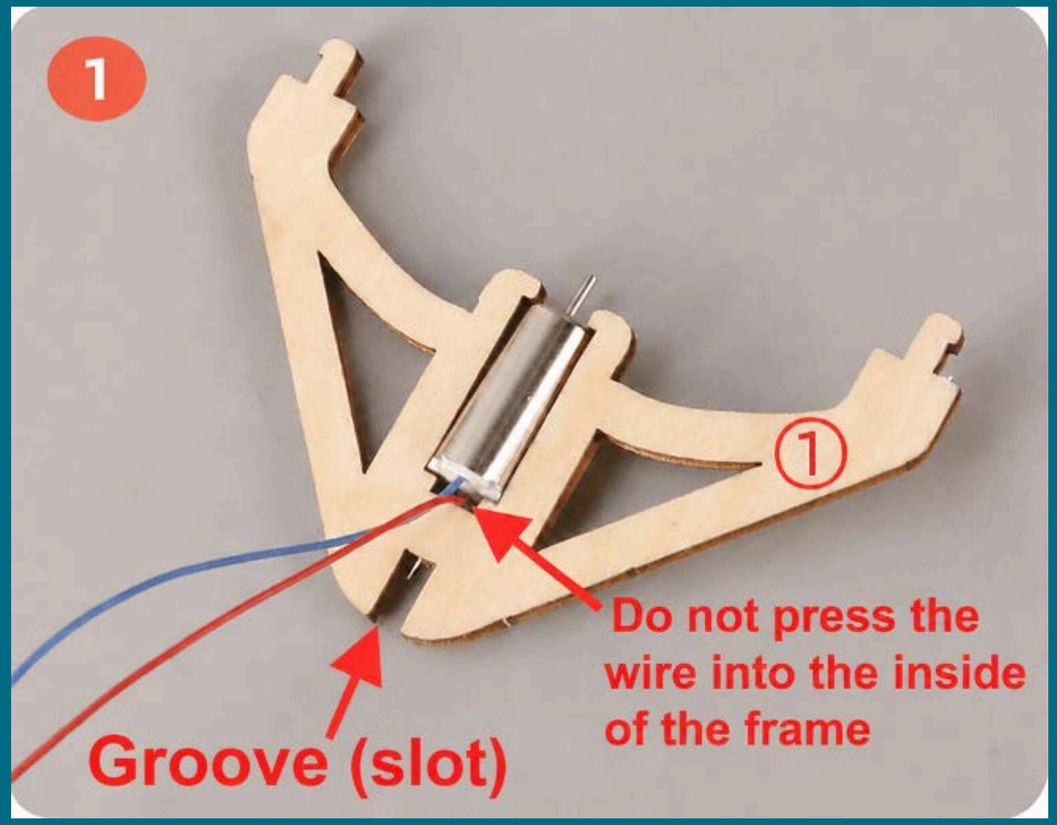
Square Circuit Board, Long Circuit Board

Motors, Charging Cable, Alcohol Glue

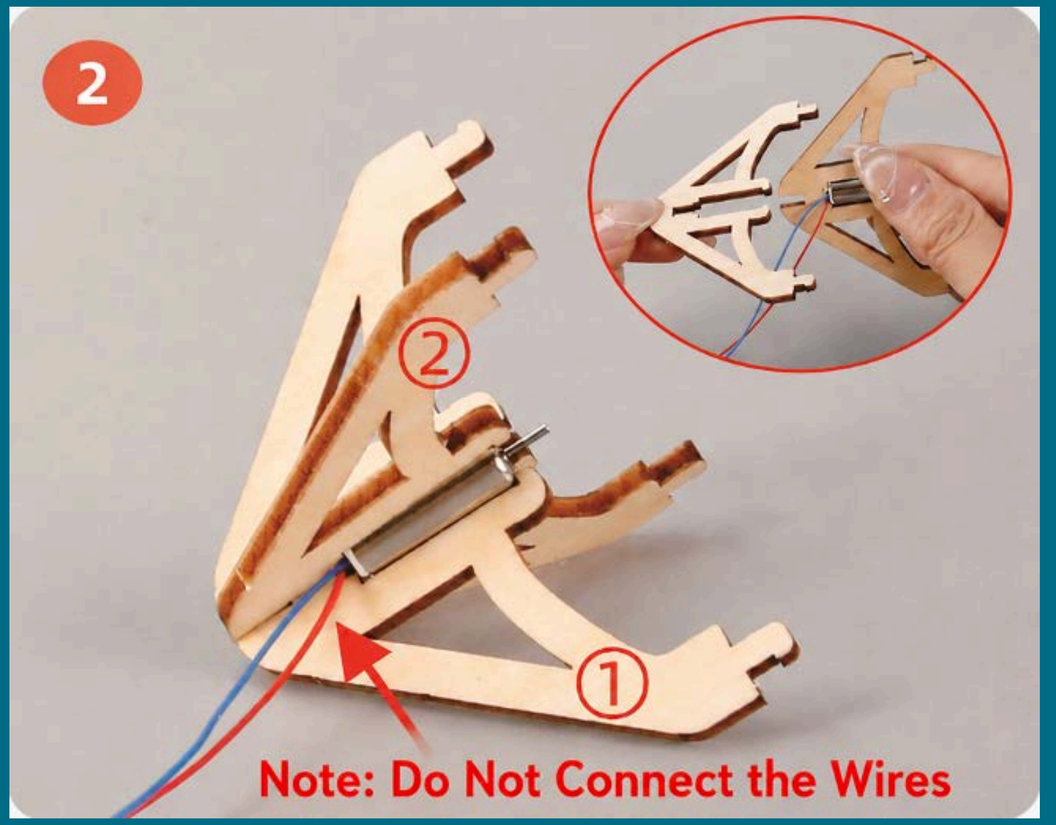
Large Battery, Small Battery, Small Rubber Band

Control Sticks/Caps, Black Propellers, Yellow Propellers





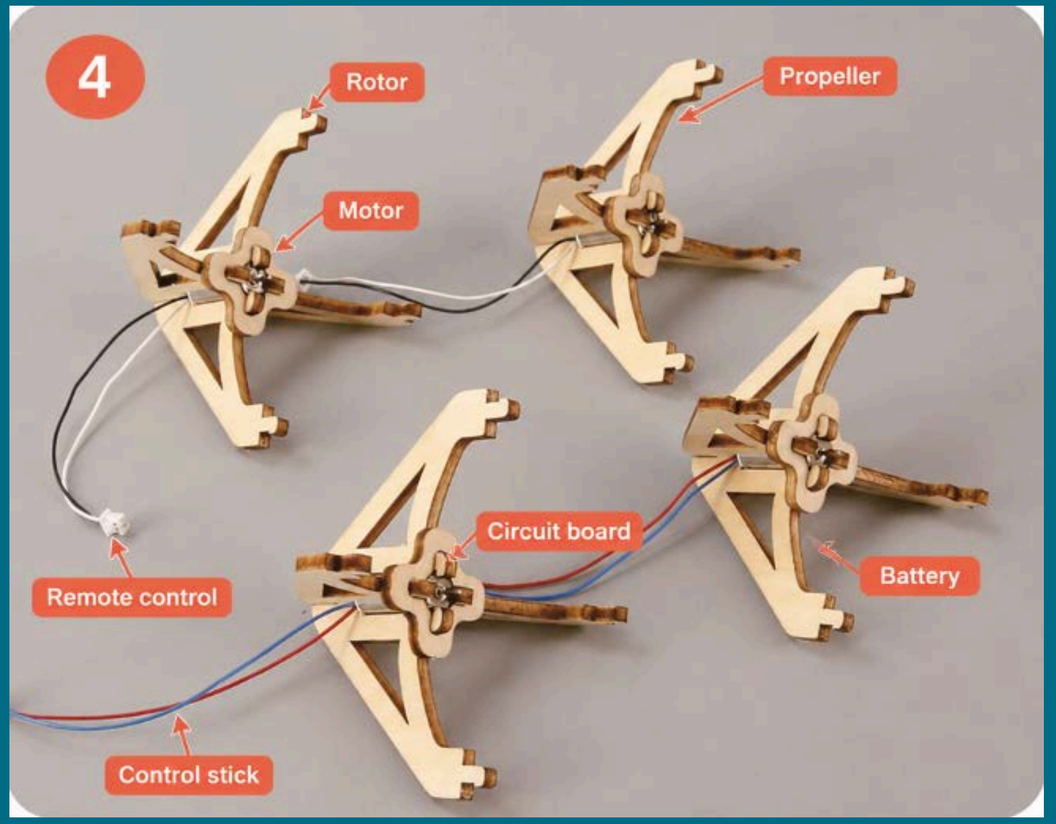
As shown, fit the motor into the slot in board No. 1.



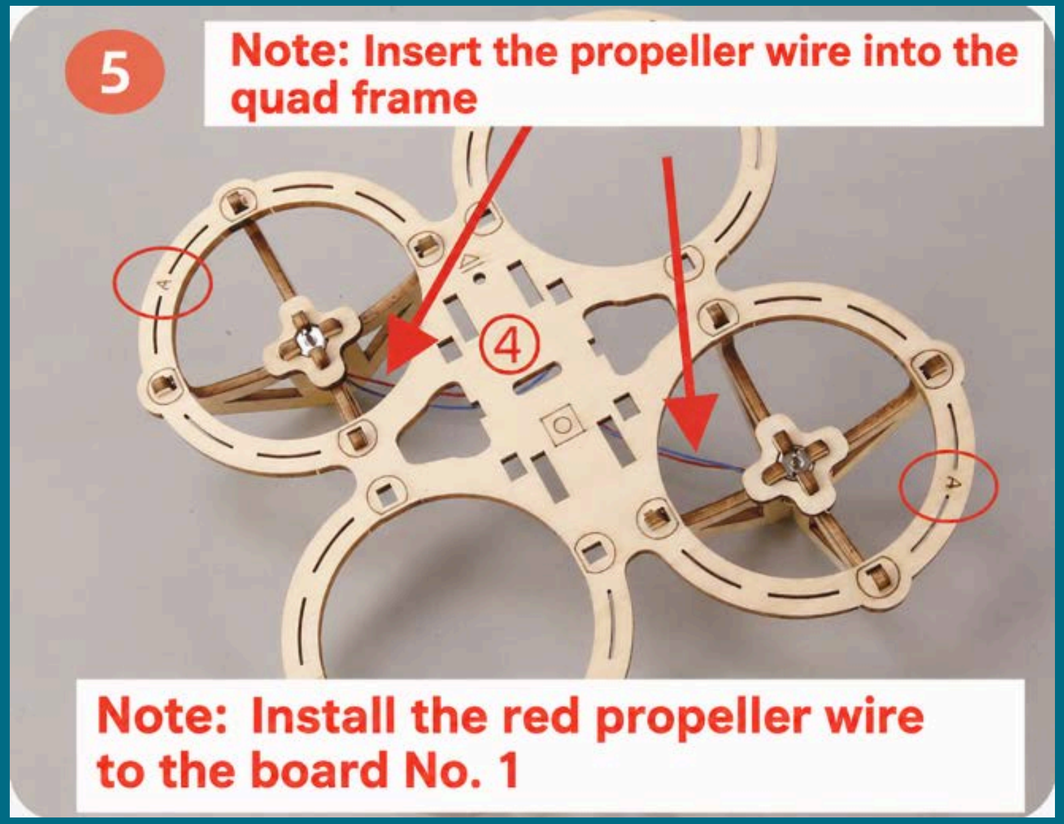
As shown, cross-fit board No. 2 with board No. 1 to secure the motor.



