Lesson 17. The Flapping Pterosaur

LECTURER:

Lesson Objective

Learning Objectives

1. Learn about Pterosaurs
2. Learn about the various ways of motor initialization

Possible Difficulties

1. Initialization of motor position
2. Setting and use of built-in data



Background Information



Background Information



Although pterosaurs lived from the Late Triassic to the end of the Cretaceous period like dinosaurs, that is, about 210 million to 65 million years ago, pterosaurs are not dinosaurs. The most notable difference is that pterosaurs could not walk upright, while dinosaurs were able to walk upright on their hind legs.

Background Information



Usually, the pterosaurs that people often refer to actually refer to Pterosauria, which is an extinct reptile. Pterosauria, which means "winged lizard" in Greek, is a clade of flying reptiles.

Background Information



Pterosaurs were the first vertebrates known to be able to fly. The wings of pterosaurs were derived from the skin membrane between the side of the body and the four wing phalanges. Early pterosaurs had longer tail packs, elongated jaws, and teeth; later pterosaurs lacked teeth and had shorter tails.

Background Information





There are very large differences in the size of pterosaurs. Some are as small as birds with a wingspan of about 25 centimeters, and some have a wingspan of more than 12 meters and a length longer than an ordinary truck.

Background Information

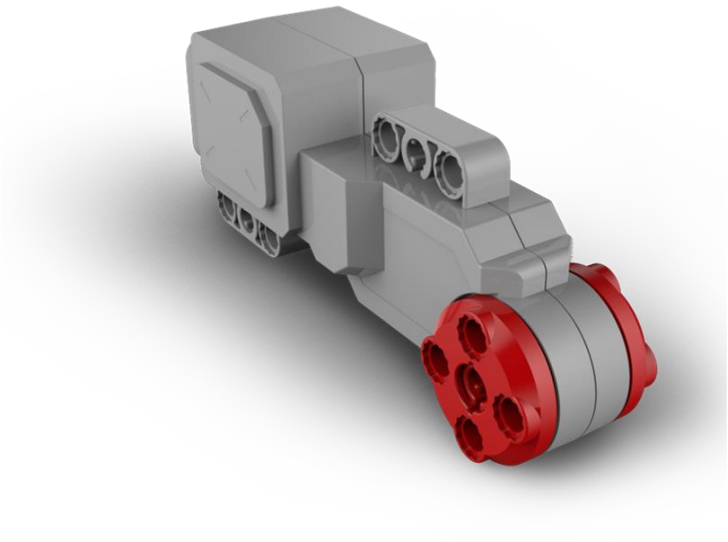


Today, we will make a pterosaur robot. The speed and direction of the flapping wings of the pterosaur are controlled by the rotational position of the motor.



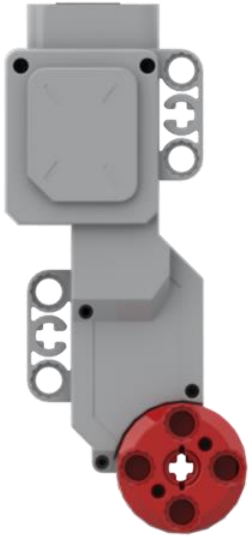
Knowledge Introduction

Programming Knowledge



There are many ways to control the robot through the rotation of the motor. The most common way is to achieve forward and reverse rotation by obtaining the encoder value. The problem here is that the encoder values are re-recorded every time the program is started.

Programming Knowledge



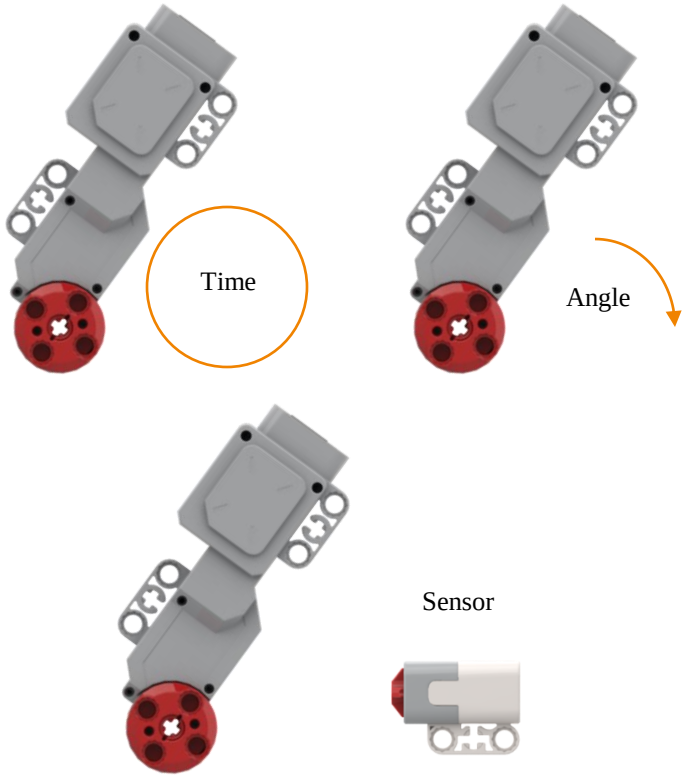
The position of zero value when first started



