Lesson 3. Swinging Shark

LECTURER: XXX

Lesson Objective

Learning Objectives

1. Know about the function of fish fins.
2. Understand how the Attitude Sensor controls the rotation of the motor.

Possible Difficulties

1. The ratio of Attitude Sensor data to angle is 10:1.
2. Limit the roll angle of the robot flip through the motor code.



Background Information







Context Import



In many classic horror movies, we can see a triangular dorsal fin surfacing and slowly swimming towards its prey, do you know what creature this frightening triangular dorsal fin belongs to?

Context Import



This triangle on the sea means sharks, because sharks will attack humans, so if you see a similar sign on the beach, remember not to swim in the water.

Context Import

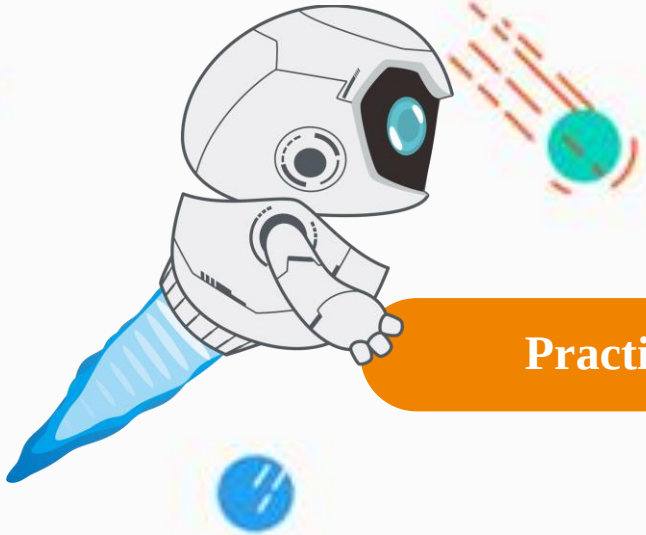


Sharks have long, spindle-shaped bodies. The gill slit is on the side, the pectoral fin is the same as other fish, but not connected with the front edge of the mouth; the dorsal fin is on the upper part of the body; the tail is crooked.

Context Import



Mako sharks are the fastest swimmers of all sharks. Due to their size, they can swim 1,000 miles in just one month at a speed of 35 mph. But when they're hunting or feeling threatened, they can swim at speeds in excess of 60 mph. This speed ranks among the top ten among all marine animals.



Practice



New Knowledge



Sharks have a particularly prominent dorsal fin, what exactly does it do?

The most commonly heard explanation is that it helps the shark to swim faster. The reality, of course, is that the shark's dorsal fin grows too high and is forced to be exposed when it approaches the water's surface.

New Knowledge

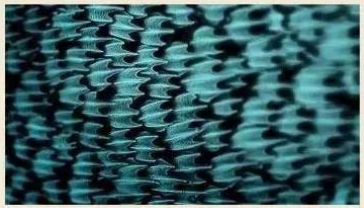


Scientists specializing in the study of sharks after scientific and rigorous experiments found that sharks swing tail fins stirred up twice the amount of water than other fish, which is the key to swim faster.

New Knowledge



Super Stretch Fibers on the Surface of Sharkskin Swimsuits





rough folds on the skin surface

In parallel with the research, the scientists invented the sharkskin swimsuit. How fast can this swimsuit make you?

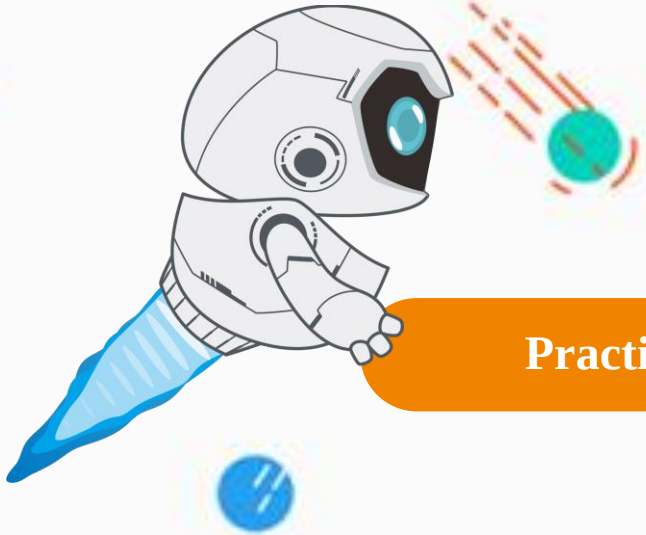
The answer is: the Olympic Games need to prohibit athletes from using shark skin swimsuits to ensure the fairness of the competition.