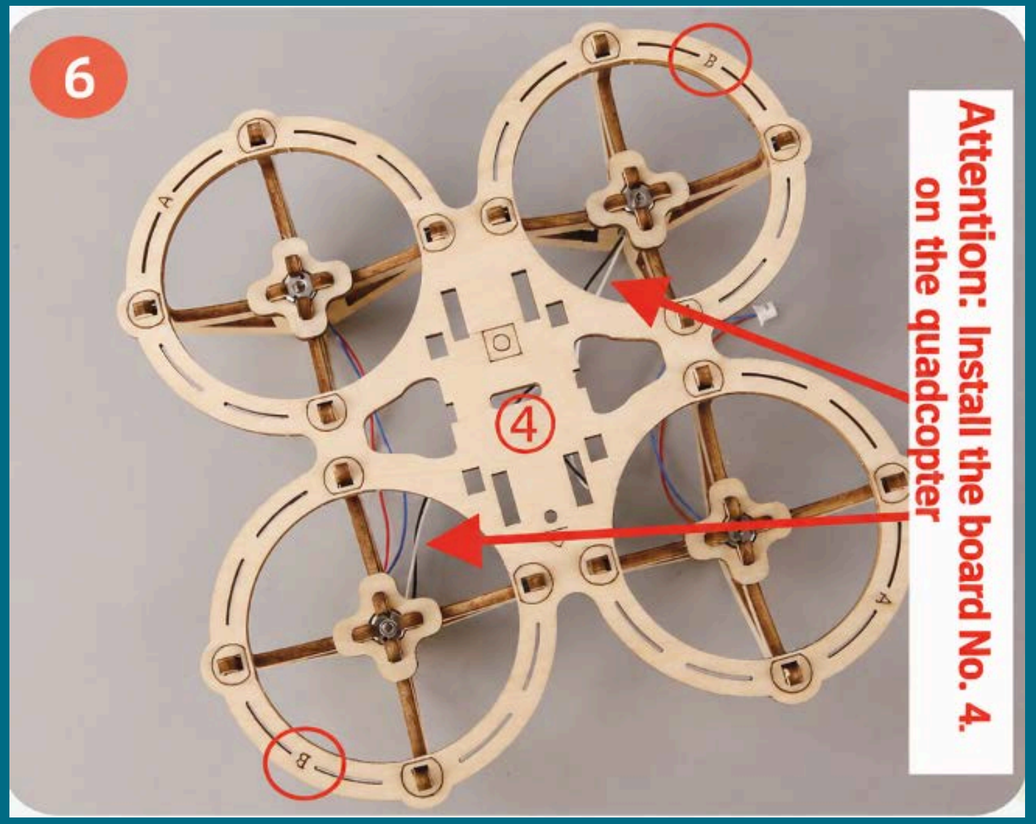
As shown, align board No. 3 with the central raised slot and press it into place.



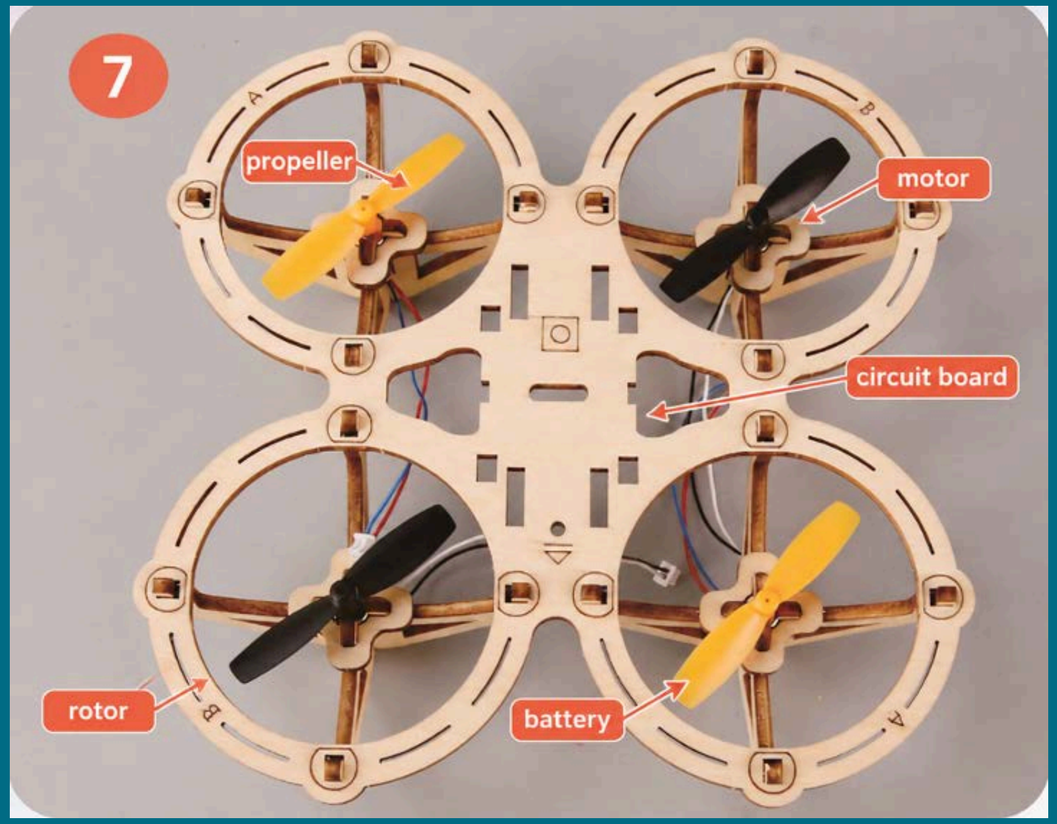
As shown, repeat steps 1, 2, and 3 to assemble four units.



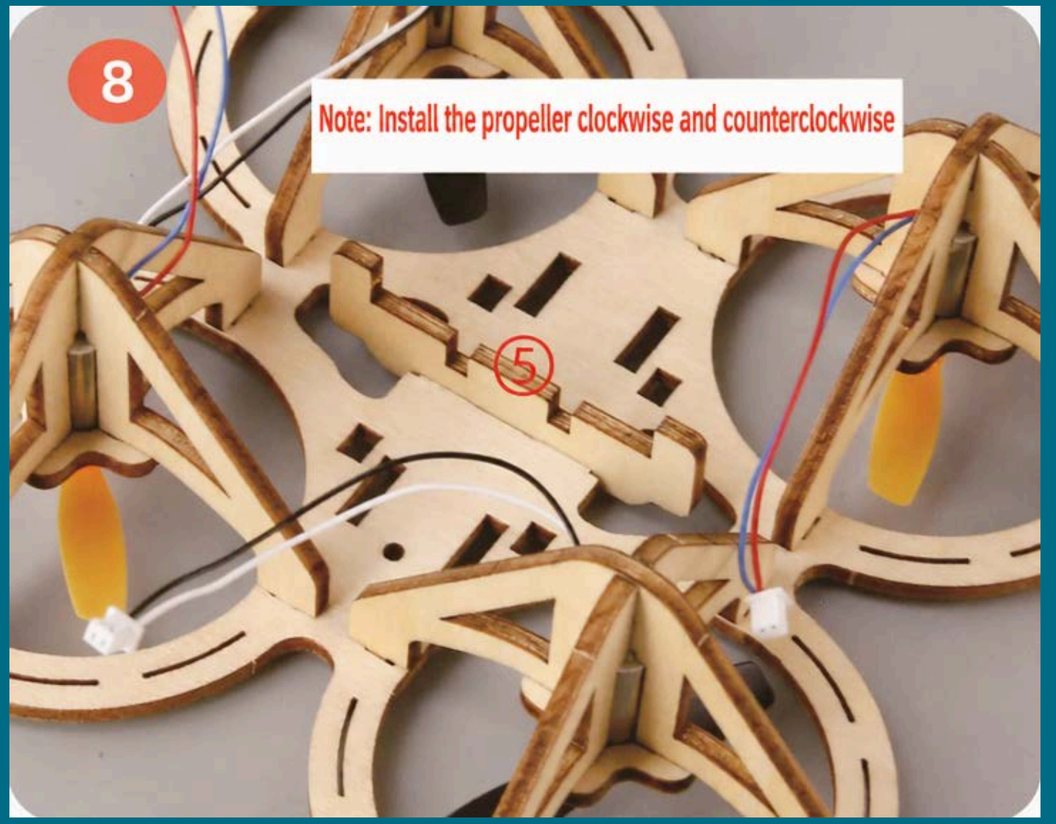
As shown, insert the red-and-blue wire assembly from step 4 upward into the circle marked A on board No. 4.



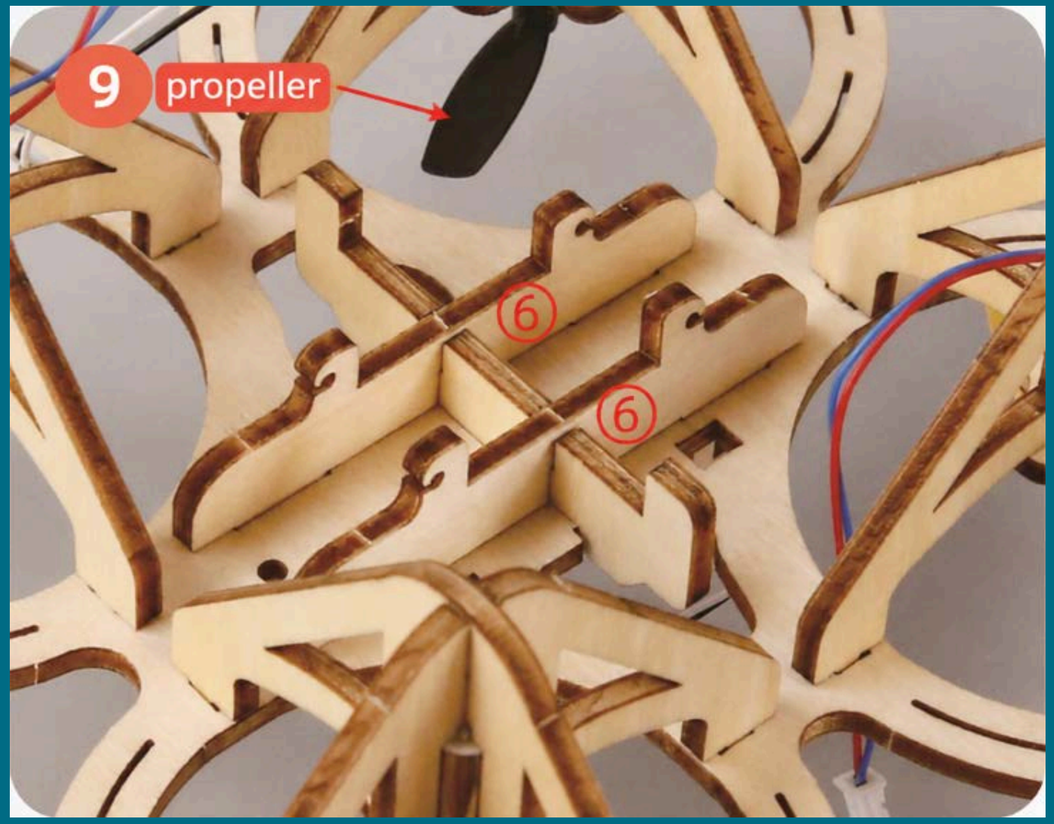
As shown, fit the black-and-white wire assembly from step 4 into the circle marked B on board No. 4.