Position of zero value when starting without homing

Different initial positions will seriously affect the normal operation of the robot. For example, we almost never return the motor to its pre-start position after each spin. This results in a different position for the zero value each time the motor is started. At this time, it is too difficult to control the robot to operate correctly.

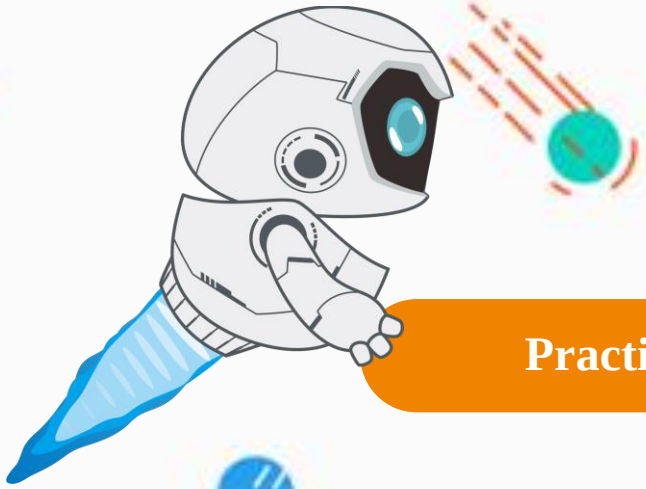
Programming knowledge



So every time we start the program, we try to initialize the position and code of the motors as much as possible, so that they can be the same as the first time at every start.

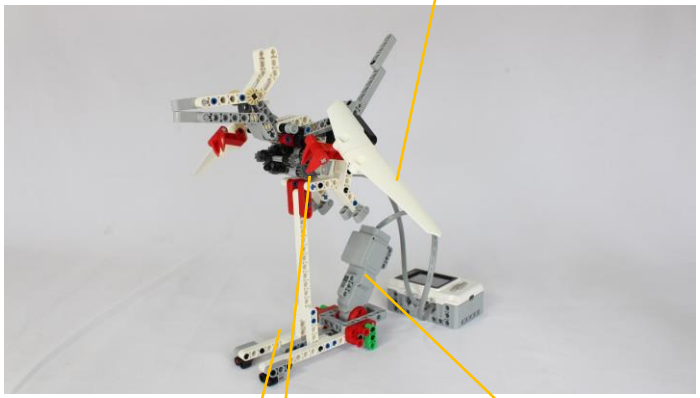
The three common initialization methods are:

1. Let the motor rotate in one direction for a few seconds to ensure that the motor returns to the initial position.
2. Rotate the motor by the corresponding degree to ensure that the motor returns to the initial position.
3. The sensor controls the motor to rotate, and when the sensor is activated, it means that the motor returns to the initial position.