New Knowledge



The shark's particularly prominent dorsal fin is often used in film and television productions to signal the imminent appearance of sharks hunting. But in reality, the shark fin, like any other dorsal fin, only serves to maintain balance, and the dorsal fin is exposed simply because it is extraordinarily long and tall.

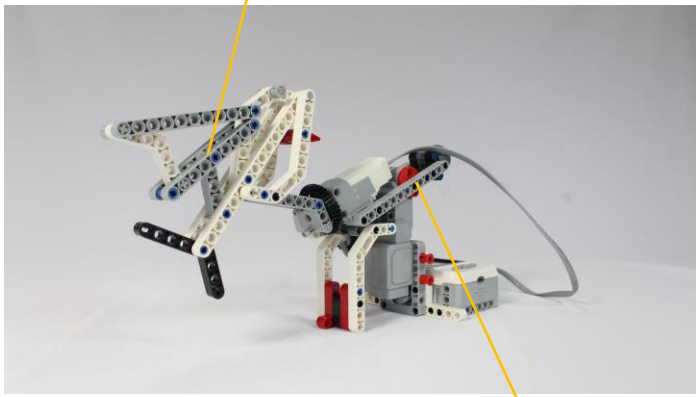
Today we will use attitude sensors to control the shark robot.



Practice

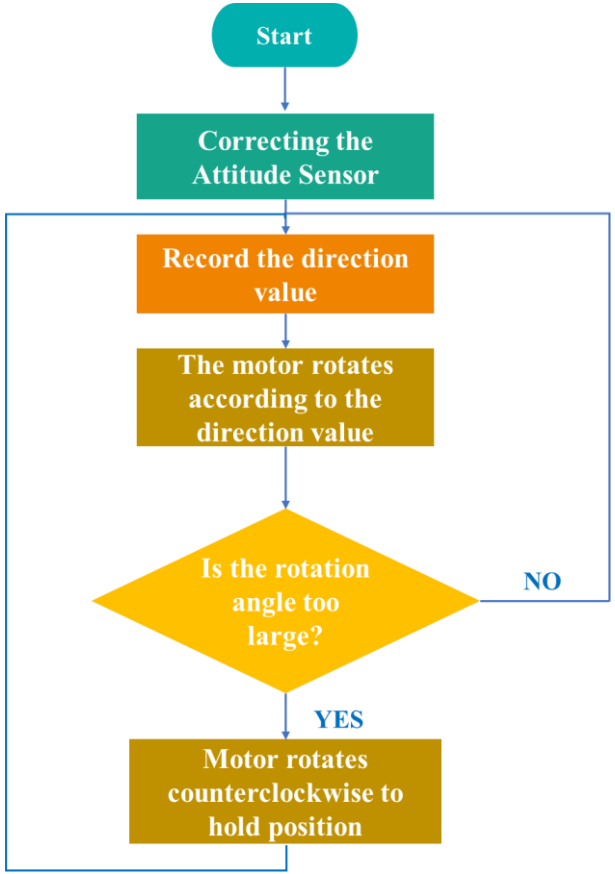


New Knowledge



Build a shark robot according to the building manual. When you rotate the attitude sensor, the shark can rotate correspondingly according to the attitude data.