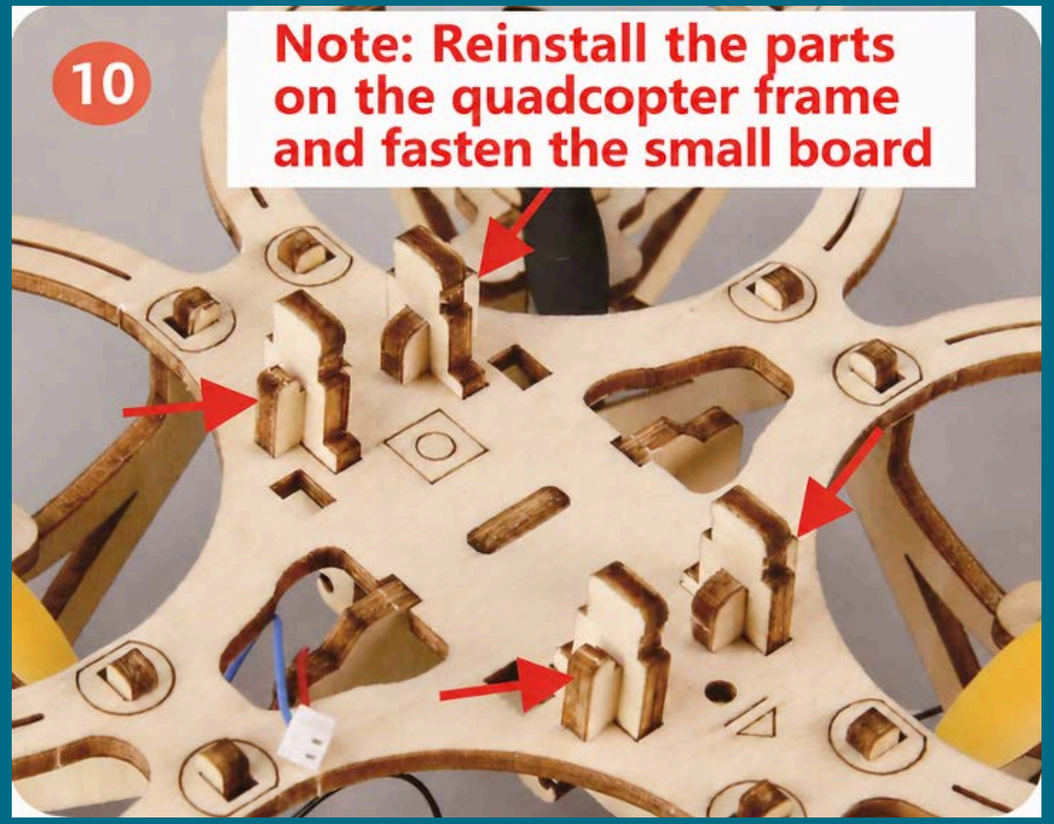
As shown, install the yellow propeller on the motor in the circle marked A, and the black propeller on the motor in the circle marked B.



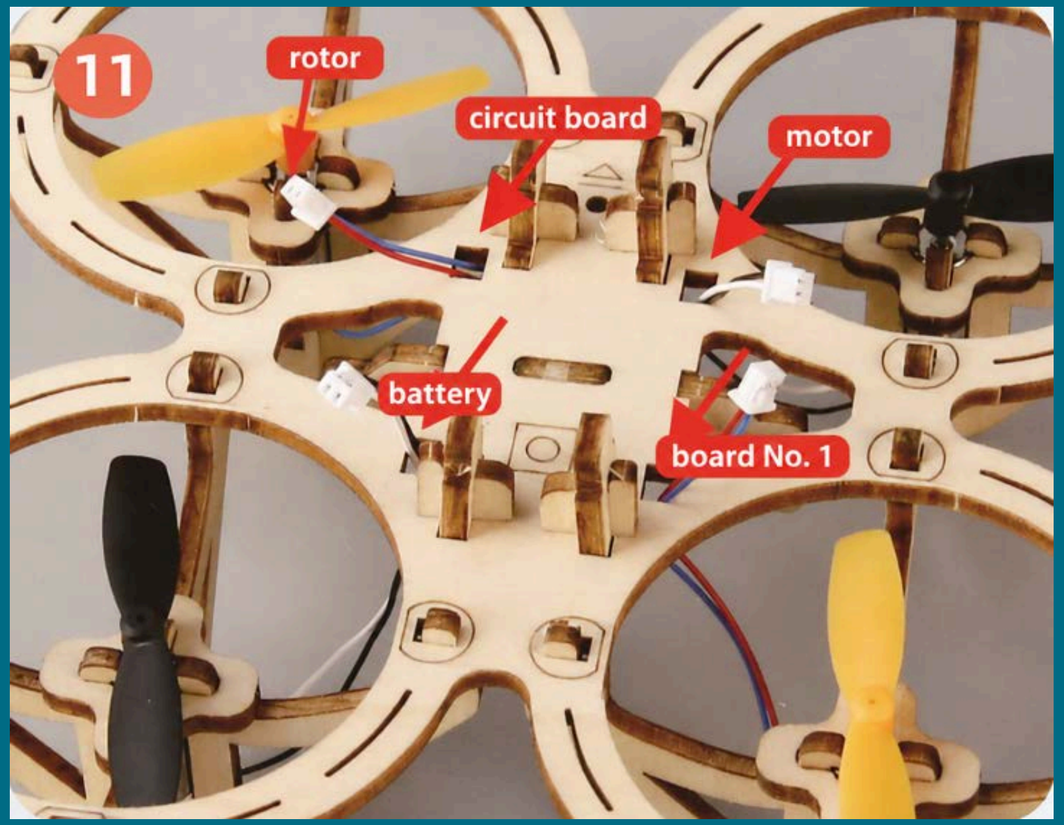
As shown, turn it over and fit in board No. 5.



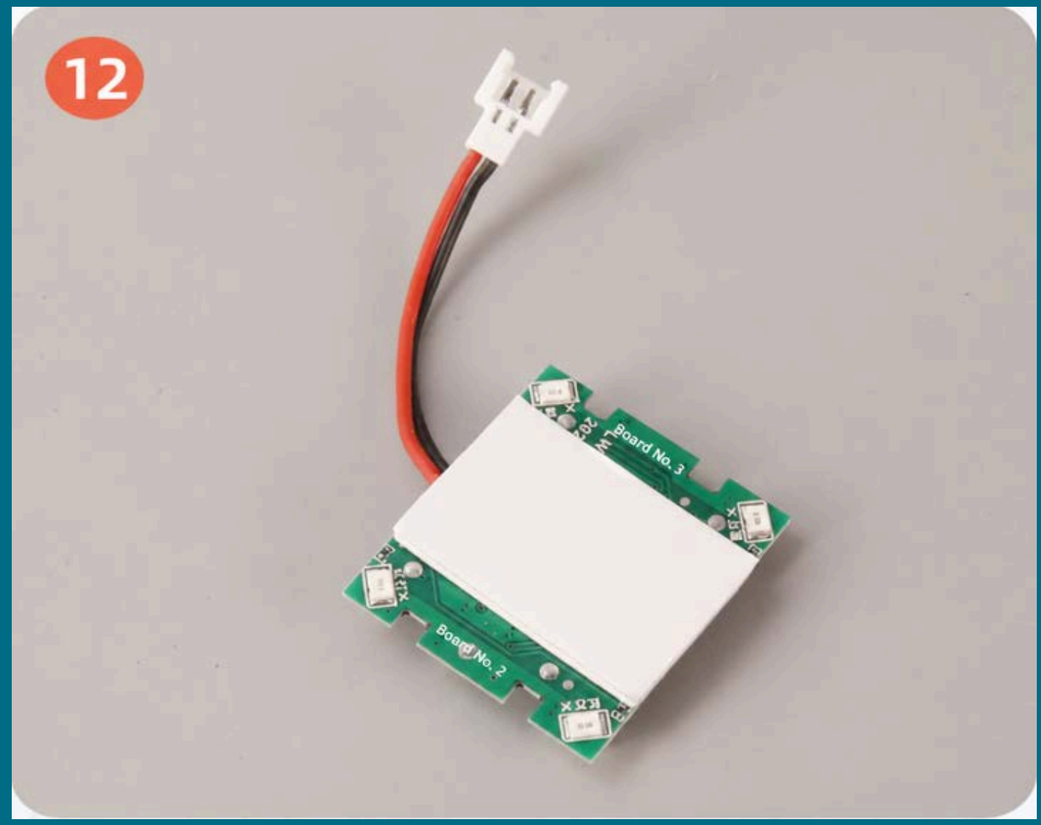
As shown, fit two board No. 6 pieces into the double slots.



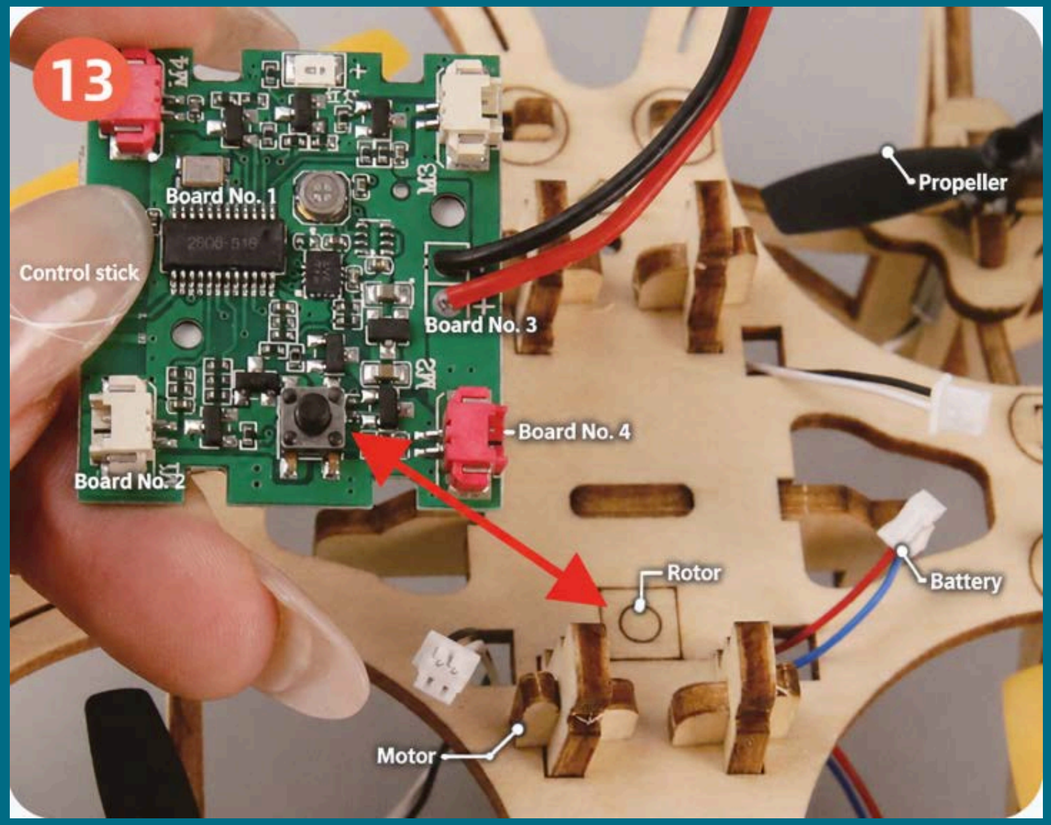
As shown, turn it to the front and secure it with the small clip.