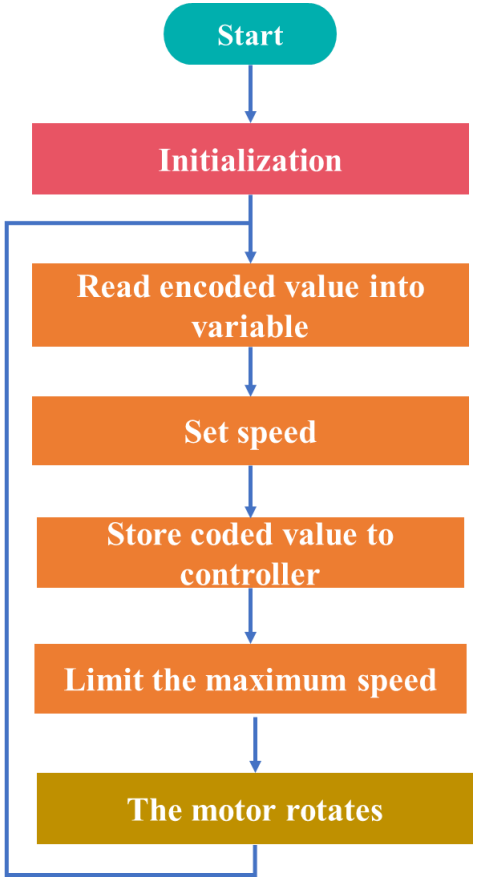
Practice

New knowledge



According to the building manual, build a pterosaur robot. The pterosaur robot can perform forward or reverse flapping movements according to the code value of the motor.

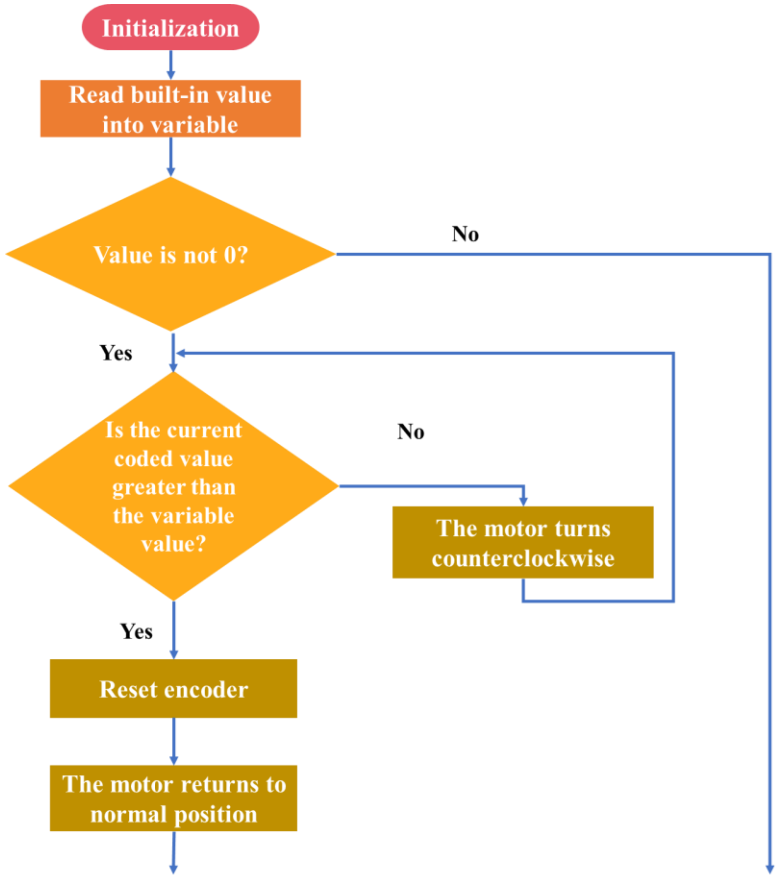
Practice | Flow Chart



The flow chart of the main program is shown on the left.

The task in this section focuses on the initialization of the motor, and the flapping action only needs to be driven by the gear.

Practice | Flow Chart

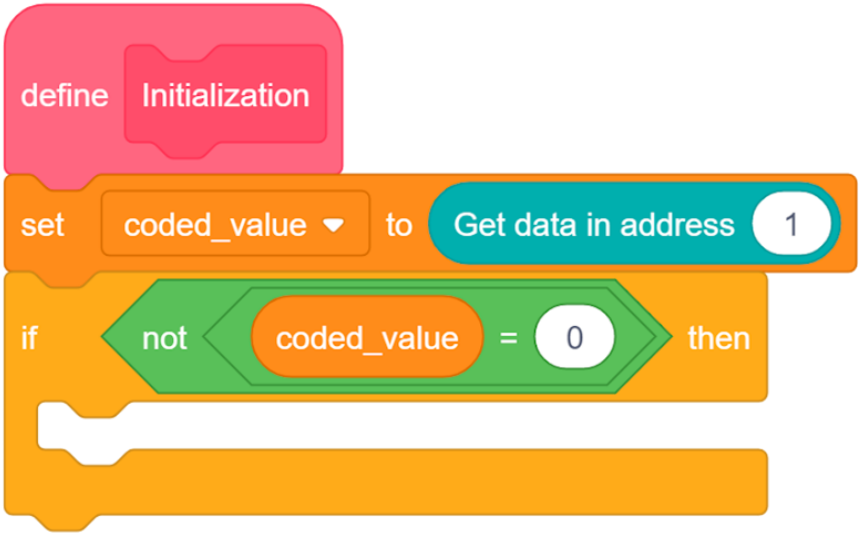


The flow chart of initialization is shown in the left figure.