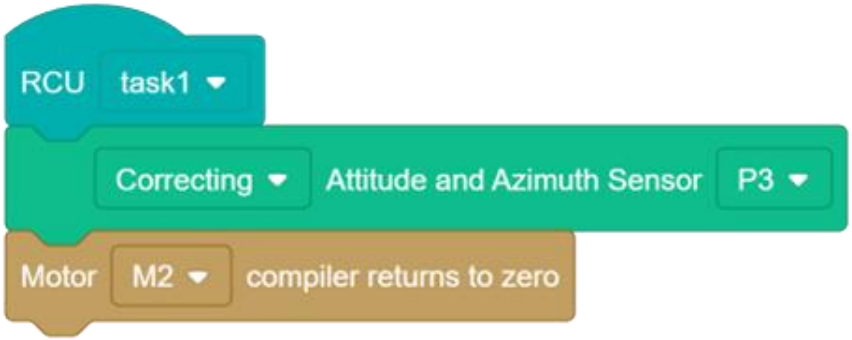
Practice | Flow Chart



The shark needs to receive the data of the attitude sensor first, use the Pitch Angle value to control the pitching action of the shark, and use the Roll Angle value to control the shark's flip.

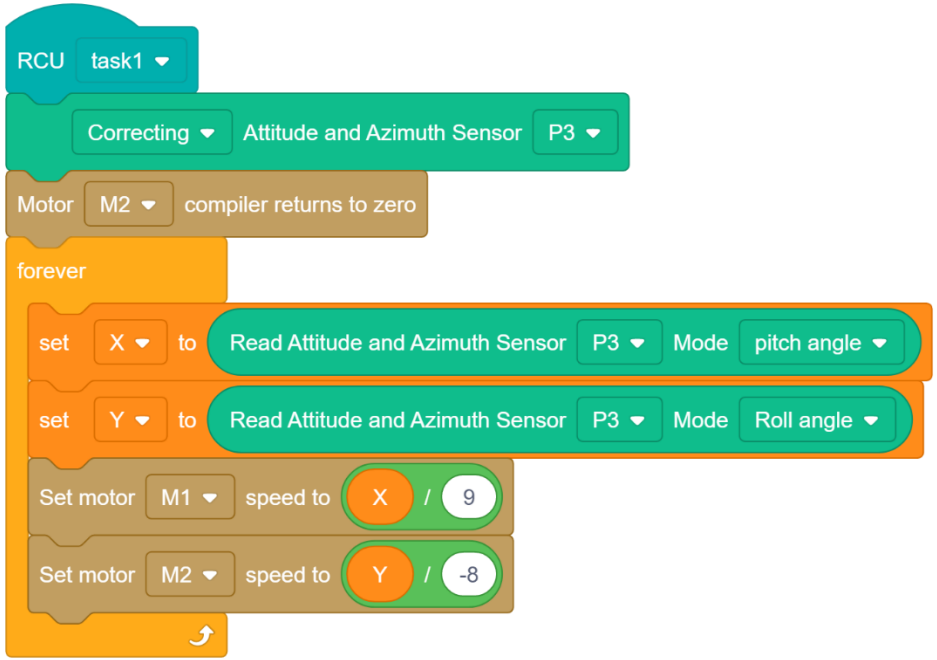
In order to keep the shark balanced, the shark cannot be turned upside down, and the angle needs to be restricted.

Practice | Programming



Initial Setting

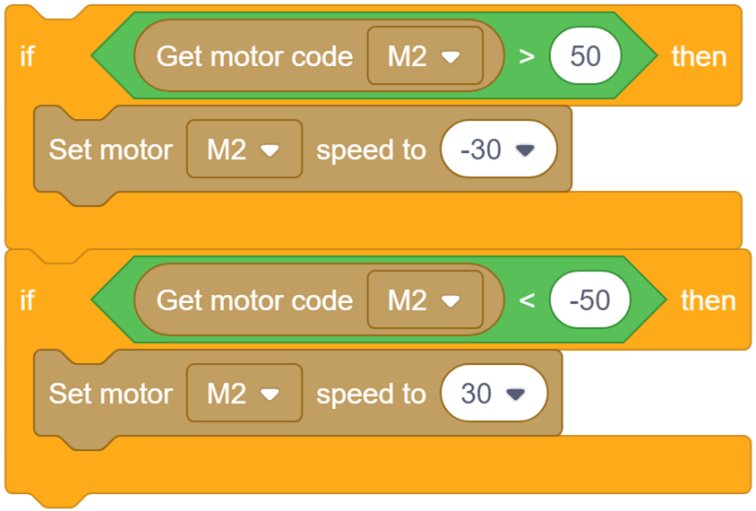
Correct the attitude sensor and reset the motor code value to zero.