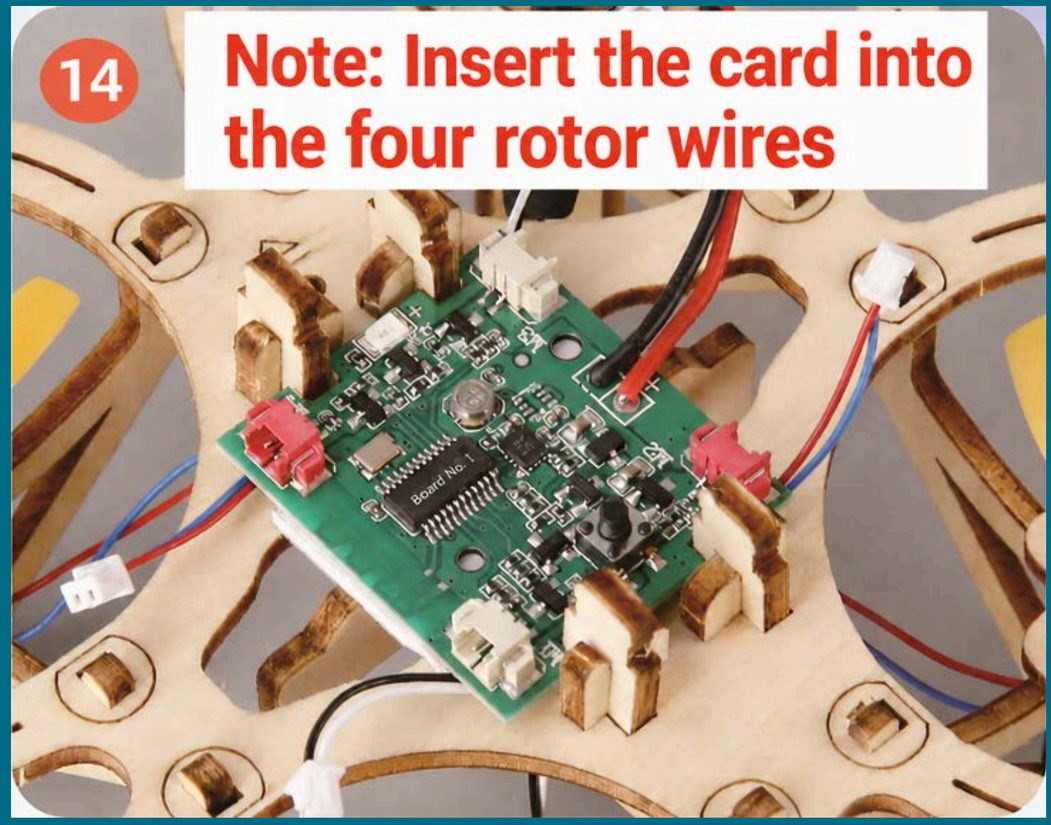
As shown, feed the motor connector wires one by one through the square holes in the bottom.



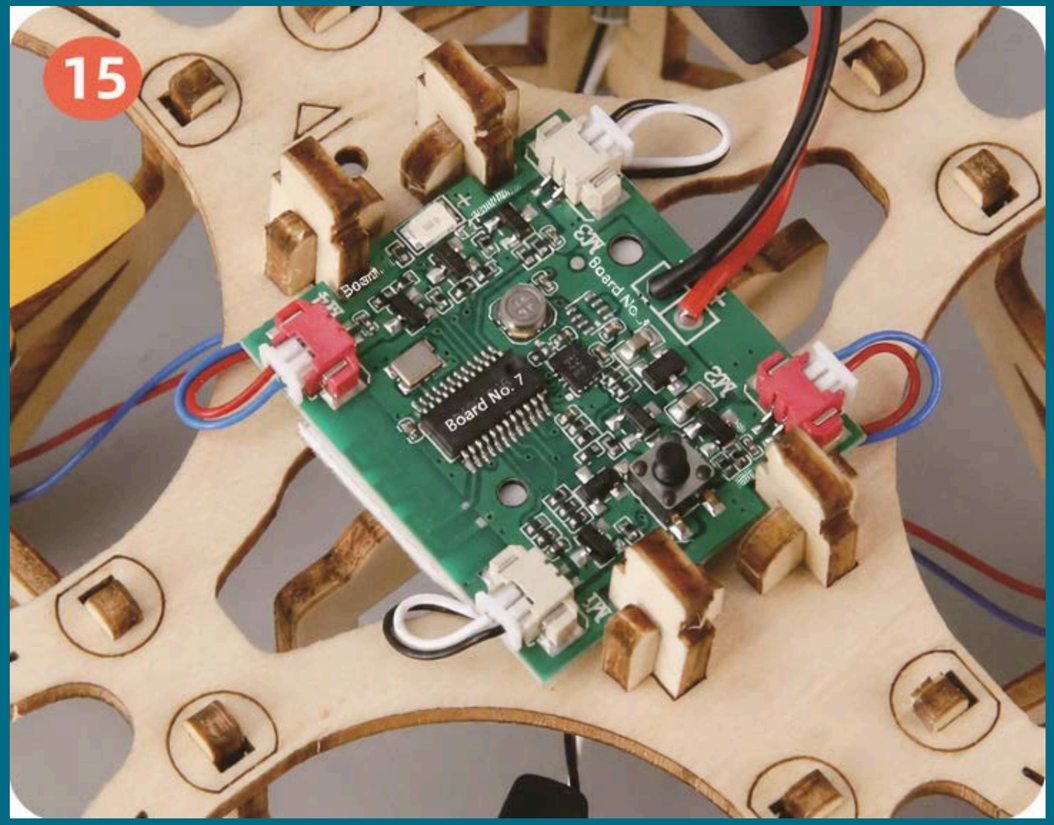
As shown, stick the foam adhesive onto the square circuit board.



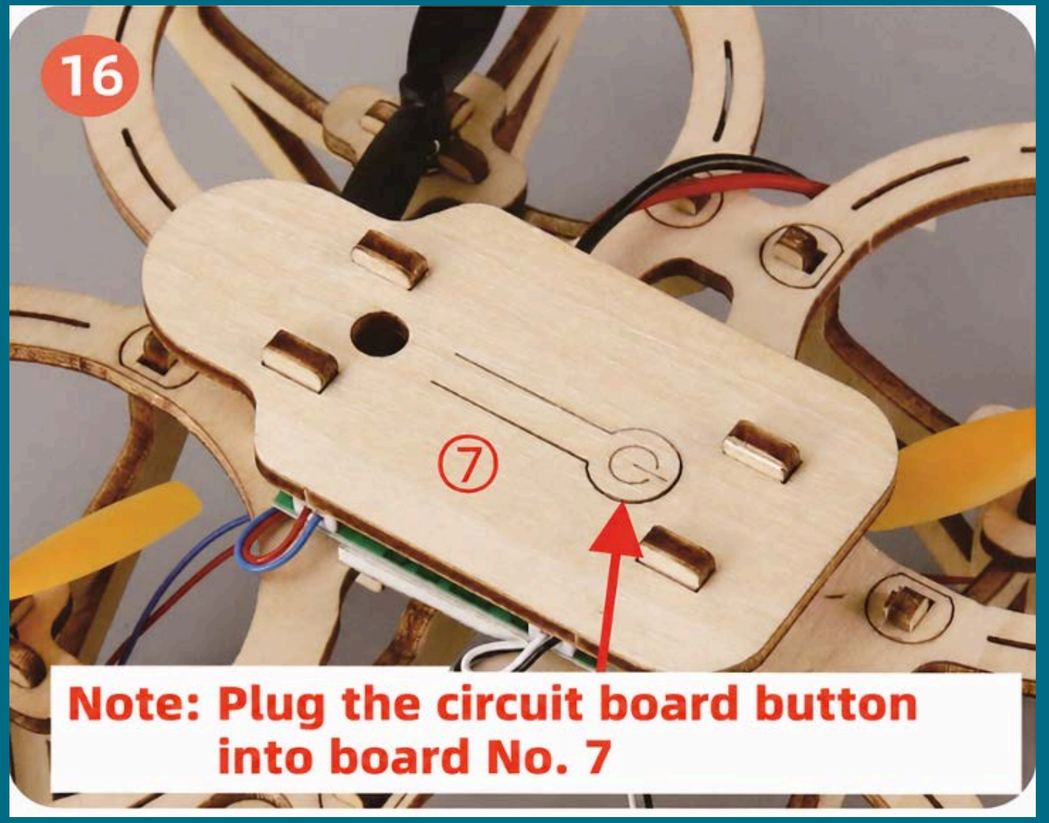
As shown, first check the attachment orientation against the markings. Align the button with the scan pattern, then fit it into place.