In initialization, a value of 0 means that the program was never started, for debugging or correction.

By comparing the encoder value with the built-in value previously stored in the control, it is determined that the motor has returned to the initial position. After returning to the initial position, the motor returns to the normal position.

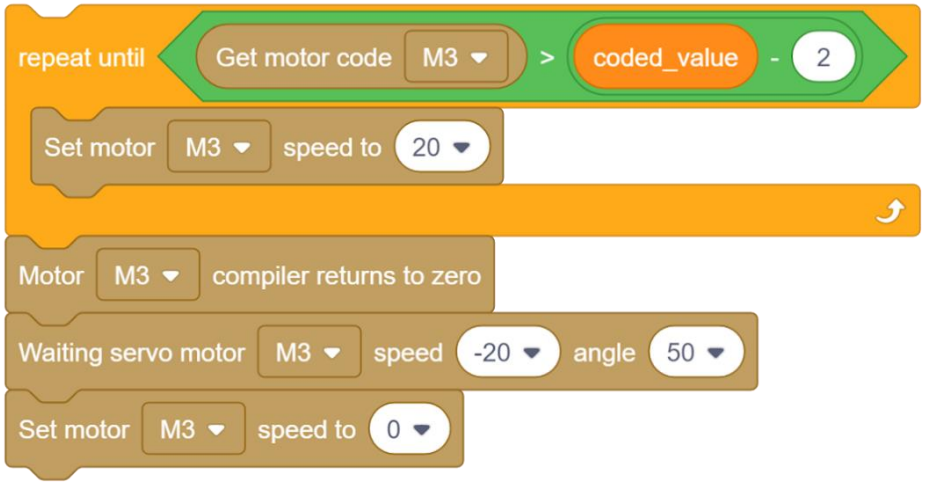
Practice | Programming



Function - Initialization

Define this function. The basic framework of the initialization function, the initialization is only performed when the coded value is not 0.

Practice | Programming

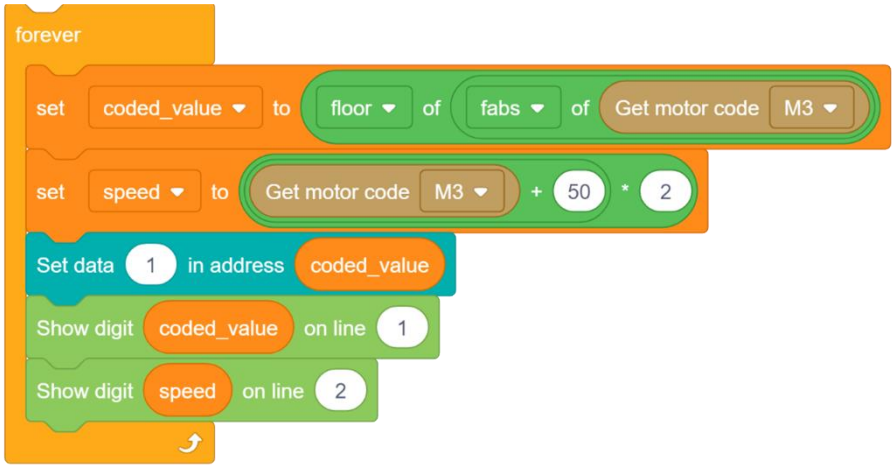


Make the motor turn

Reset the encoder and lift the motor when the motor turns to the set angle.

The reason for subtracting 2 from the coded value is to prevent the error from causing the program to enter an infinite loop.