Motor Rotation

Use the pitch and roll angle values to control the motor rotation.

The smaller the value, the more pronounced the rotation of the shark.



The judgment of the rotation

When the encoder value is greater than 50 or less than -50 (left or right rotation) over a certain range, the motor turns counterclockwise to output power to maintain the current attitude of the shark. The power should not be too large, as it will cause the shark to rotate incorrectly.

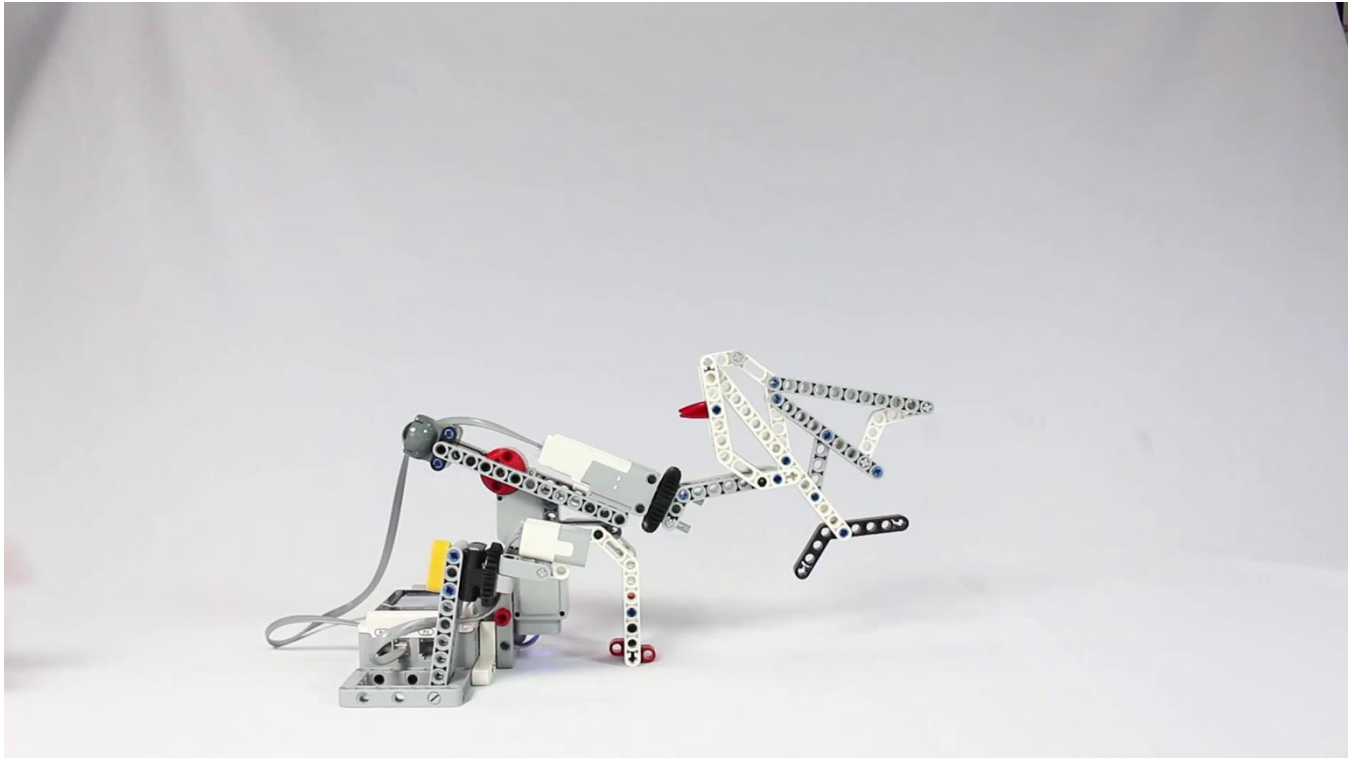
Practice | Programming

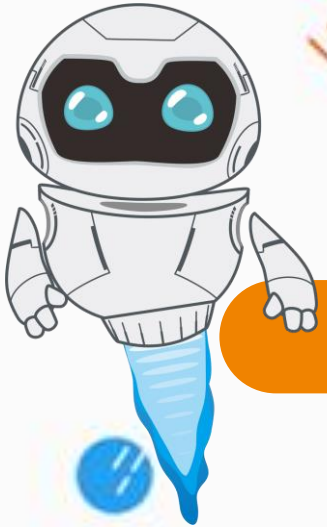


Integrate the programs

Combine the programs of each segment according to the flow chart.

Practice | Programming





Results



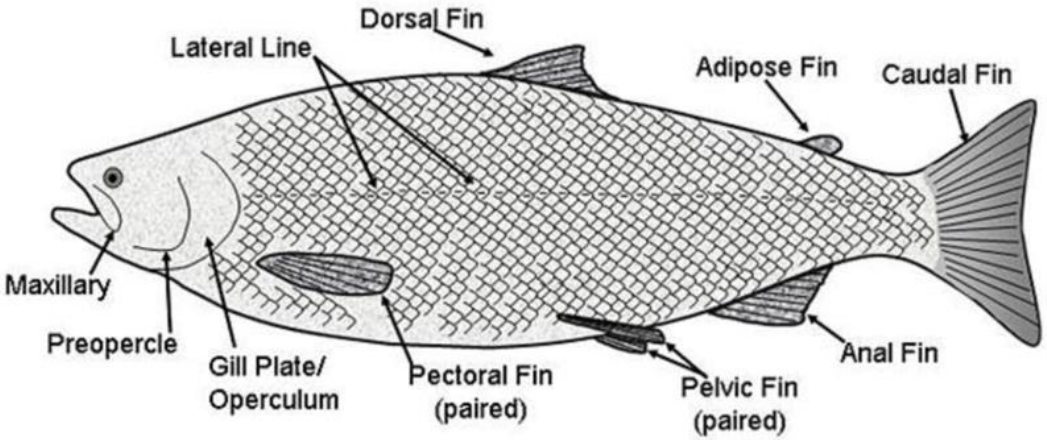
Program Optimization

This lesson implements the shark rotation function, where the shark robot is able to rotate correspondingly to the position of the attitude sensor.

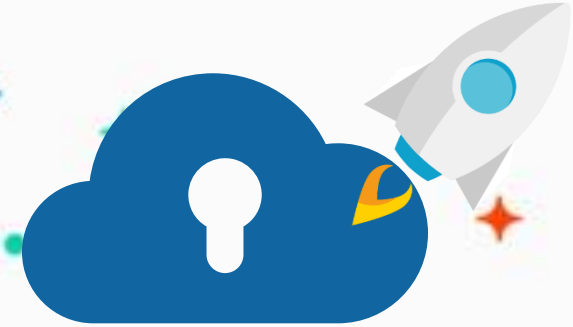
Next, modify the program so that the shark can rotate more flexibly according to the attitude sensor data.

Requirement: The shark robot will be able to adjust itself more flexibly when it receives the fore-aft (pitch) data.

Further Reading



Fins are important organs used by most fishes to swim and maintain body balance, including paired even fins and unpaired odd fins. Among them, the even fins are distributed along both sides of the body and are divided into pectoral fins and pelvic fins, also known as lateral fins; the odd fins grow along the midline of the body and are divided into dorsal fins, caudal fins, anal fins, etc., also known as single fins. Evidence from fossils, embryonic development and molecular biology shows that fish fins gradually evolved into limbs of terrestrial animals 400 million years ago.



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Thanks!

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