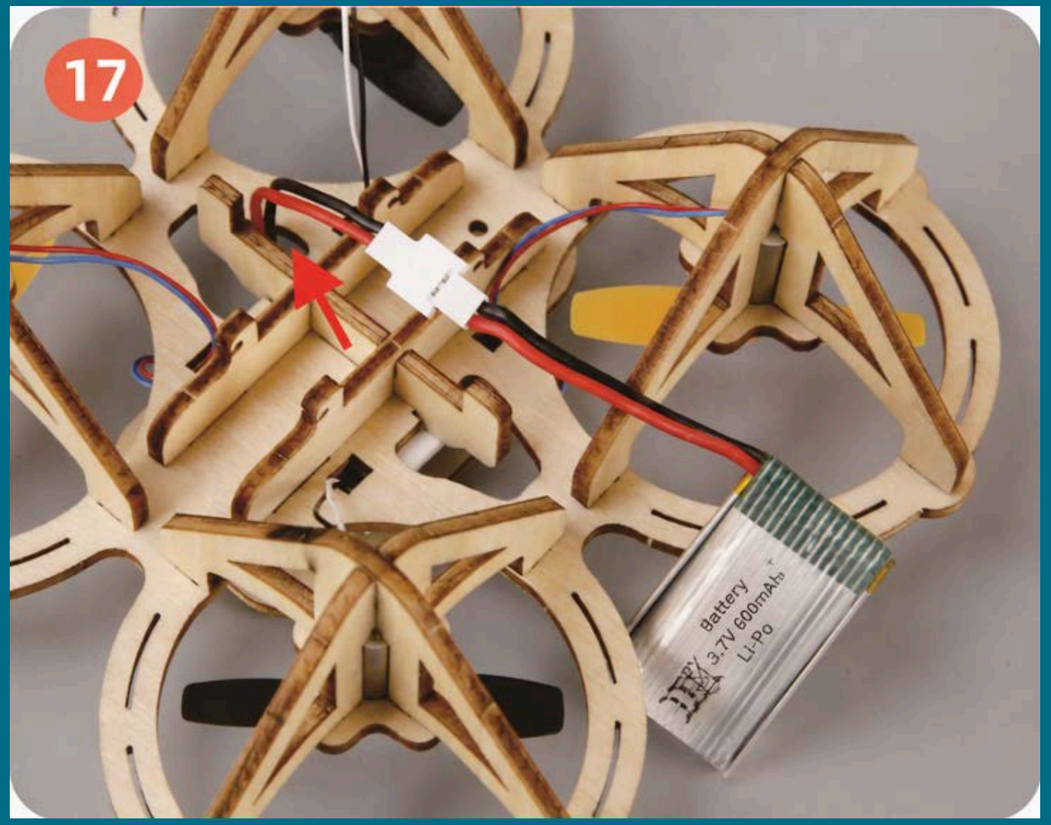
As shown, after confirming the orientation as in step 13, peel off the foam adhesive backing and fit it into the slot.



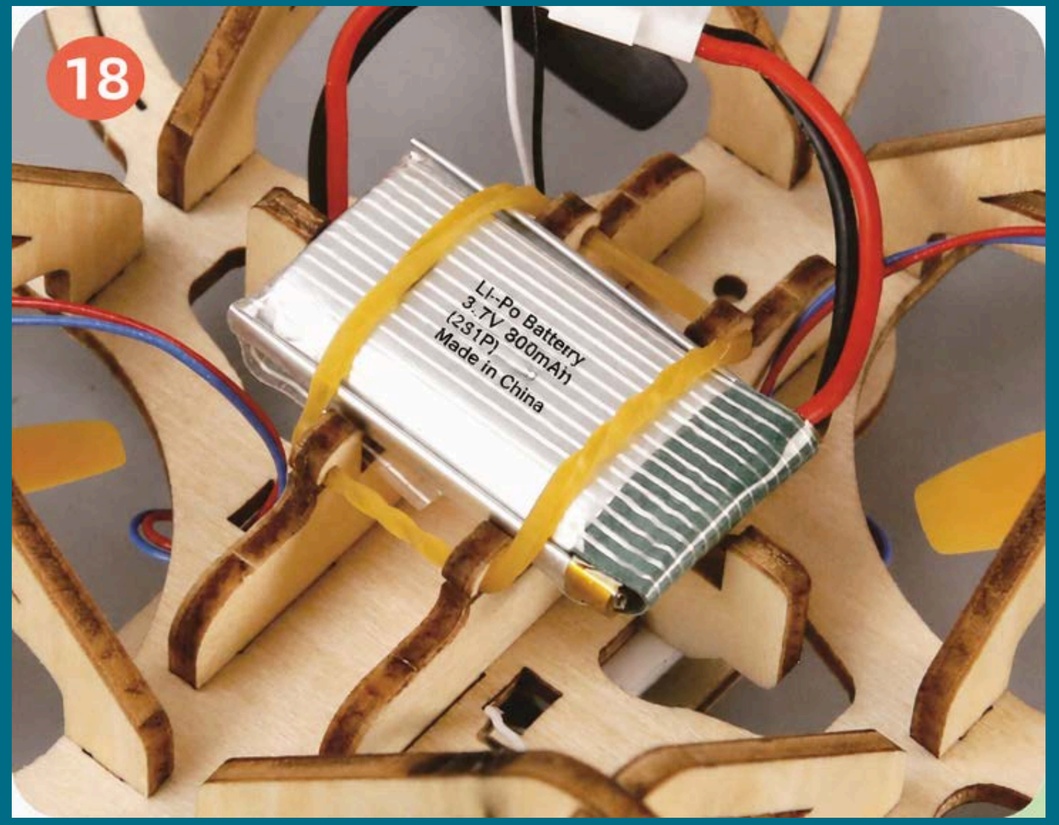
As shown, insert the wires that were fed through into the four corner ports of the circuit board.



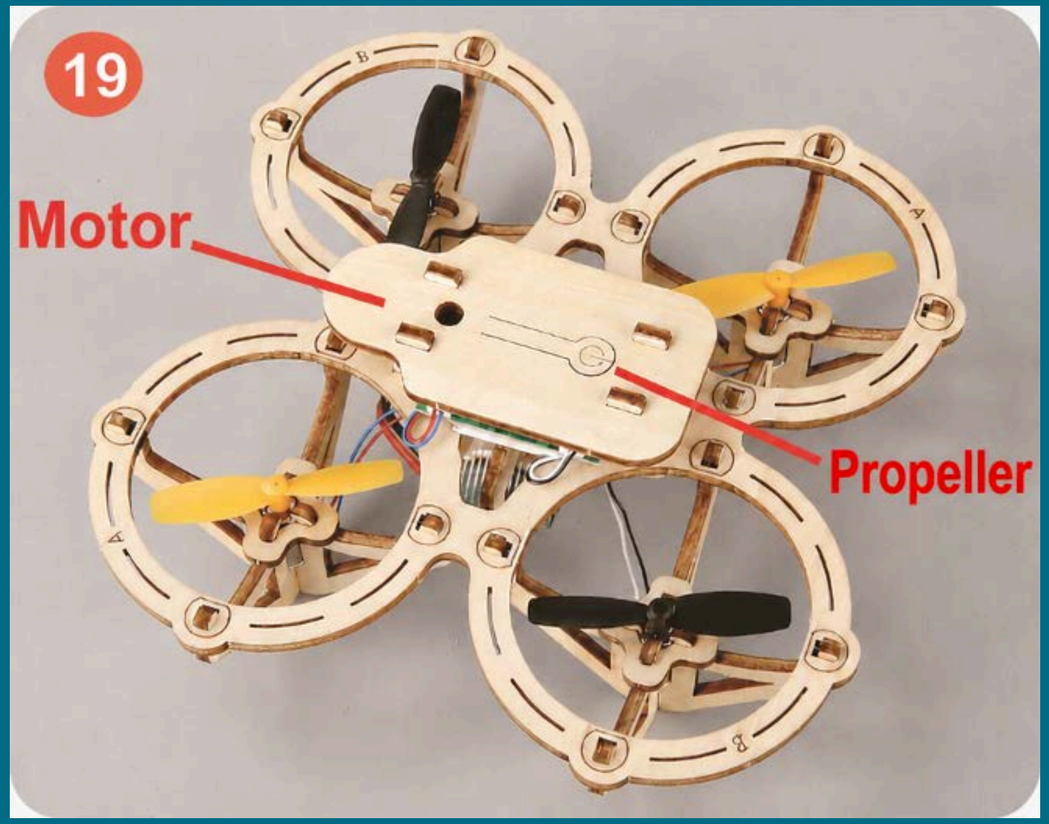
As shown, install board No. 7 on top of the circuit board.



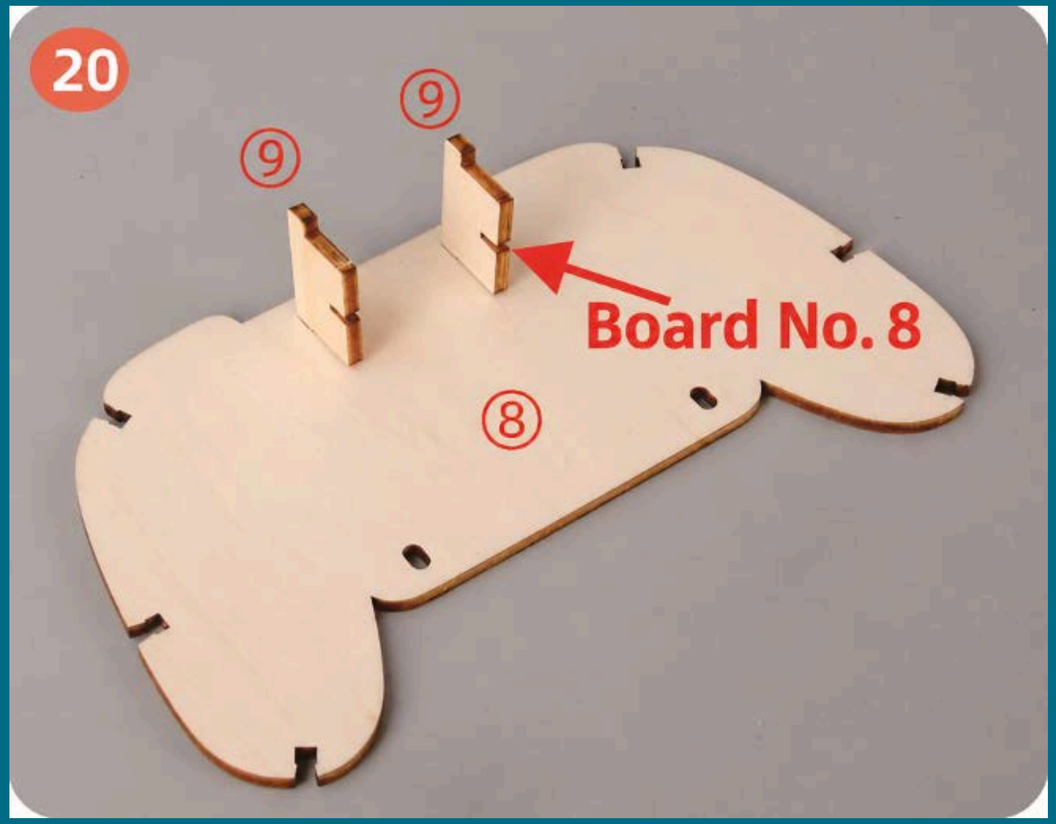
As shown, first feed the circuit board’s connector wire through to the bottom, then connect it to the large battery.



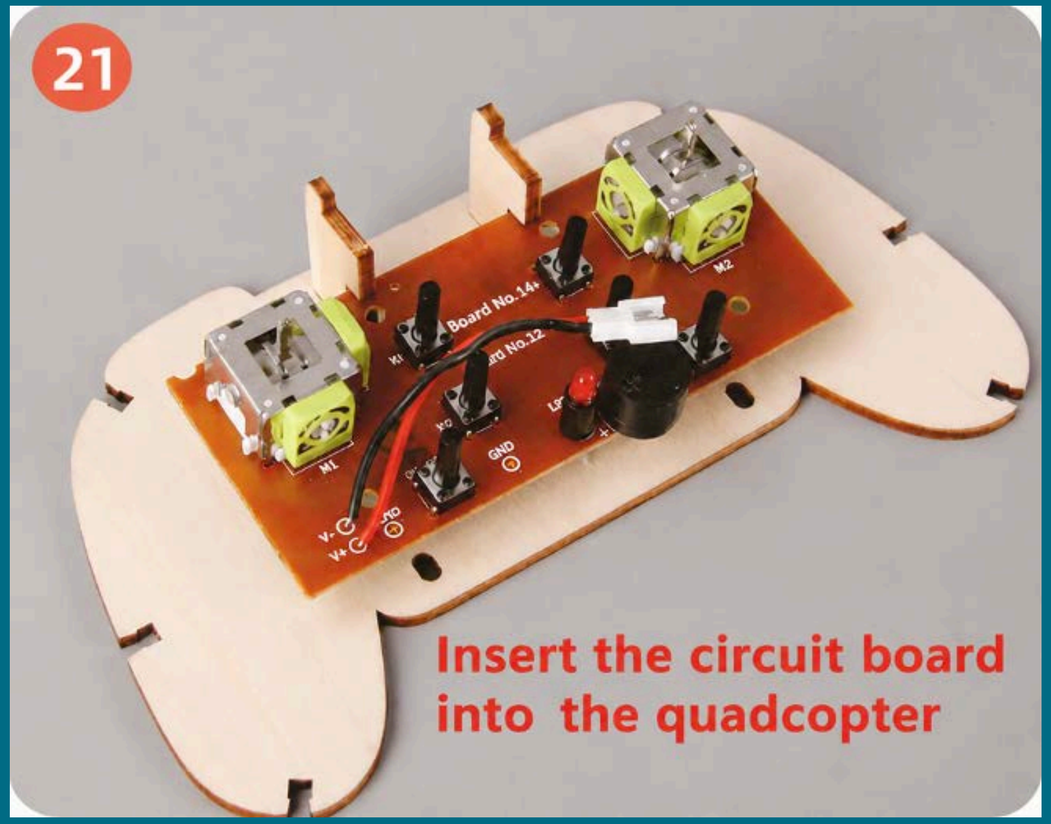
As shown, place the large battery in the slot and secure it by hooking the rubber band into the grooves on both sides.



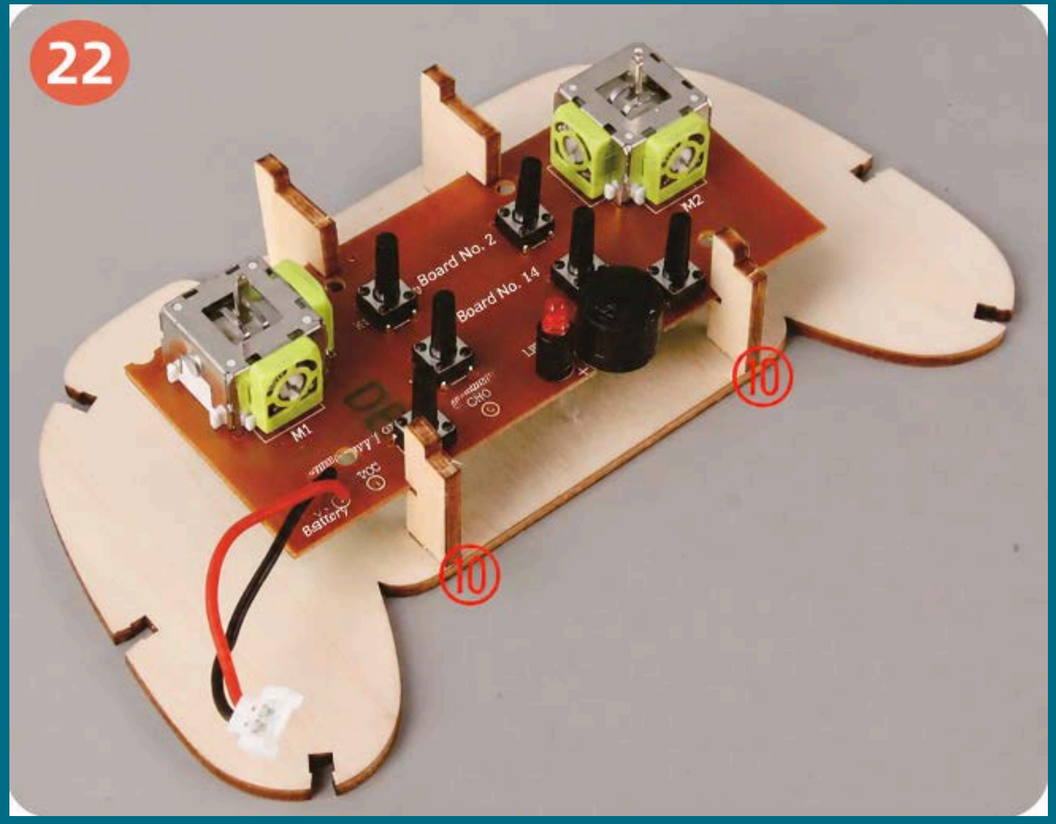
Use the markings above to identify the drone’s front and rear. The drone assembly is complete.



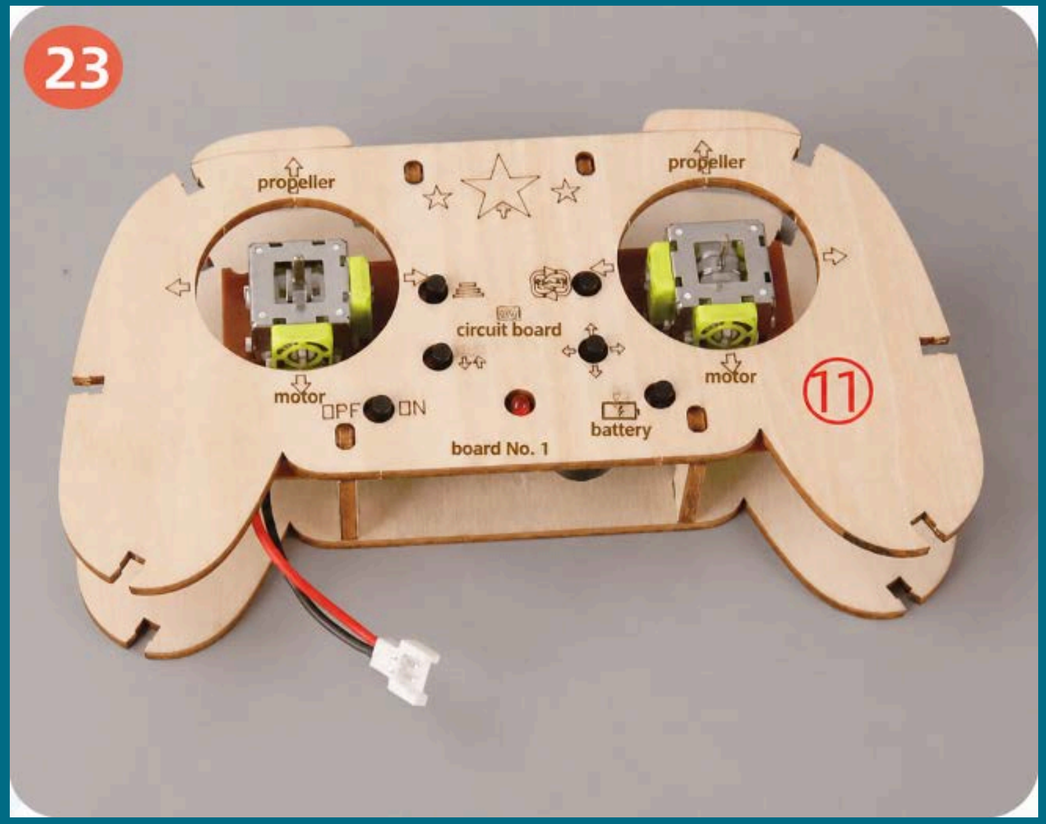
As shown, fit two board No. 9 pieces vertically into board No. 8.



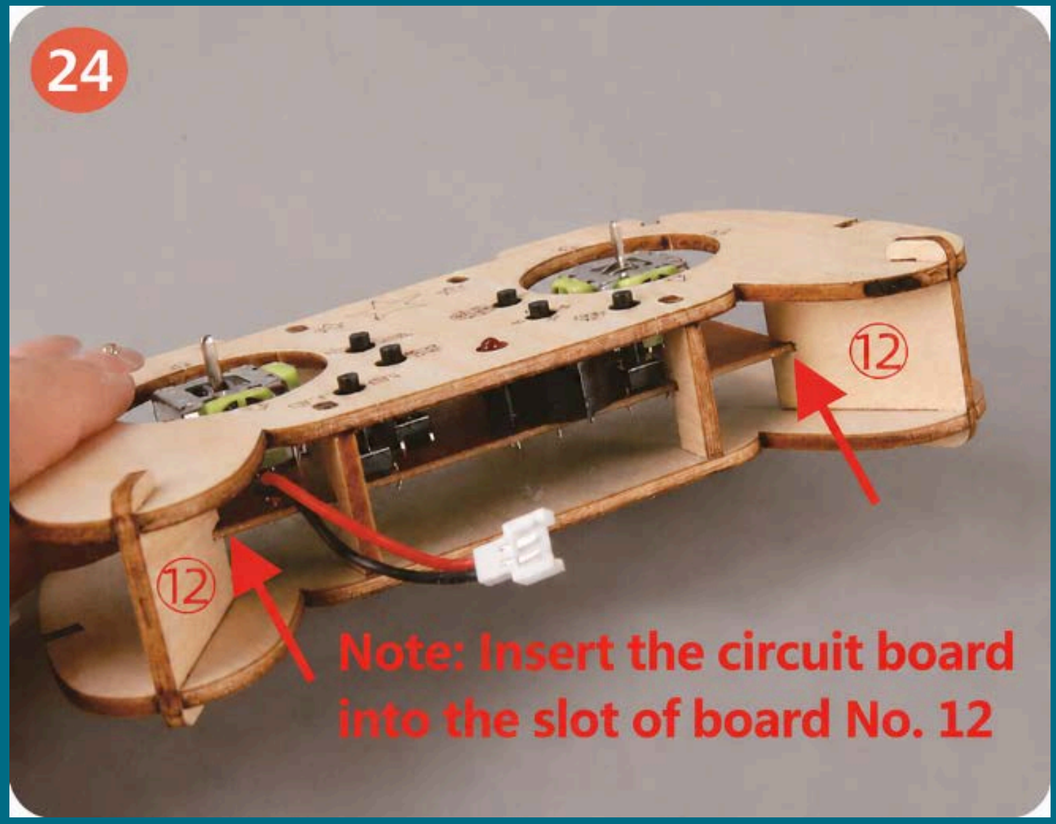
As shown, fit the long circuit board into the slot.



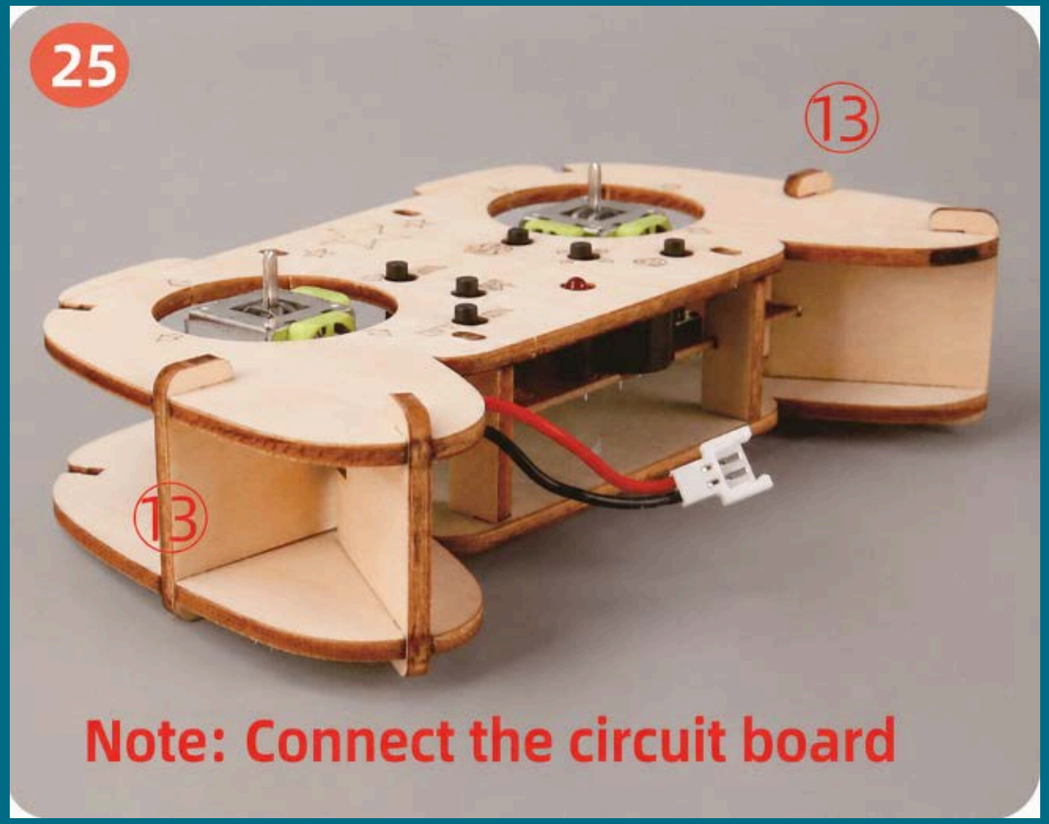
As shown, first place the circuit board in the slot in board No. 10, then press it into the slot.



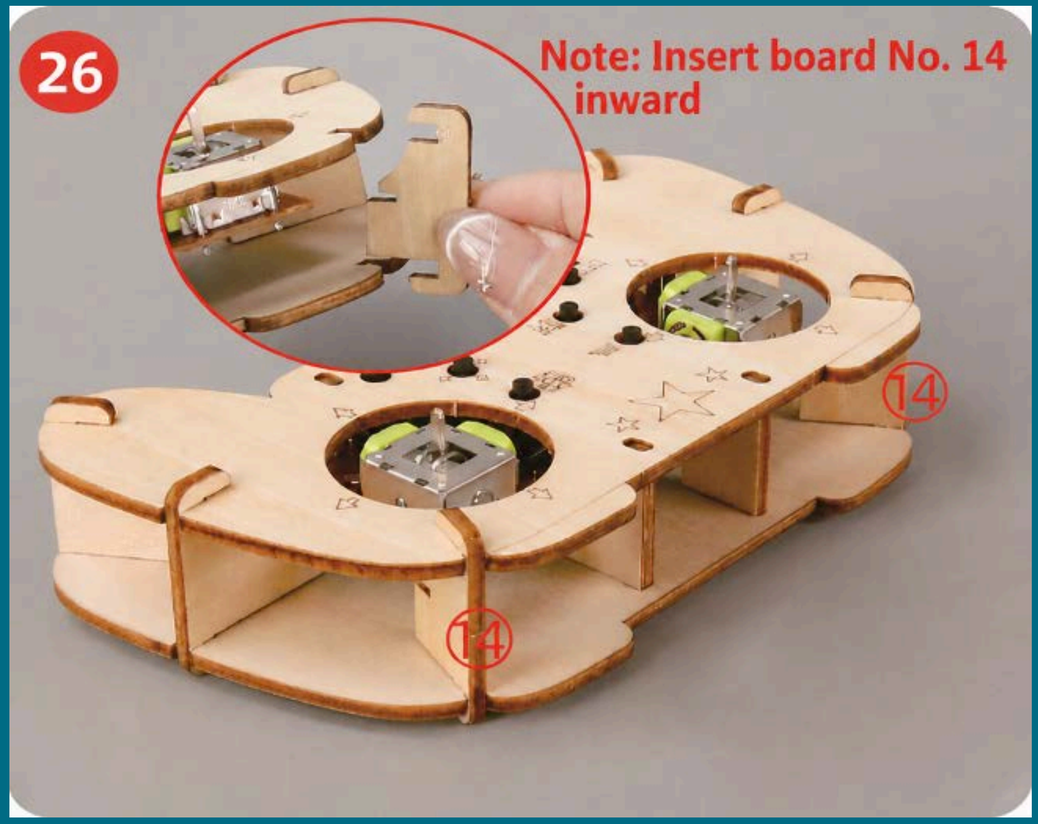
As shown, align board No. 11 with all the buttons, then press it into place.



As shown, fit two board No. 12 pieces into the slots on both sides.



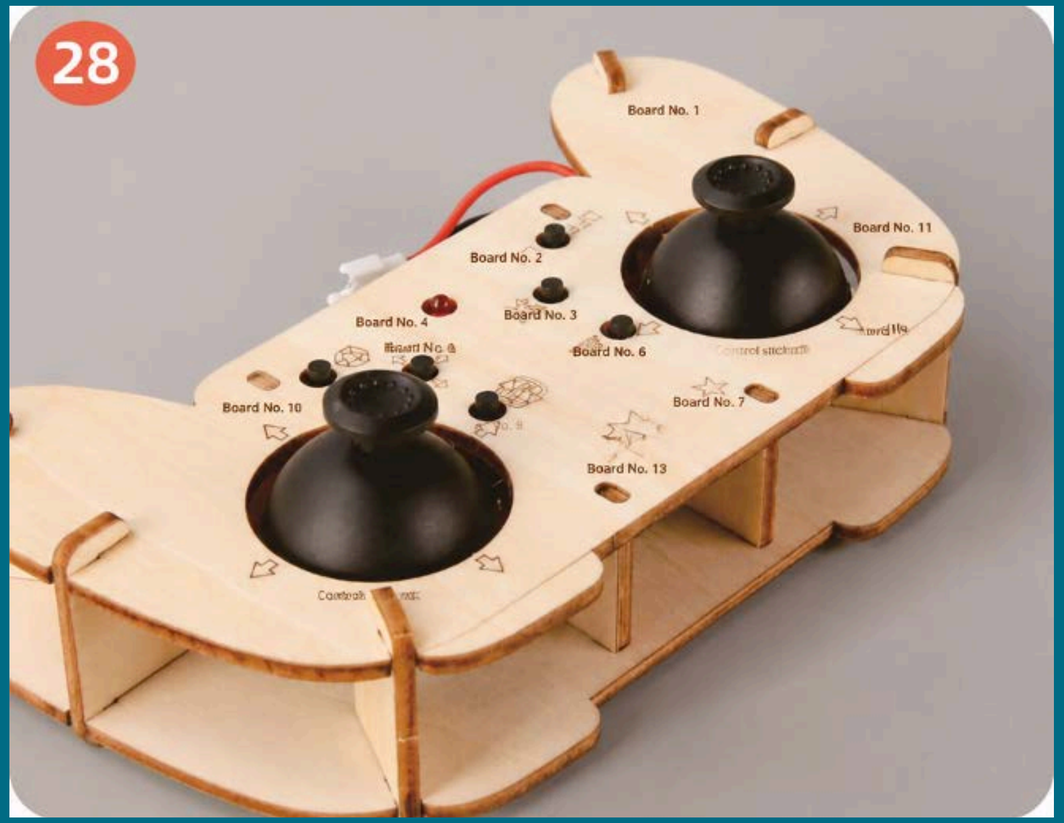
As shown, fit two board No. 13 pieces into the slots on both sides.



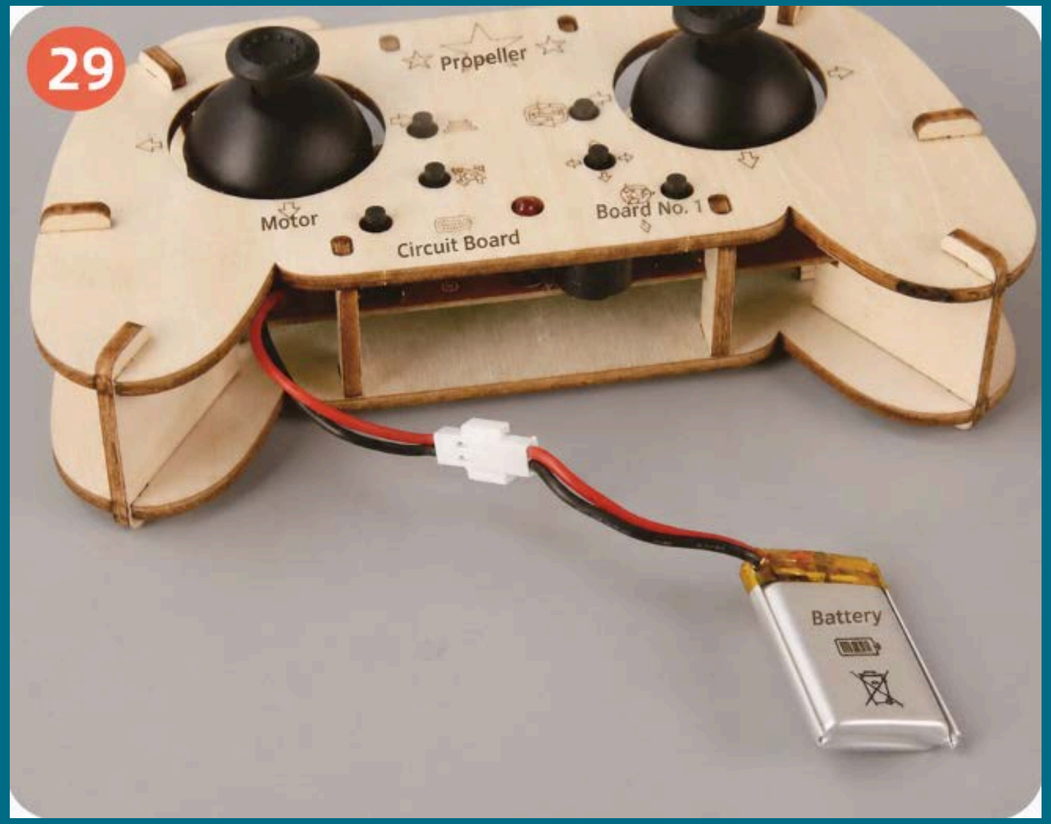
As shown, turn the assembly around and fit in two board No. 14 pieces.



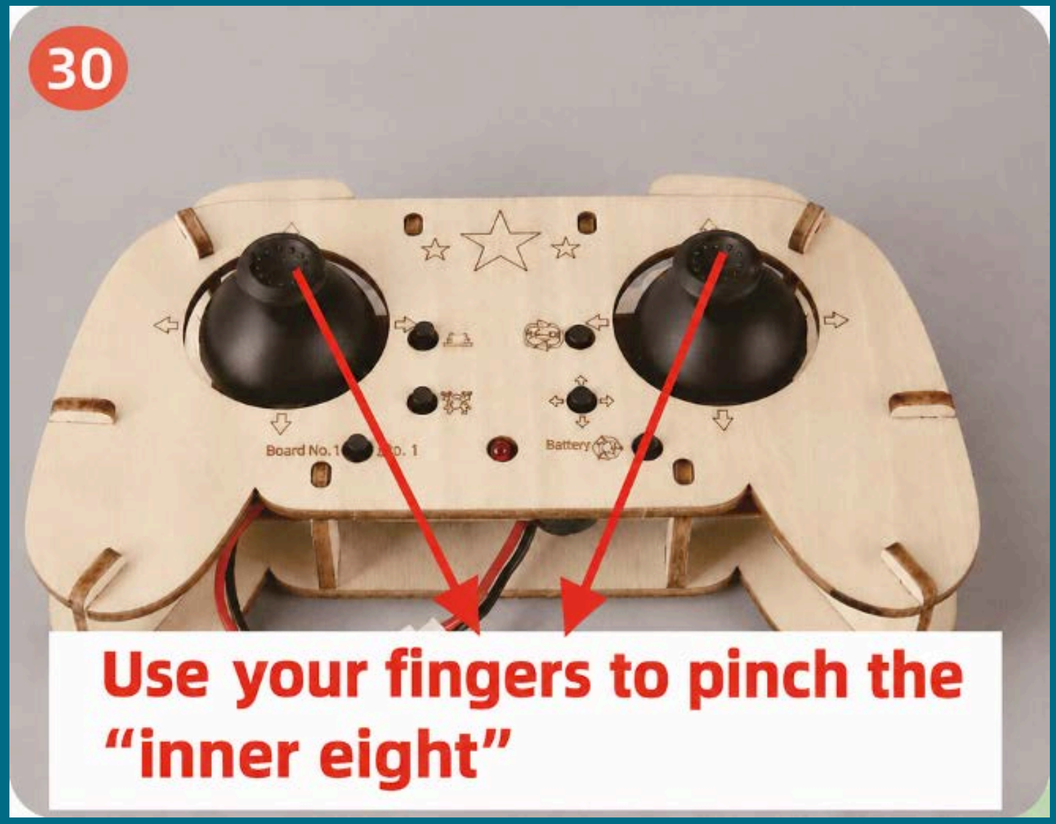
As shown, install the two control sticks.



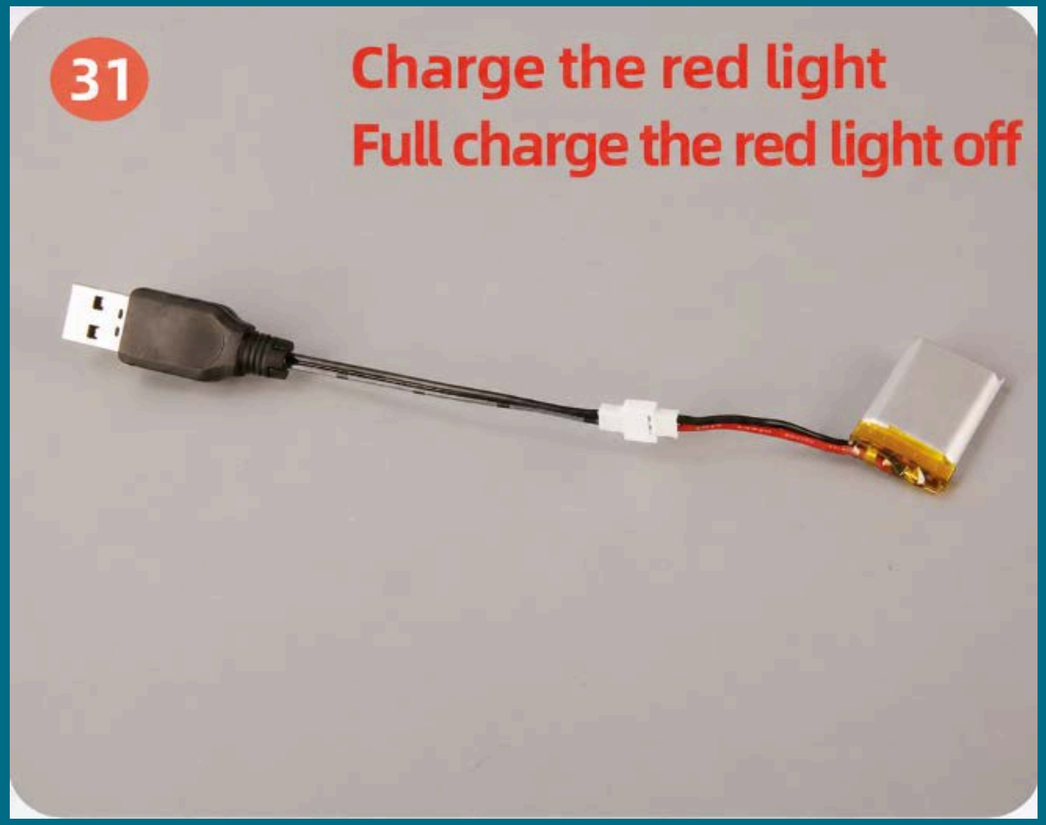
As shown, attach the two control caps to the control sticks.



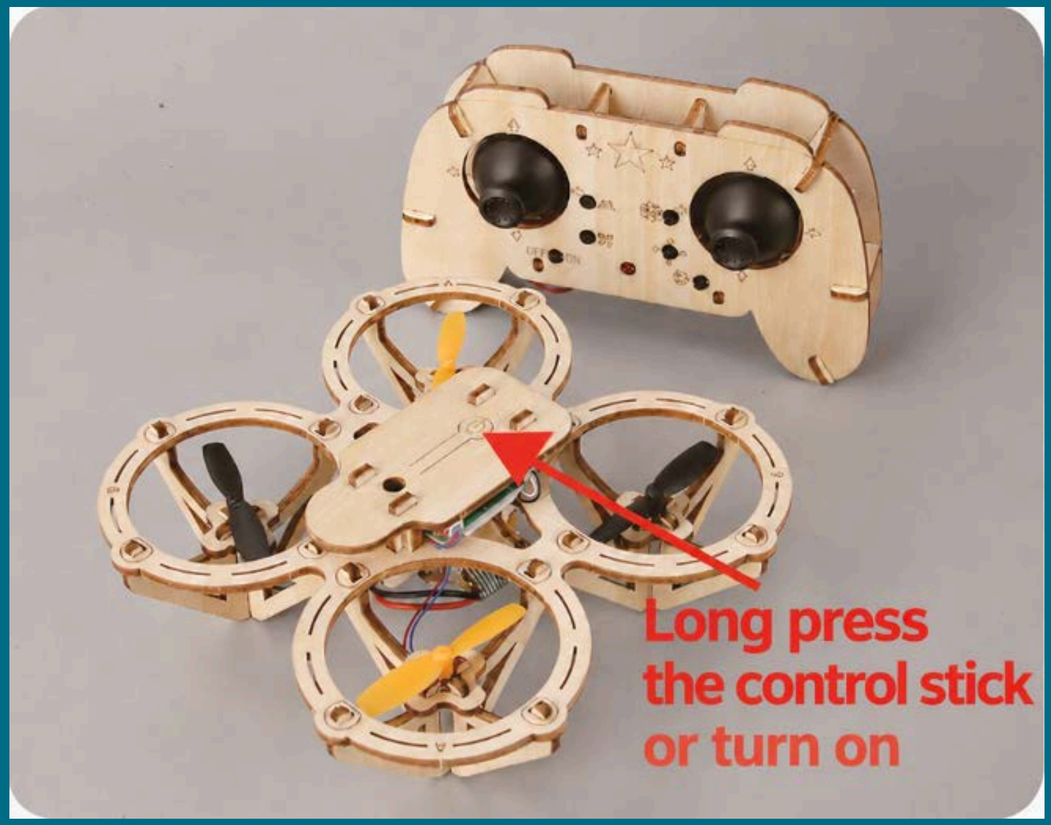
As shown, connect the small battery to the long circuit board.



As shown, tuck the small battery into the space below to complete the remote-control assembly.



If the quadcopter or remote-control battery runs out, you can charge it with the included data cable.



Finished Product
The aircraft flies for about 5 minutes on a full charge.

Experimental Principle

This wooden DIY quadcopter model primarily uses Bernoulli’s principle and Newton’s third law. The rapidly rotating propellers create a pressure difference and an opposing force from the air, providing lift to overcome gravity. The remote control then commands the main board to adjust the speed differences among the four motors, balancing counter-torque and adjusting the aircraft’s attitude so it can hover, ascend, descend, move, and turn stably.





Safe Flight Guidelines

Preflight Inspection



Before every flight, check that the propellers, battery, remote control, and other parts are in good condition.

Follow Flight-Area Regulations



Choose a suitable flying location. Make sure the area is not marked as a no-fly zone, and do not operate near crowds or in prohibited areas.

Keep the Aircraft Within Sight



Keep the quadcopter within sight at all times to avoid losing control if visual contact is lost.

Emergency Response



Learn and understand emergency procedures, such as making a quick landing or returning home if the aircraft becomes uncontrollable.

Emergency Procedures

01
Emergency Landing if Control Is Lost
If the quadcopter becomes uncontrollable, alert people nearby and try to avoid landing in a crowded area.
02
Battery Failure Response
If the aircraft’s battery fails, quickly lower its altitude and find a safe place for an emergency landing.
03
Rapid Diagnosis of Mechanical Failures
Become familiar with the aircraft’s structure before flying. If you notice unusual sounds or flight behavior, quickly identify the problem and take appropriate action.



Further Learning

Some internationally well-known quadcopter companies are China’s DJI, France’s Parrot, Germany’s AscTec, and the United States’ 3D Robotics.

1. Aerial Photography and Film: This is the most common use. DJI’s Phantom series, for example, can carry cameras that shoot 4K video for filming movies or recording scenery.
2. Large-Scale Light Shows: Intel’s Shooting Star drones are lightweight and equipped with LED lights. They can fly in coordinated groups to create patterns in the sky, and have performed at the Olympic Games and the Super Bowl.
3. Extreme Racing and Research: Miniature quadcopters can also reach extreme speeds. In March 2025, “Prowess,” a miniature quadcopter designed by Xu Yang, a student at The Chinese University of Hong Kong, Shenzhen, set the Guinness World Record for a remote-controlled miniature quadcopter at 340.78 km/h.