Practice | Programming



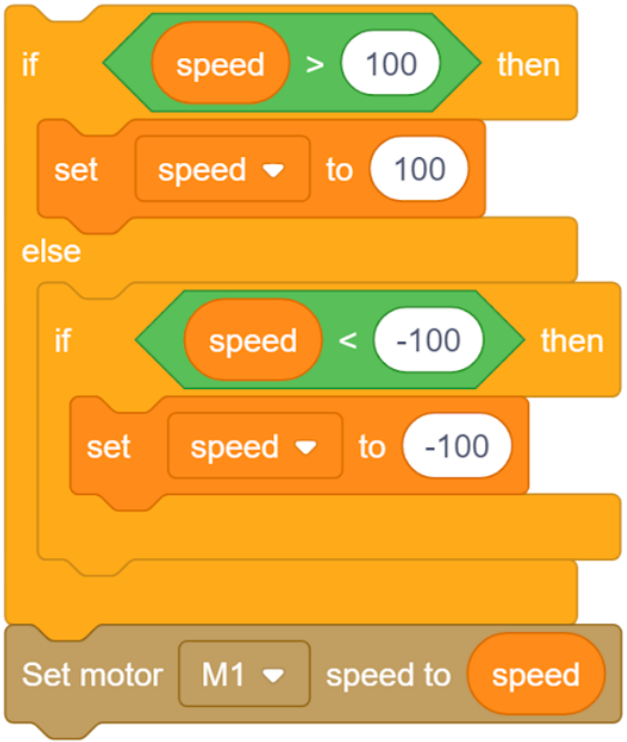
Main program

The main program sets the code and the value of the speed variable and saves them in the controller.

Since the controller cannot store negative numbers, it is necessary to process the encoded value. After using the absolute value, it is necessary to use rounding to ensure that the value is an integer.

After adding 50 to the speed value, the counterclockwise direction is deceleration and can reverse. Multiplying by 2 is for the motor to have enough speed to move.

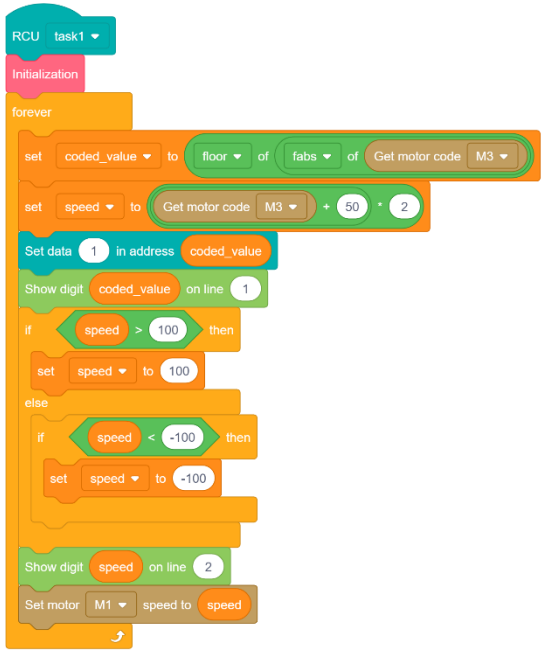
Practice | Programming

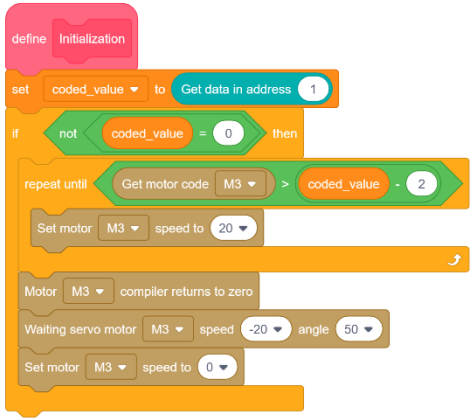


Speed limit

Limit the speed value and let the motor rotate. Due to a certain error in the encoder, the speed value may exceed 100 or -100, which needs to be limited.

Practice | Programming

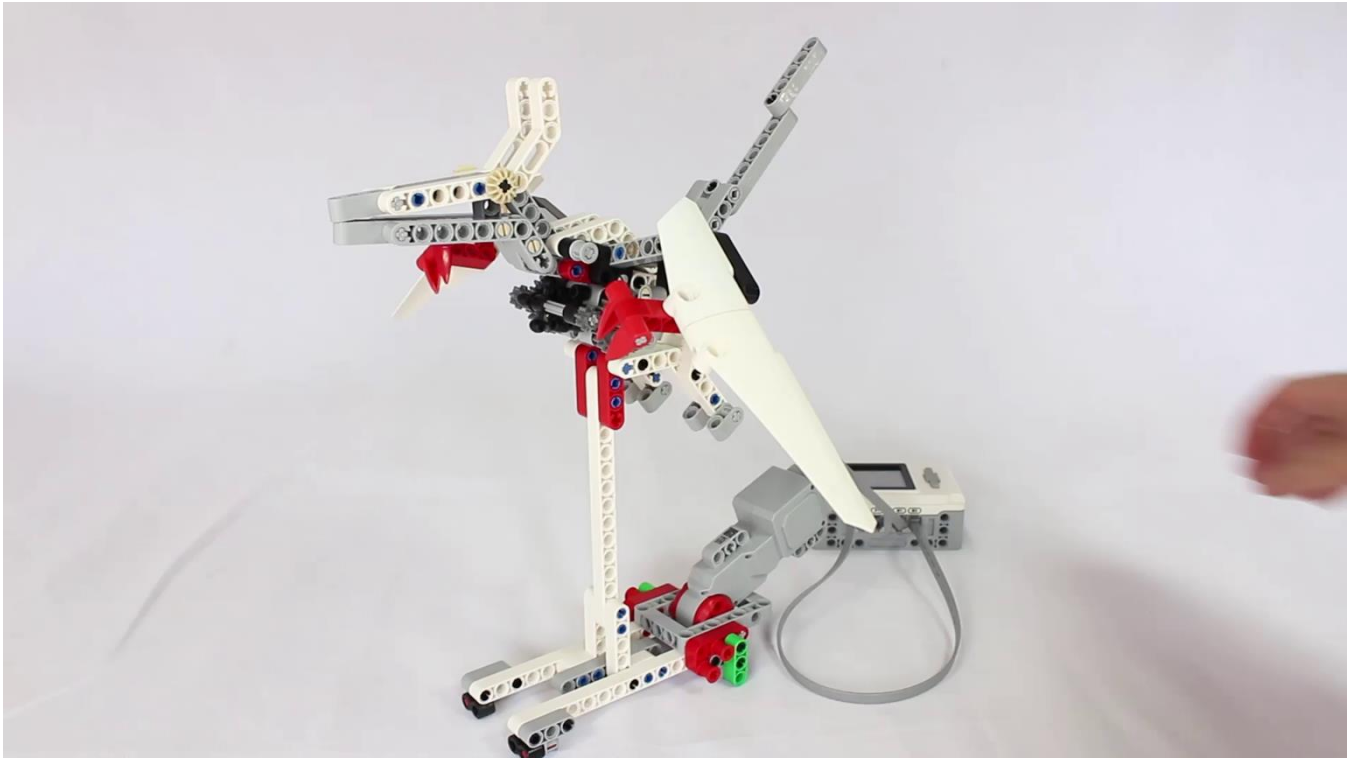


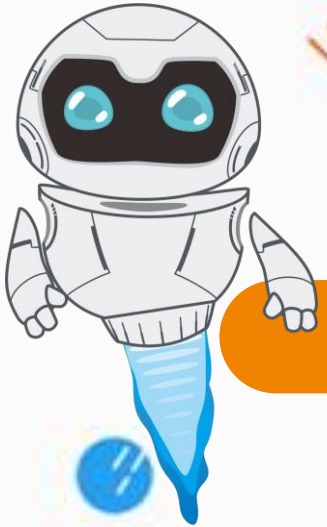


Integrate programs

Integrate programs according to the flow chart.

Practice | Programming





Results



Program Optimization

In this lesson, we implemented the function of the motor handle to control the flapping wings of the pterosaur, and completed the initialization of the motor position without using time and additional hardware.

Modify the program so that the pterosaur flapping its wings can be more regular.

Requirements: Adjust the speed to the maximum value so that the robot's movements can be smooth and reasonable.

Further Reading



The biggest difference between pterosaurs and dinosaurs is that pterosaurs are reptiles that can fly, while dinosaurs have become the overlords on land. Secondly, the shape and bone structure of pterosaurs and dinosaurs themselves are completely different, because the wings of pterosaurs are composed of skin and bones, rather than feathers like birds.

Just as bats are not birds, their wings are actually pterosaur-like membranes.

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Thanks!

LECTURER: