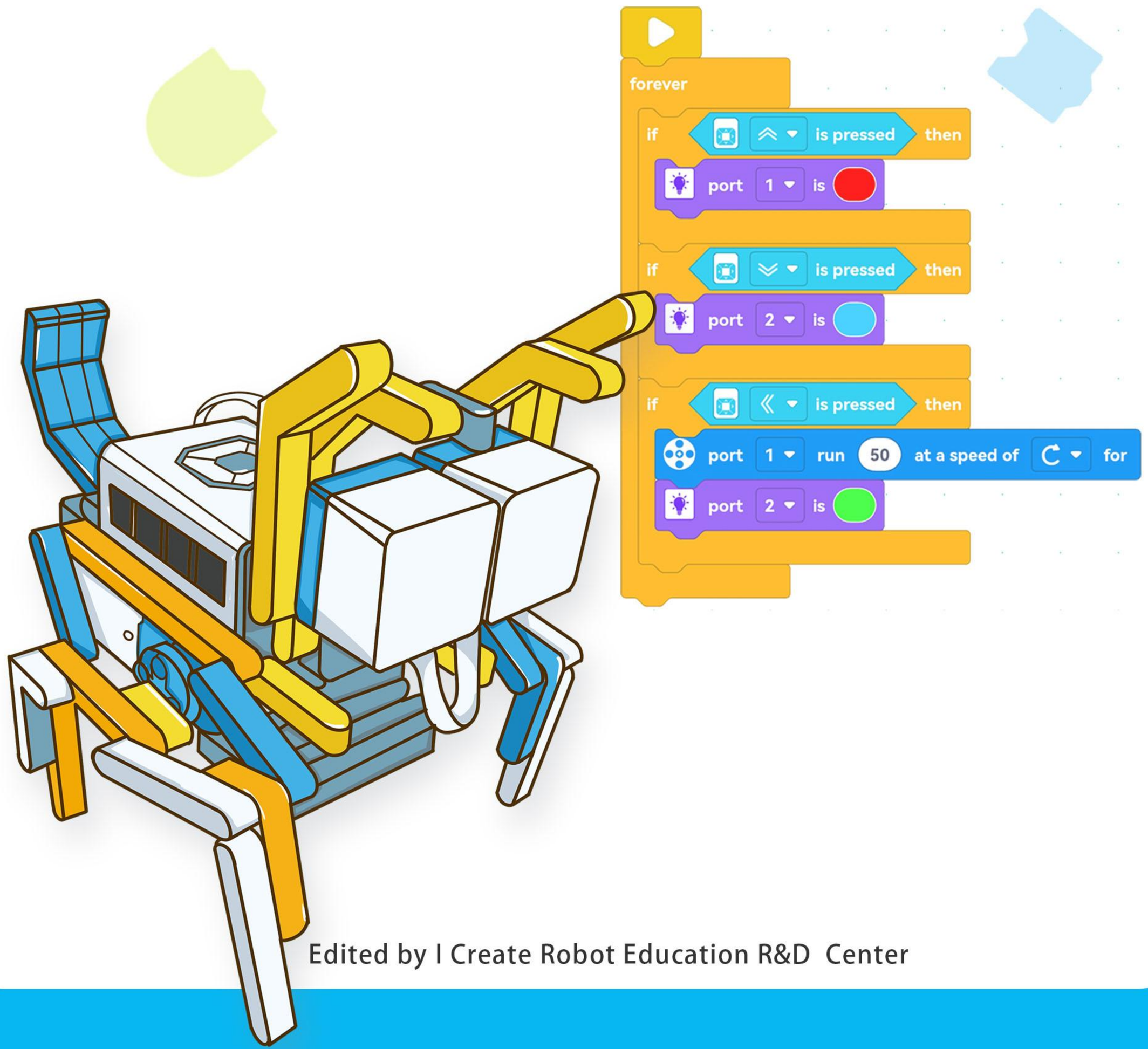
I Create Robot
艾克瑞特机器人教育

ICBricks
Coding Robot Course



Edited by I Create Robot Education R&D Center

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Smart Fan

I Introduction

The electric fan was first invented by Schuyler Wheeler in 1880. Over time, fans have evolved through several stages:

1. First-generation Fans (Late 19th Century): Simple design, beginning of widespread use.
2. Popularization and Improvement (Mid-20th Century): Fans became household essentials with added speed control features.
3. Electronically Controlled Fans (Late 20th Century): Remote control, energy-saving motors.
4. Smart Fans (21st Century): Controlled via apps or voice, with automatic speed adjustment.

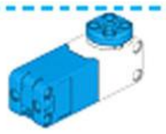
In this lesson, we will build a smart fan, experiencing its evolution from a mechanical device to an intelligent appliance.

II Key Learning Points

1. Electric Motor: Learn how an electric motor converts electrical energy into mechanical energy to drive the fan's rotation.
2. Mechanical Structure: Understand the principles of gear transmission.

3. Basic Principles of Smart Devices: Gain a preliminary understanding of what makes a device "smart" and how sensors and control systems enable automation.

III Building the Project

Item Name	Quantity	Part Image
Main Control Unit	1	
Distance Sensor	1	
Servo Motor	1	
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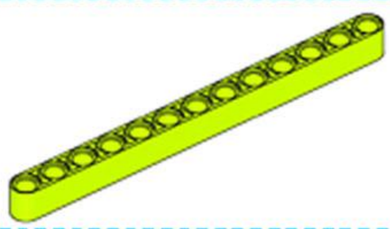
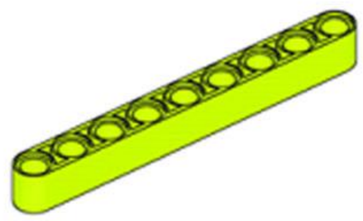
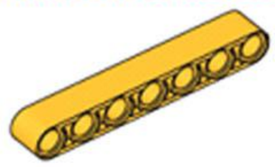
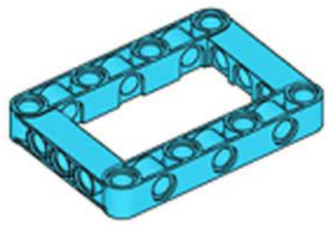
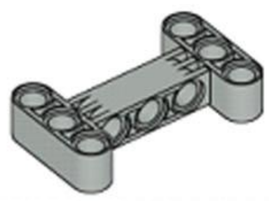
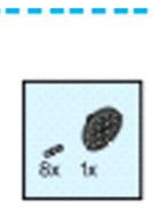
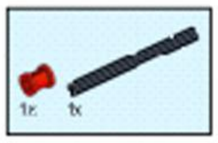
1x13 Hole Arm Beam	2	
1x9 Hole Arm Beam	2	
1x7 Hole Arm Beam	2	
5x7 Hole Arm Ring	1	

Black Friction Pins	24	
4x4 L-Connector Pin	2	
3x5 H-Bend Arm Beam	1	
3x3 H-Connector Pin	2	
1X6 Cross Axle	1	
40-Tooth Gear	1	
Full Axle Sleeve	2	

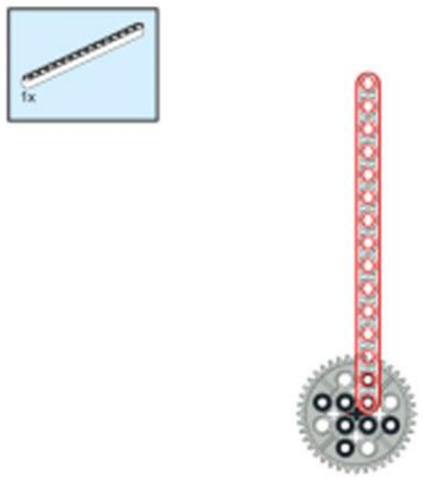
2. Building the Smart Fan

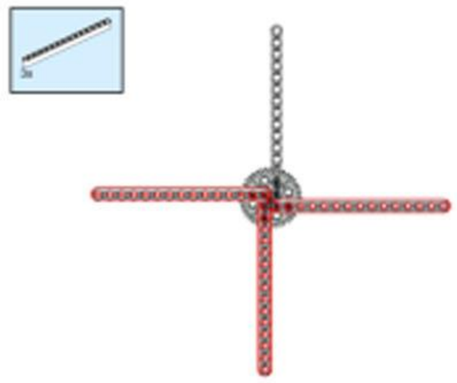


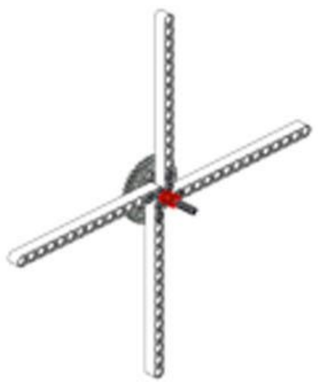






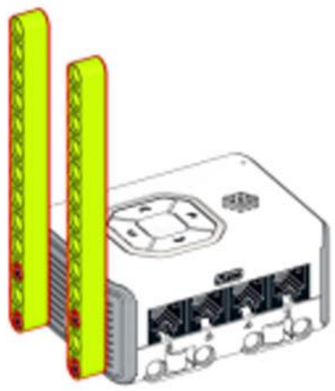


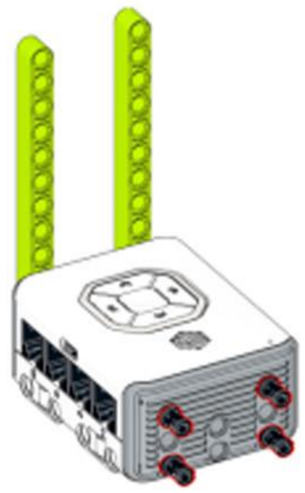


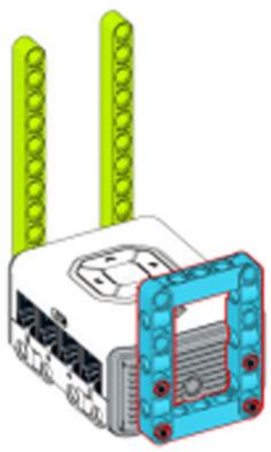


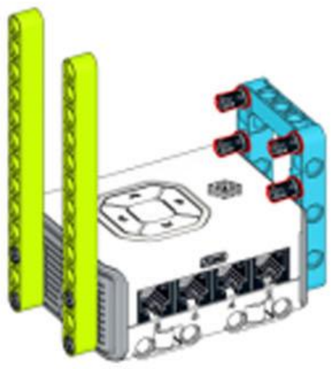


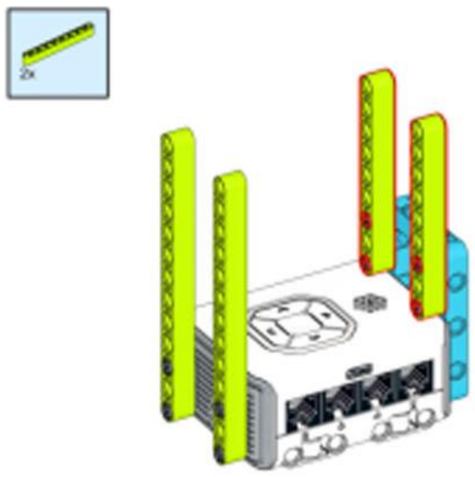








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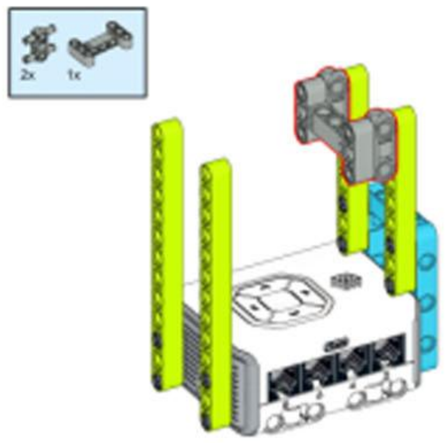
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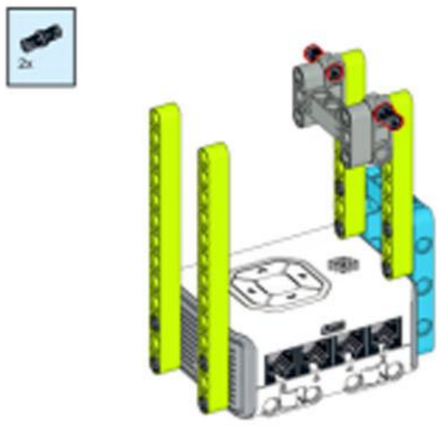
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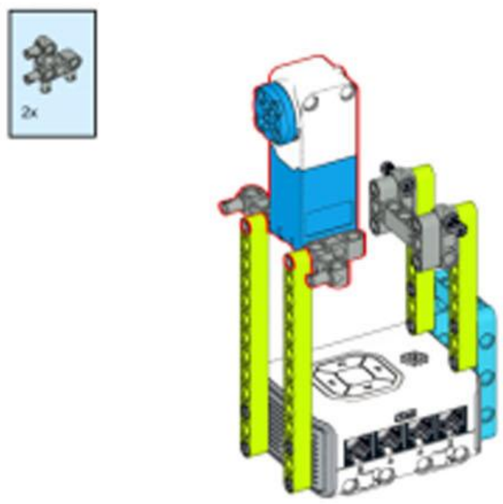
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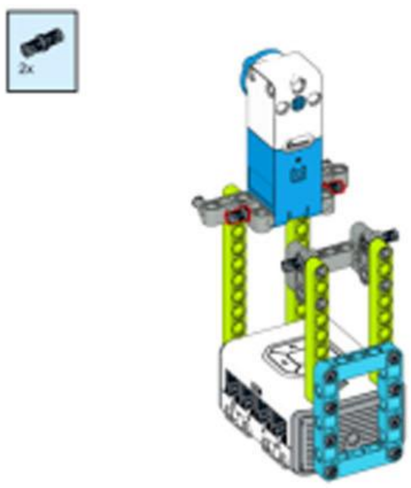
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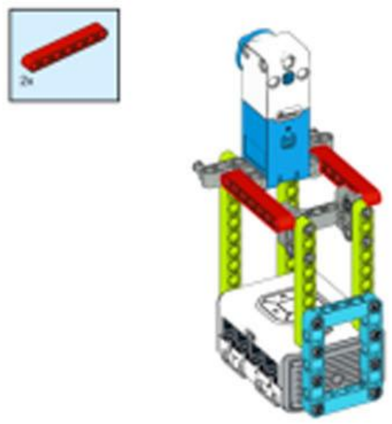
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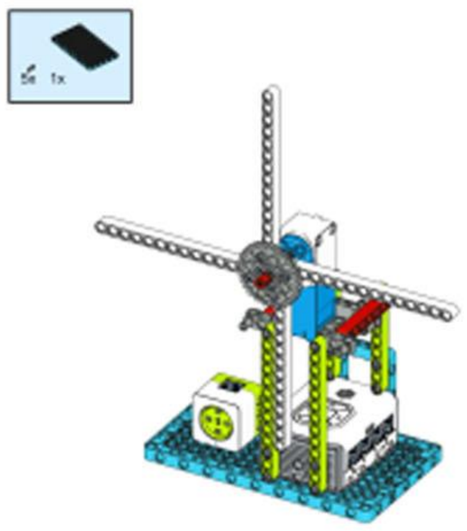

1x

Once assembly is complete, connect the distance sensor to Port 1 of the main control unit and the servo motor to Port 2. Press the power button on the control unit to turn it on. Move your hand close to the distance sensor, and you'll notice the fan starts; the closer your hand, the faster the fan speed. As you move further away, the fan speed slows down until it stops.

As your smart fan runs, observe its operation. The motor's movement drives the gears, which in turn drive the fan blades. This demonstrates gear transmission and illustrates how an electric motor converts electrical energy into mechanical energy. Through this hands-on project, you not only learned about the history of fans but also experienced the fun of building smart devices with electronic building blocks. This smart fan showcases the basic principle of "smart" devices: sensors collect data, the control module analyzes the data, and the system performs corresponding actions.

IV Summary

Through building the smart fan, what knowledge points did you learn today? Record your thoughts on your knowledge card.

Golf Robot

I Introduction

Golf originated in 15th-century Scotland, where players use clubs to hit a small ball into holes on a course, aiming to complete the game in the fewest strokes possible. Known as the "gentleman's sport," golf is famous for its graceful movements and strategic depth.

Today, golf is not only a globally popular sport but also incorporates technological innovations like automatic swing trainers and virtual reality simulators. Recently, golf robots have emerged, assisting players in analyzing the accuracy and power of their shots, making them valuable tools for practice and teaching.

This chapter will build a golf robot that can swing and hit a golf ball. Through this work, learn how to control the robot's movements and experience the fun of combining technology and sports.

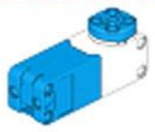
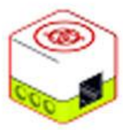
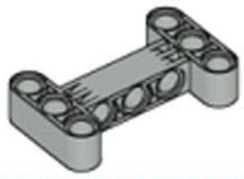
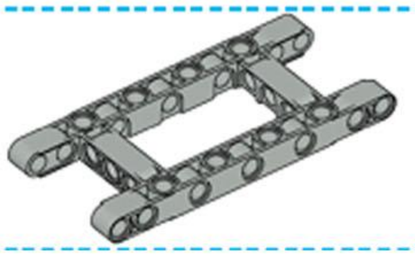
II Key Learning Points

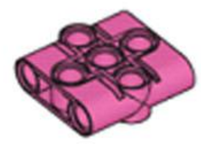
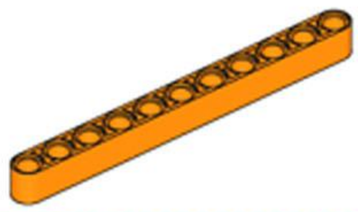
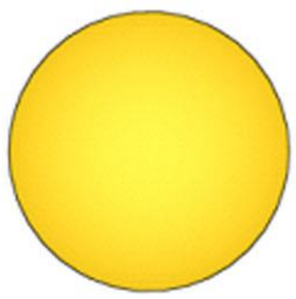
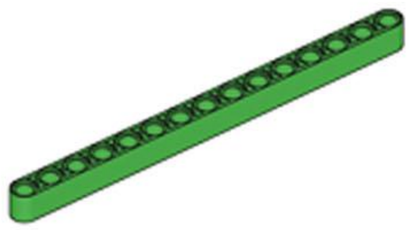
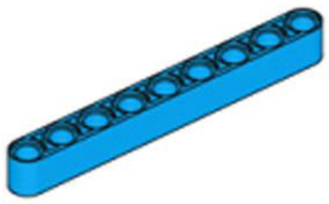
1. Complete the construction of a golf robot.
2. Learn to use the gyroscope sensor.
3. Understand the origins and development of golf.

III.Building the Project

III Building the Project

1. Preparation

Item Name	Quantity	Part Image
Main Control Unit	1	
Servo Motor	1	
Gyroscope Sensor	1	
Black Friction Pins	29	
Differential	1	
1x3 Hole Pin	1	
3x3 H-Connector Pin	5	
3x5 H-Hole Arm	3	
4x4 L-Connector Pin	3	
5x11H-Hole Arm Beam	2	

3x3 Hole Arm	1	
1x7 Hole Arm Beam	2	
1X11 Hole Arm Beam	2	
Small Ball	1	
1X15 Hole Arm Beam	1	
1X9 Hole Arm Beam	5	
Blue Long Pins	2	

2. Assembly Analysis

Let's consider the structure of the golf robot:

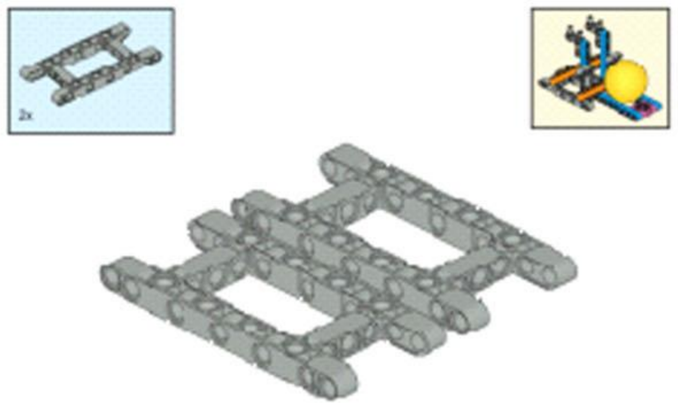
（1）It requires a stable support frame to keep it upright.

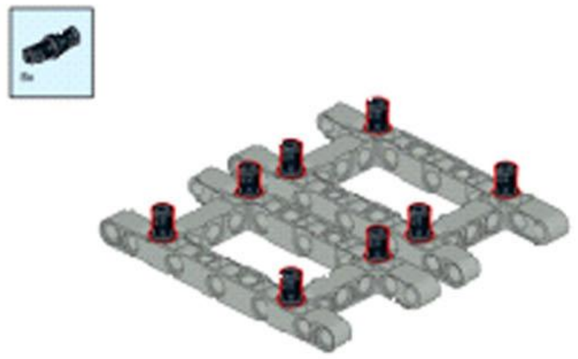
（2）It needs a mechanical arm capable of swinging a club.

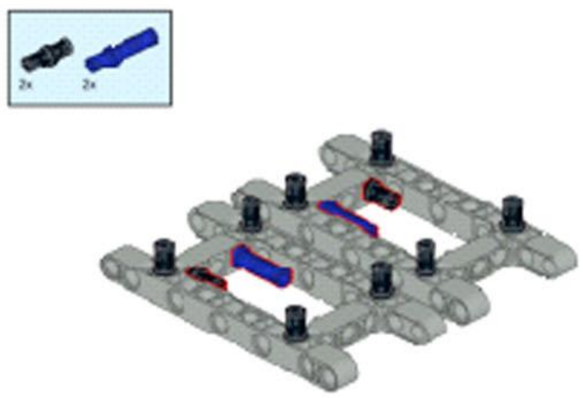
（3）Some decorative parts are also necessary, like a head and a tray to hold the ball.

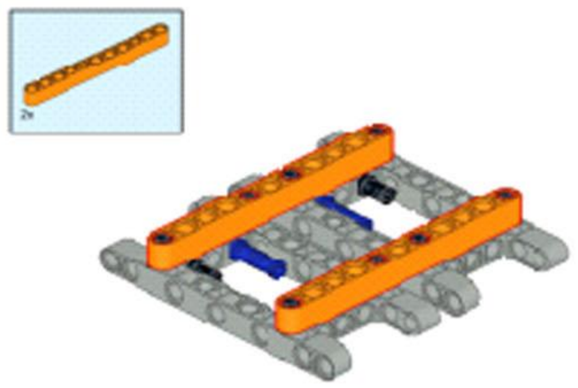
Let's start building this robot together.

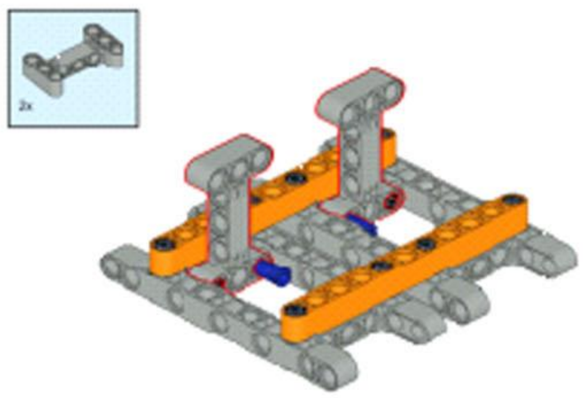
3. Building the Smart Fan

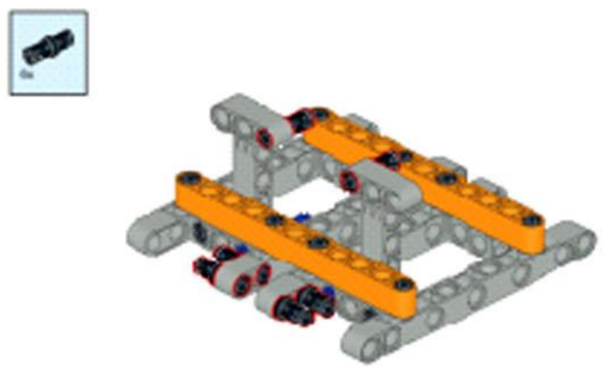


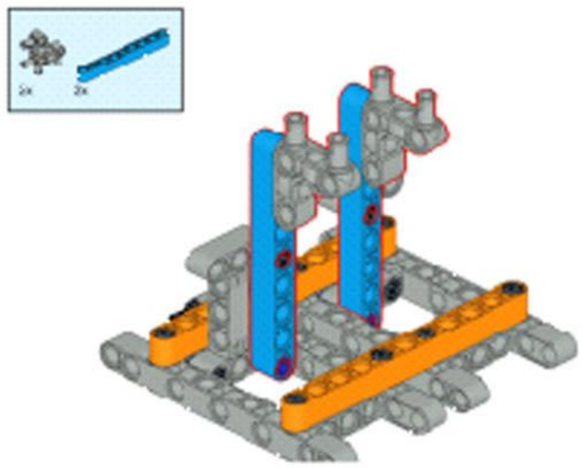


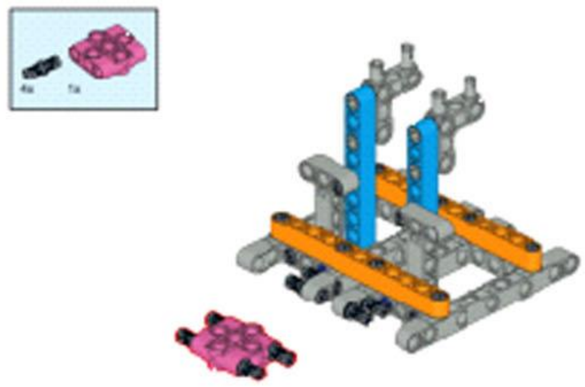


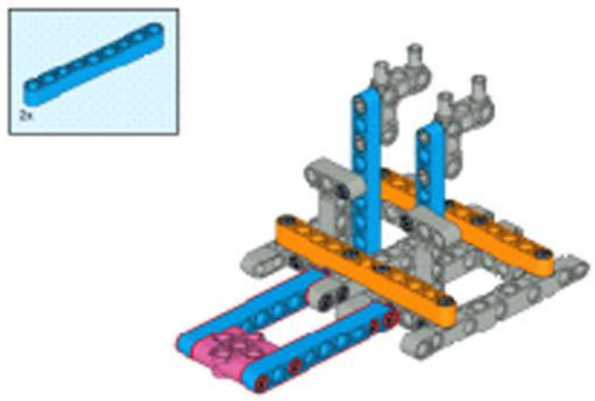


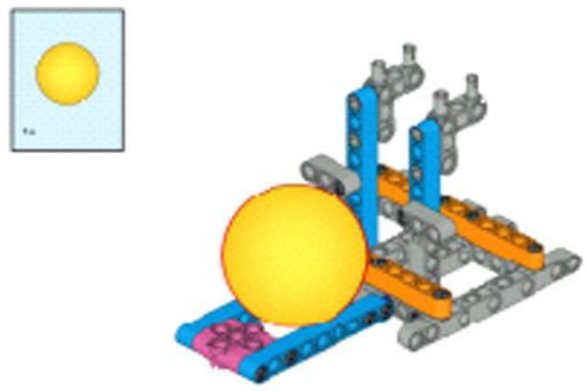


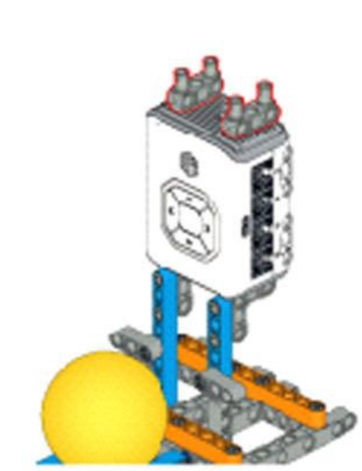


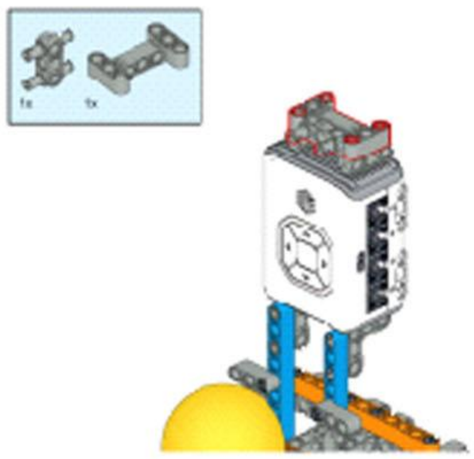


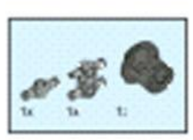


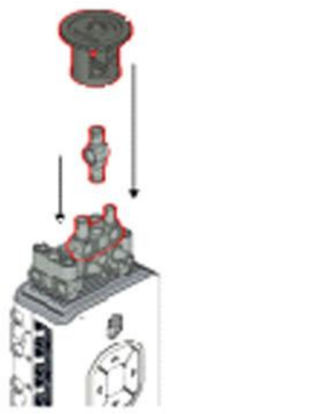


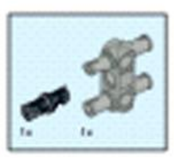


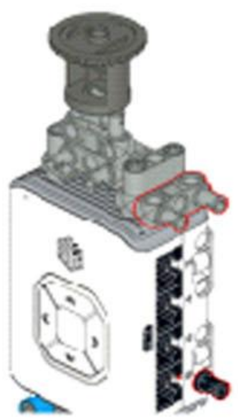


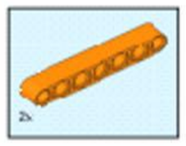


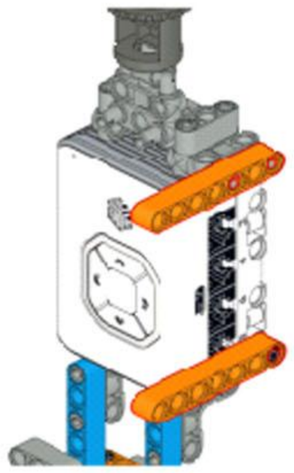




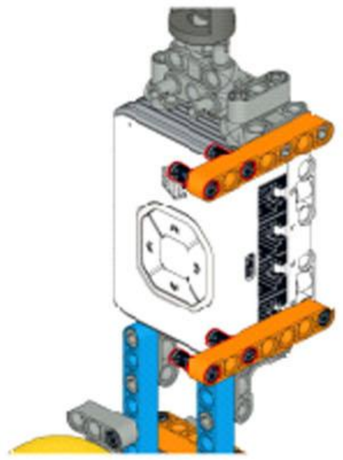


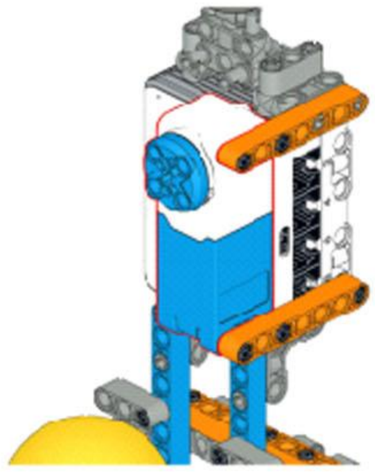


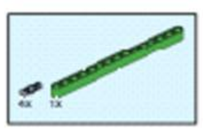


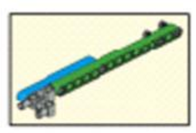


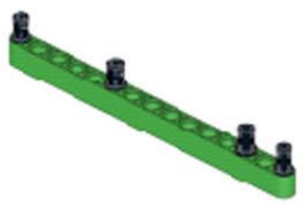


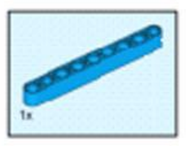


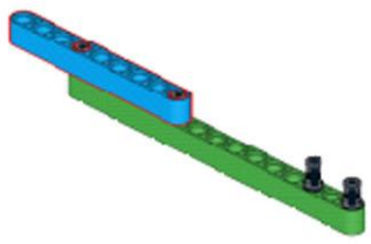






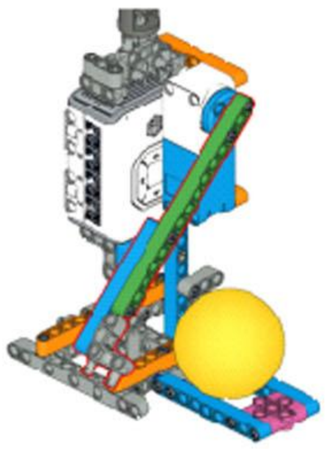


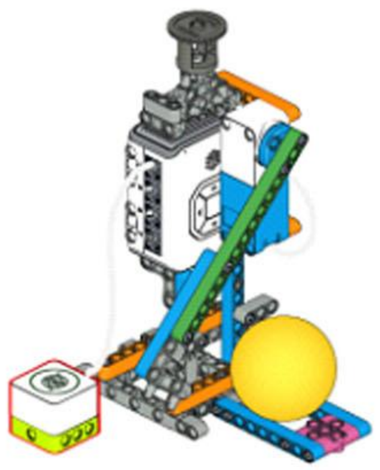












After completing the basic structure, connect the gyroscope sensor' s crystal connector to Port 1 of the main control unit and the servo motor to Port 2. The gyroscope sensor will control the robot' s swing and retract motions by tilting forward and backward.
Be cautious with the tilt angle to avoid swing failures!

IV Summary

Today, we built a golf robot together, learned to use the gyroscope sensor to control motor movement, and explored the development of golf and the application of golf robots in this sport.

Dancing Robot

I Introduction

Dance is an art form that expresses emotions and culture, enhancing coordination, flexibility, and teamwork. Common dance types include classical dance, modern dance, street dance, and folk dance, each with unique rhythms and movements.

With advances in technology, dancing robots have emerged, capable of combining music, movement, and light effects in performances.

In this lesson, we will build a simple dancing robot and learn how to use programming and design to make the robot perform a dance.

II Key Learning Points

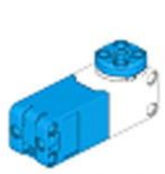
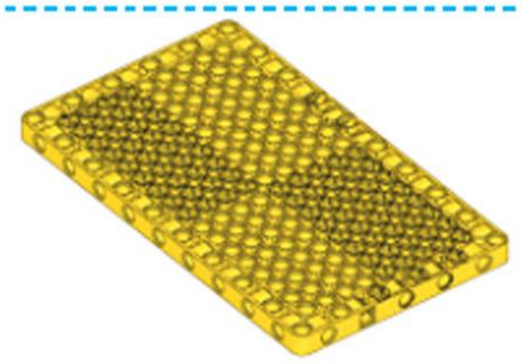
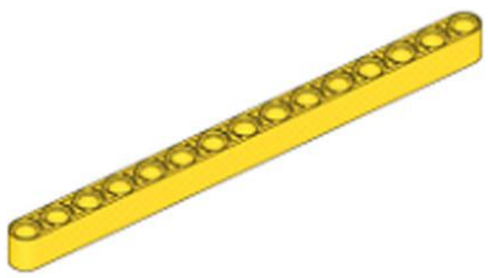
1. Understand the basic principles of mechanical structure and movement.

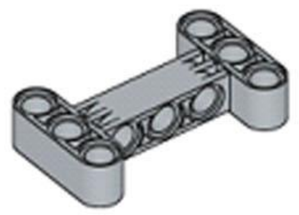
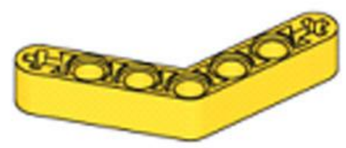
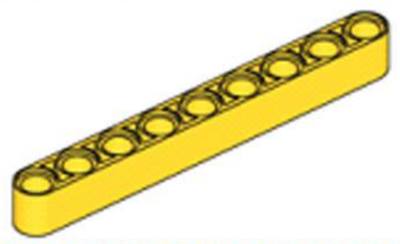
2. Learn basic programming logic to make the robot dance according to set instructions.

3. Comprehend the application of sensors in robot movement.

III Building the Project

1. Preparation

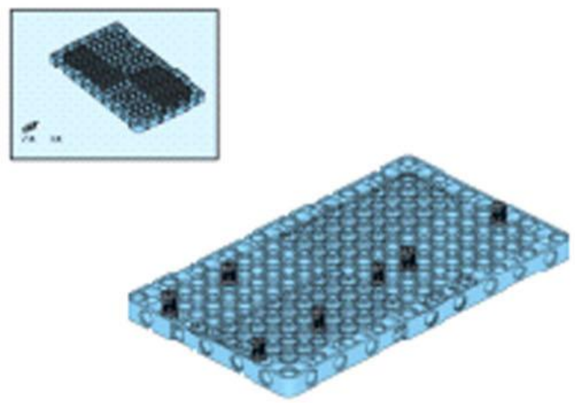
Item Name	Quantity	Part Image
Main Control Unit	1	
Servo Motor	2	
Sound Sensor	1	
11x15 Tech Base Plate	1	
3x3 Hole Arm Connector	5	
1x15 Hole Arm Beam	2	
Friction Pins	23	
1x3 Hole Arm Beam	3	

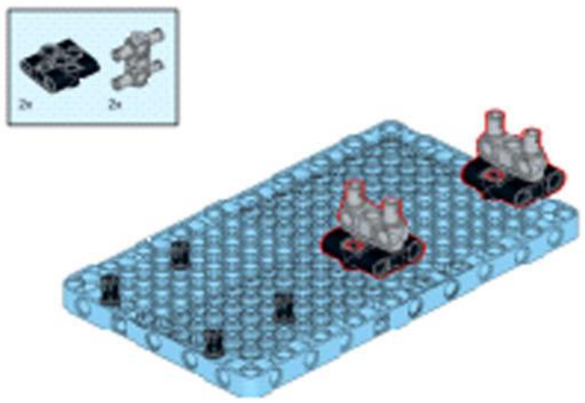
3x3 H-Connector Pin	8	
24-Tooth Gear	1	
3x5 H-Bend Arm Beam	1	
2# Axle	1	
4x4 Hole Bend Arm Beam	2	
1x9 Hole Arm Beam	1	
Cross-Axle Pin	2	

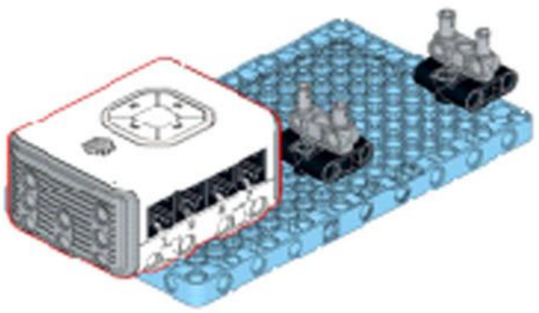
2. Assembly Analysis

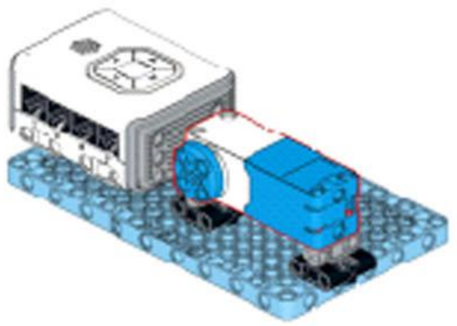
The dancing figure is a simple yet engaging robot project. It consists of a base, a rotating joint, and a figure model. By using servo motors and a sound sensor from the robot kit, we can make this figure rotate and sway to imitate dancing movements in response to a set rhythm.

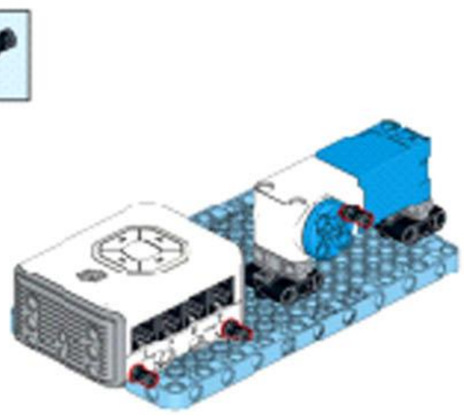
3. Building the Dancing Robot

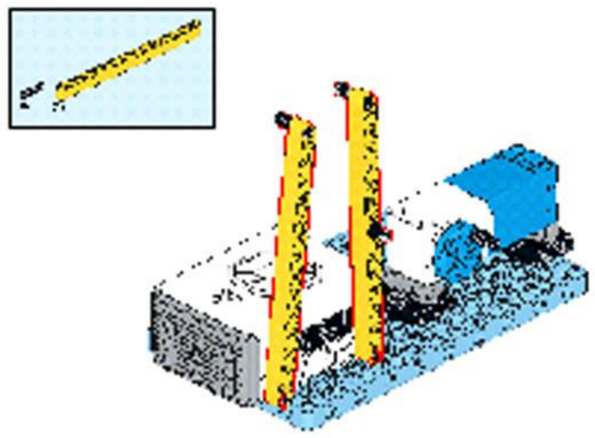


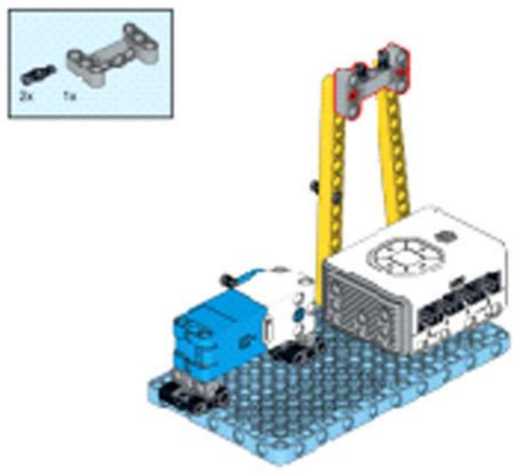


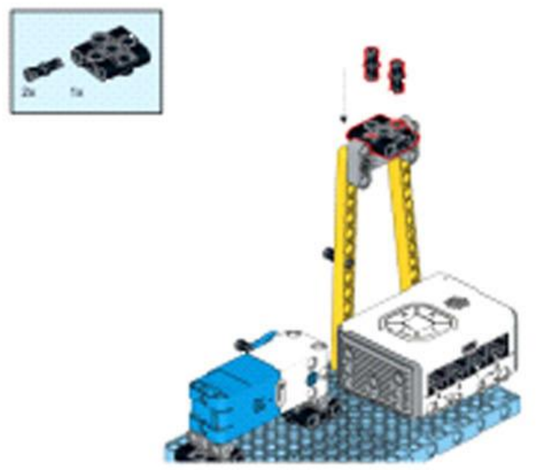


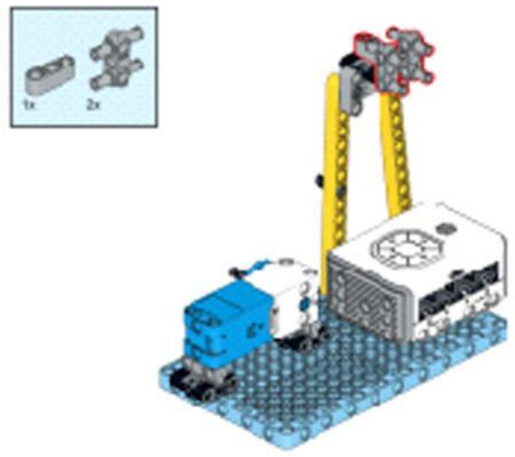


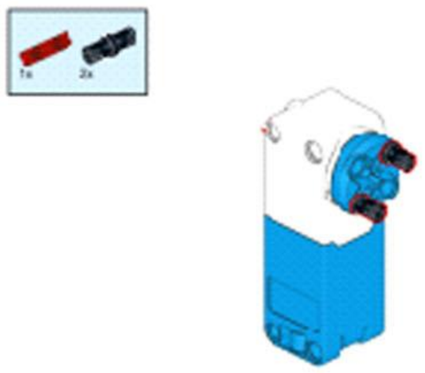


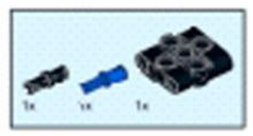


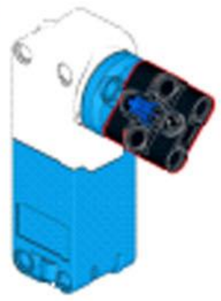


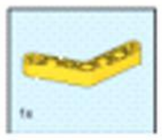


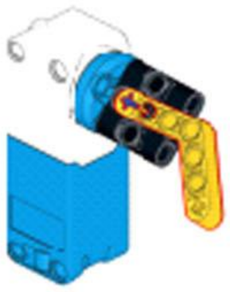




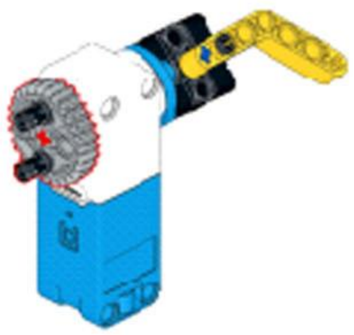


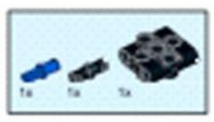


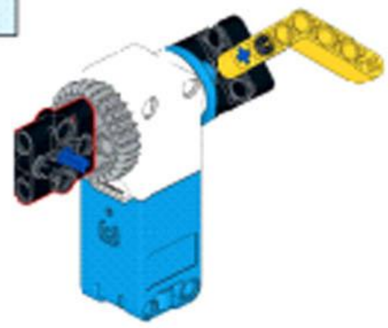


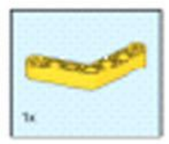


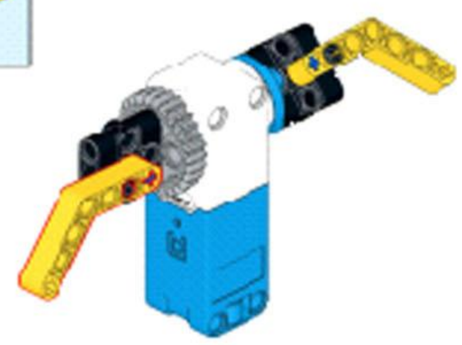




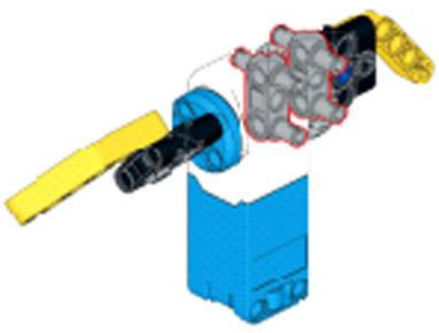


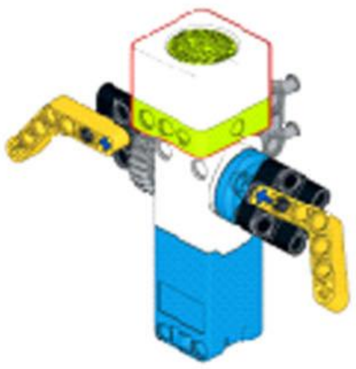




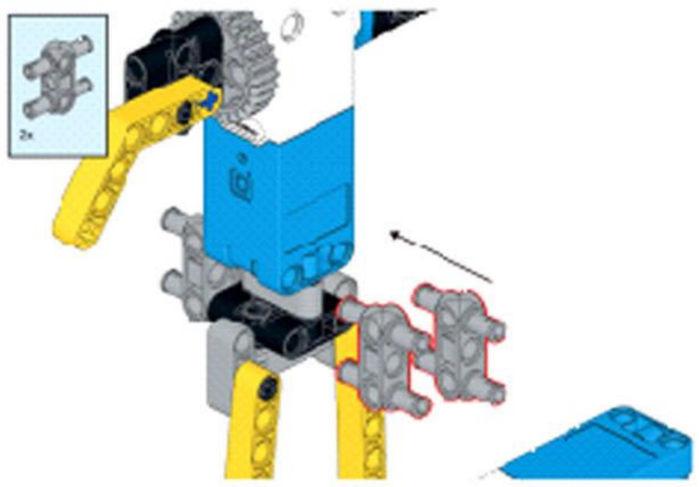


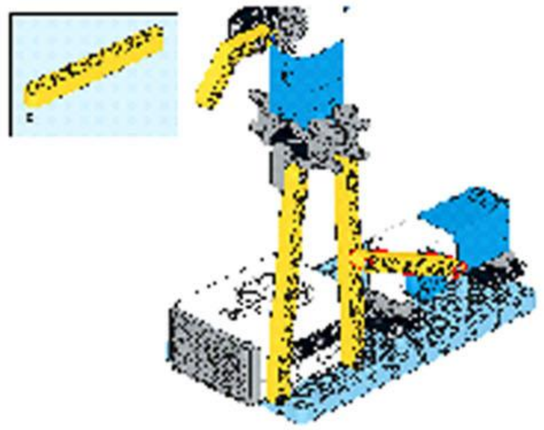














Once the dancing figure is assembled, connect the servo motors to Ports 1 and 2, and the sound sensor to Port 4 on the main control unit. After connecting, we will write a program to control the robot's dance movements.

The dancing robot utilizes the sound sensor and servo motors. For it to complete its dance routine, it needs to execute a few actions:

1.The sound sensor detects a sound, triggering the servo motors to start moving.

2.The servo motors activate, causing the robot's arms and legs to move rhythmically.

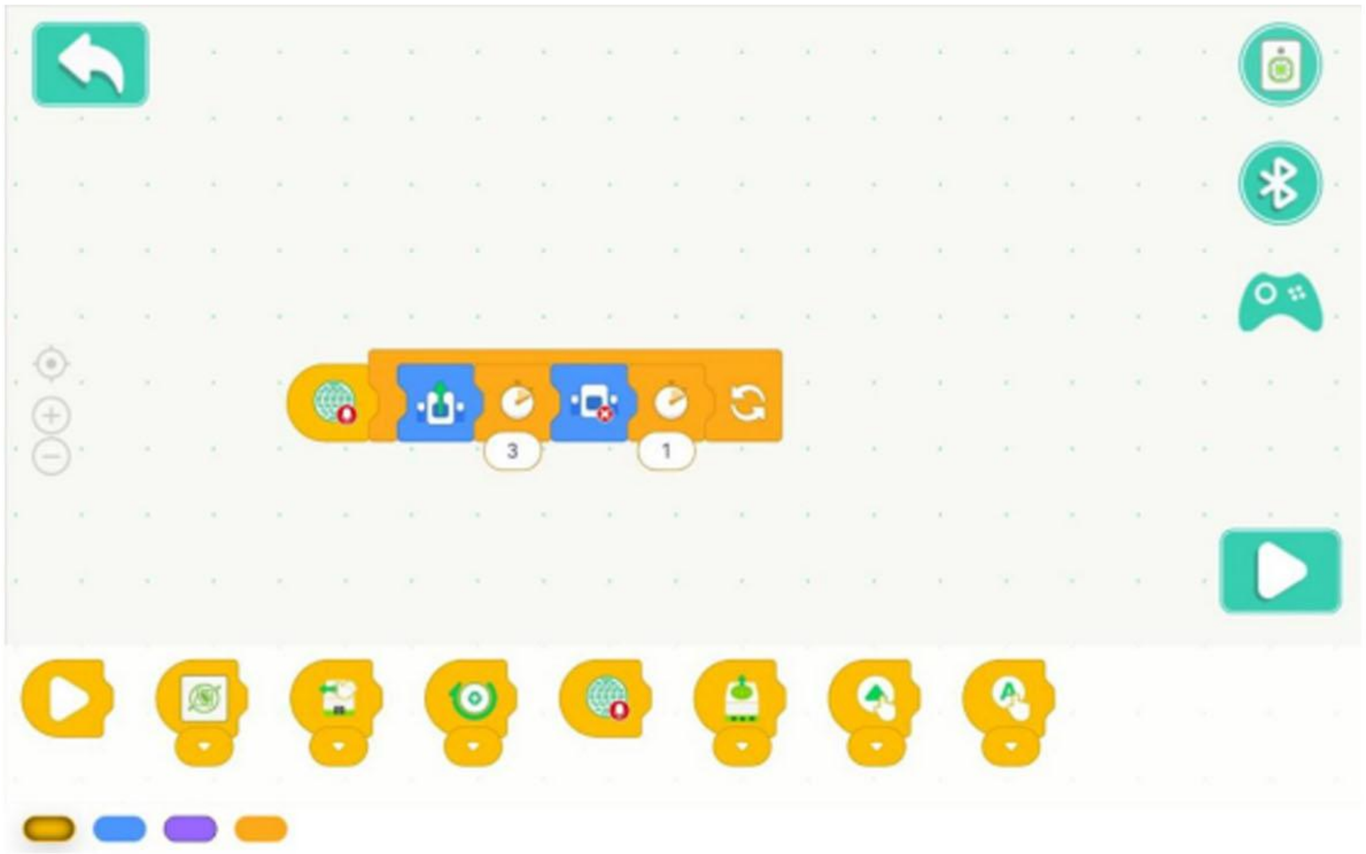


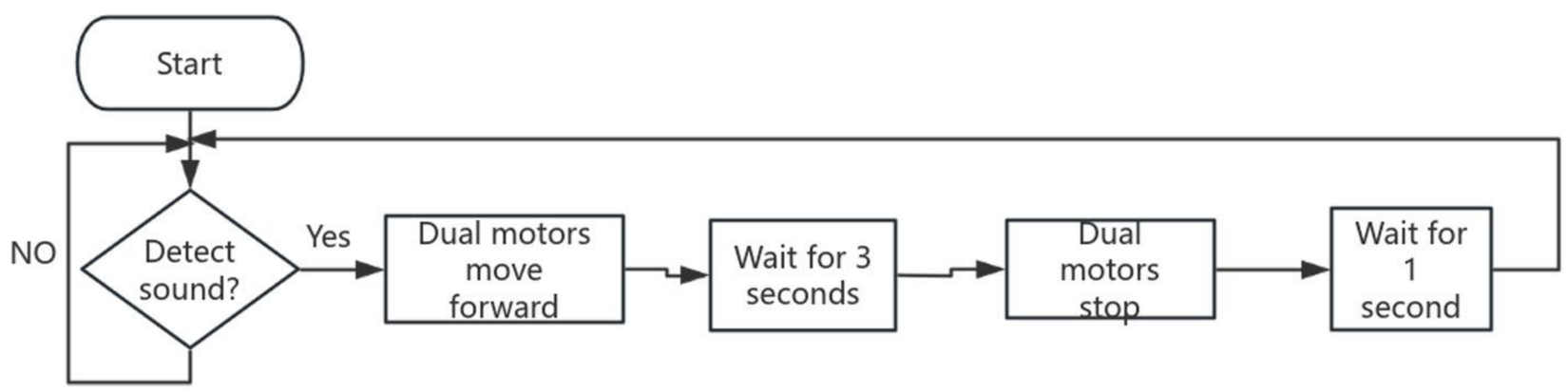
Figure 2. Dancing Robot Program

Before creating the new program, let’s learn about a few new modules:

Block Name	Module Icon	Function
Sound Start Block		Detects sound

Repeat Loop		Infinite loop
Dual Motor Block		Forward
		Forward
Wait Block		Wait for specified time

Programming Tips



Based on these programming tips, you can now complete the dancing figure’s program. You’ll notice that as the figure's legs move from side to side, it’s the motor that drives this movement.

This design uses a crank-rocker mechanism, a type of mechanical structure that converts rotational motion into back-and-forth motion. The crank-rocker mechanism consists of three main parts: a rotating rod (crank), a connecting rod (link), and a swinging part (rocker). When the crank rotates, it moves the link, which in turn makes the rocker sway. This type of structure is commonly used to mimic arm or leg movements in robots or in mechanical devices that require repetitive swaying, like pumps or compressors. It makes mechanical motion simpler and more controllable.

IV Summary

In this lesson, we combined mechanics and programming to make a simple dancing figure that performs specific actions. You learned the basics of the robot programming kit and the importance of sensors in robot movement. In the future, you can try adding more dance moves for the figure or even design a complete dance routine for a robot!

Boxing Robot

I Introduction

Boxing is a time-honored combat sport that originated in ancient Greece and Rome, emphasizing the use of fast and precise punches to defeat opponents while testing reaction speed and coordination. With advancements in technology, boxing robots have emerged as a new application. Initially designed for entertainment, they have evolved into competitive devices that simulate human boxing movements and are now valuable tools for artificial intelligence and robotics research.

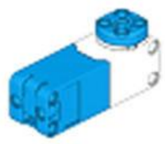
In this lesson, we'll build a simple boxing robot model, learning how to use gyroscope sensors to control the robot's arm movements, achieving quick attack responses.

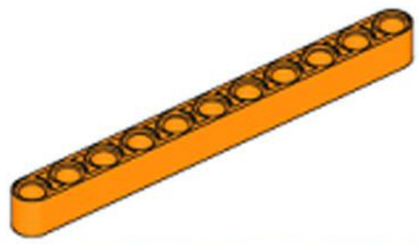
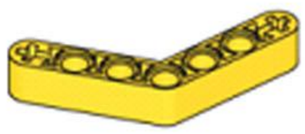
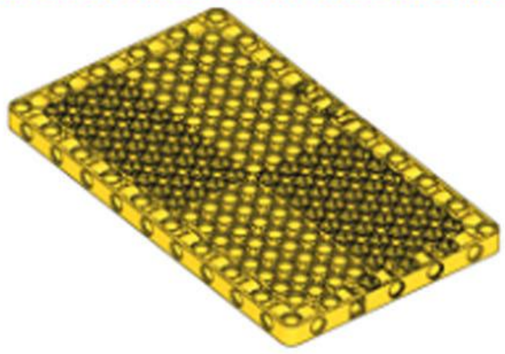
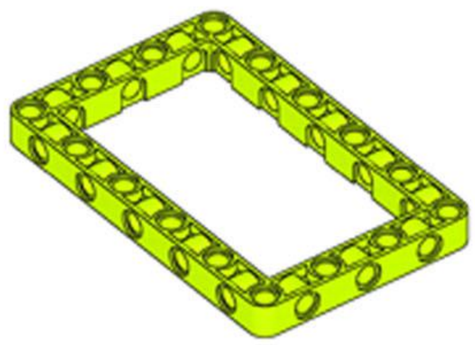
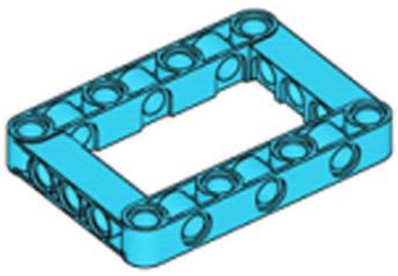
II Key Learning Points

1. Complete the assembly of a boxing robot.
2. Learn to use gyroscope sensors to control dual motors.
3. Understand linkage mechanism concepts.

III Building the Project

1. Preparation

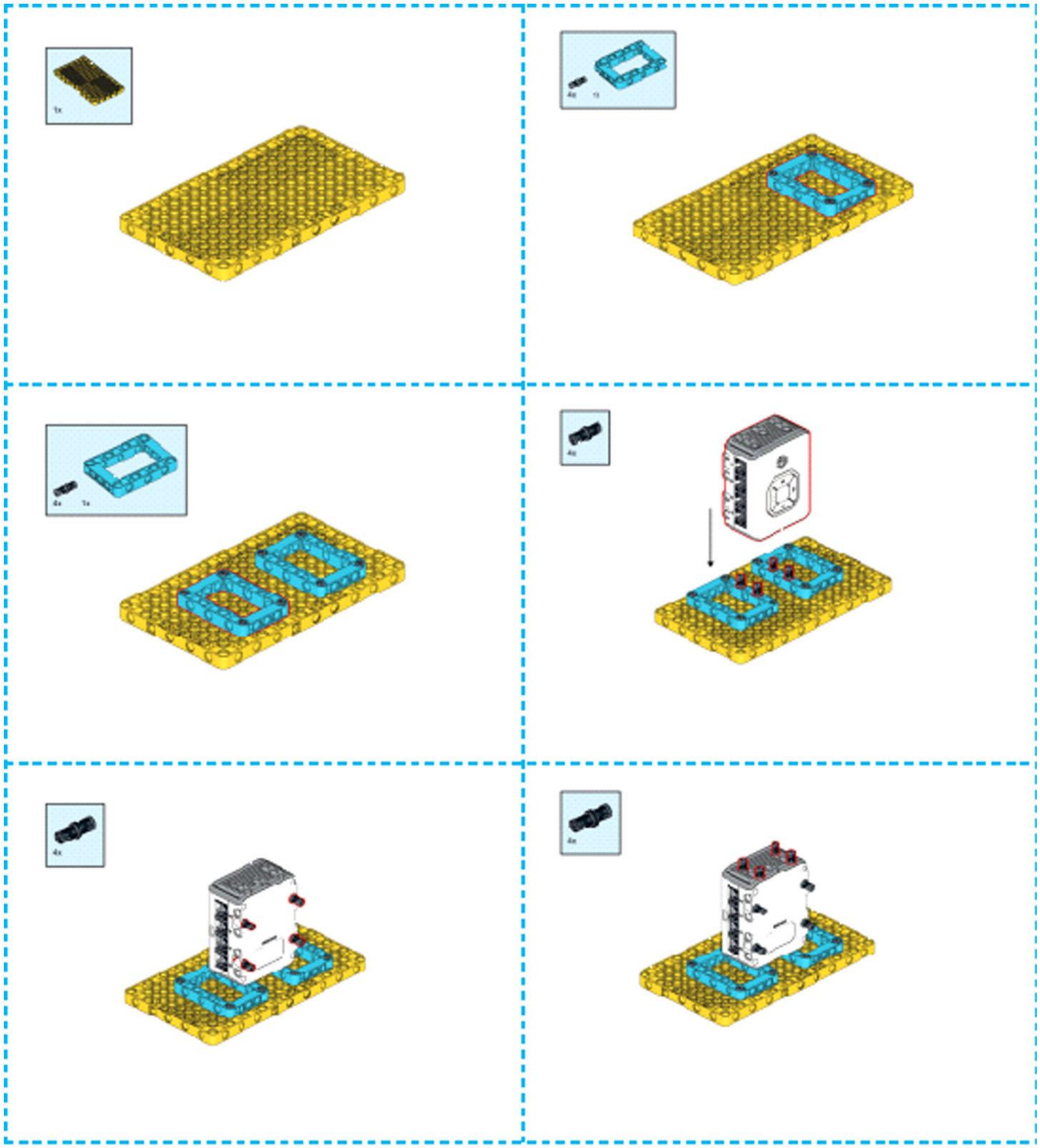
Item Name	Quantity	Part Image
Main Control Unit	1	
Gyroscope Sensor	2	
Servo Motor	2	
Friction Pin	32	
Axle Pin	4	
#2 Limit Axle	2	
1x7 Hole Arm Beam	3	
Frictionless Pin	2	
55982 Wheel Hub	2	
55981 Wheel Hub	2	
1X15 Hole Arm Beam	2	

1X11 Hole Arm Beam	2	
#1 Axle Connector	2	
Track Wheel	2	
1x3Cross Axle with Short Pin	2	
4x4 Hole Arm Beam	2	
11X19 Technic Base Plate	1	
11X15 Hole Arm Beam Ring	1	
5X7 Hole Arm Beam Ring	3	
Blue Long Pin	2	
Pin Connector	2	

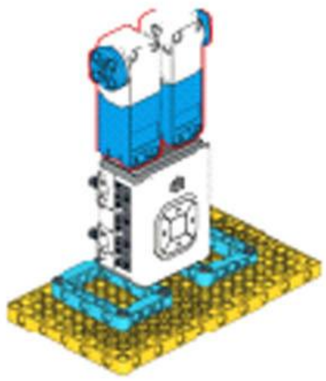
2. Assembly Analysis

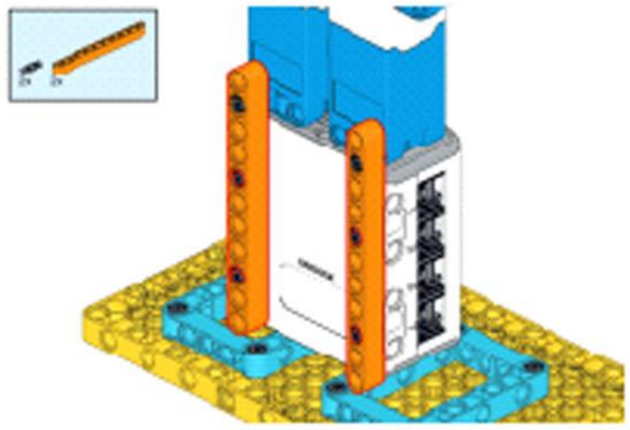
The boxing robot consists of the robot’s body, boxing arms, and h-ead. You can follow the breakdown steps to assemble each part.

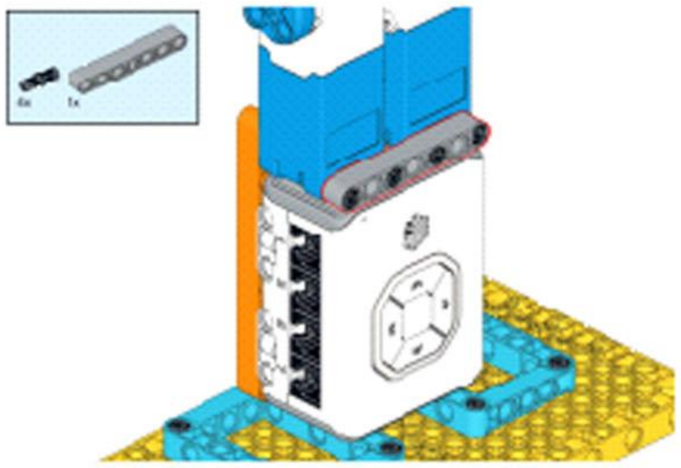
3. Building the Boxing Robot

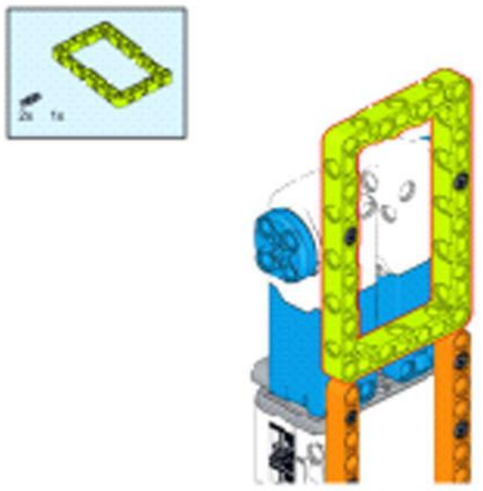


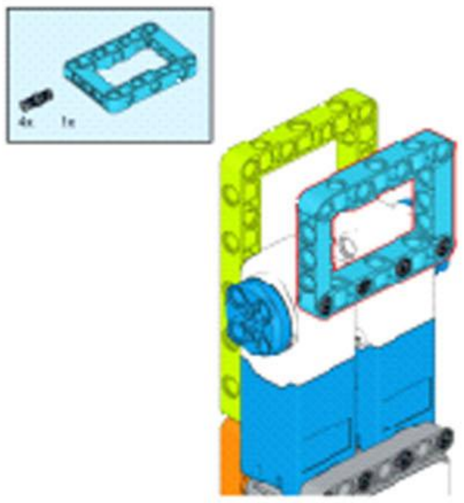
Note: Connect the motor cable to the motor first.

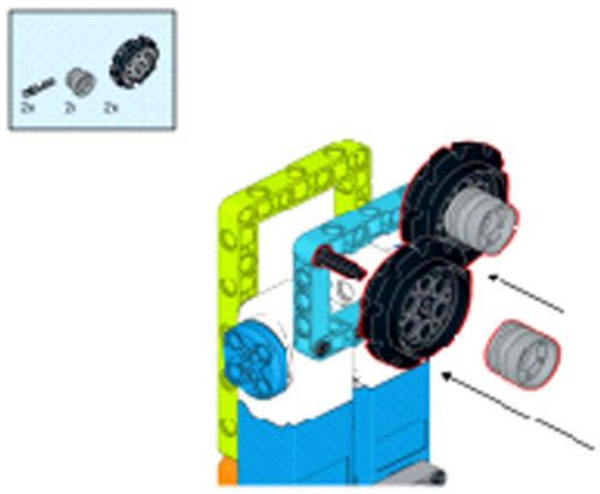


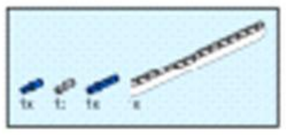


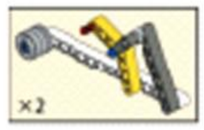


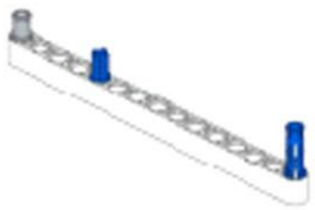


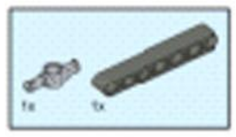


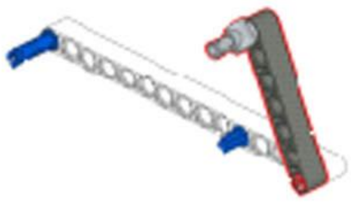


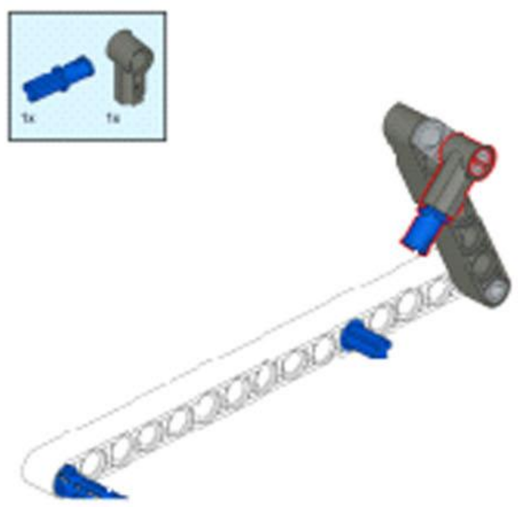


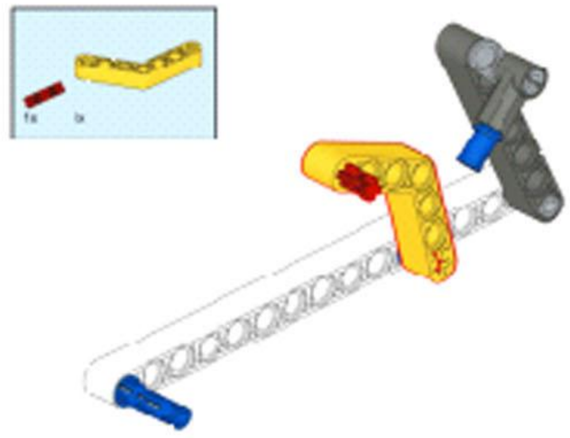


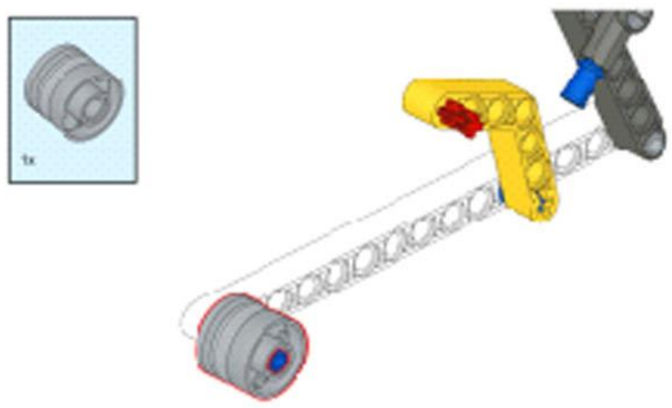


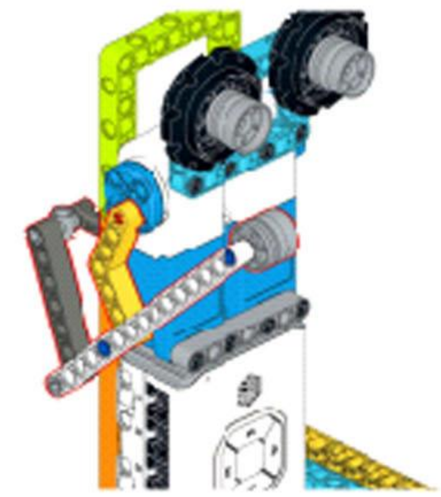


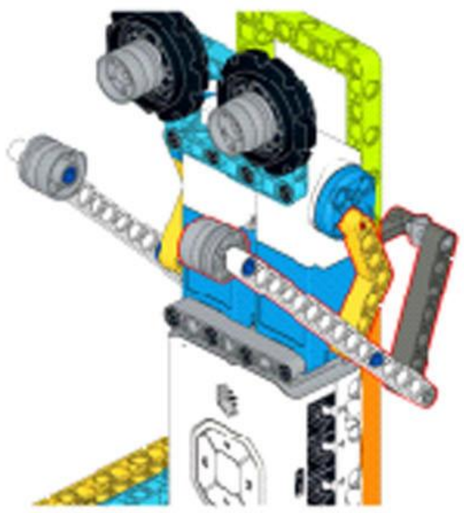


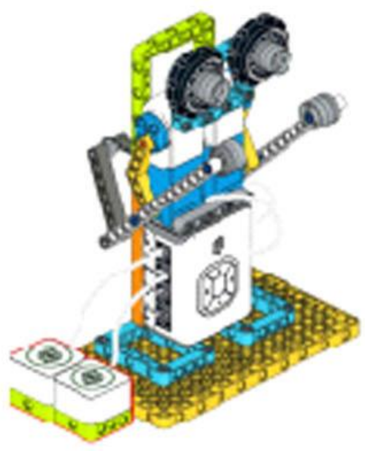












With the boxing robot build complete, you can connect the crystal c-
onnectors for the two tilt sensors to port 1.3 and the servo motor c-
onnectors to port 2.4. After the connection is done, turn the master
on, the port 1 tilt sensor controls the servo motor on port 2, and the
tilt sensor on port 3 controls the servo motor on port 4. Tilt back a-

nd forth to control the robot's punch and retract, everyone try it. As the boxing robot comes to life, you' ll notice that the motor movement drives the arm for each punch. This flexibility in arm motion is achieved through a linkage mechanism. A linkage structure is composed of several components connected by hinges (like joints), forming a system capable of movement. Similar to a human arm, the linkage structure allows a robot or mechanical device to move in multiple directions.

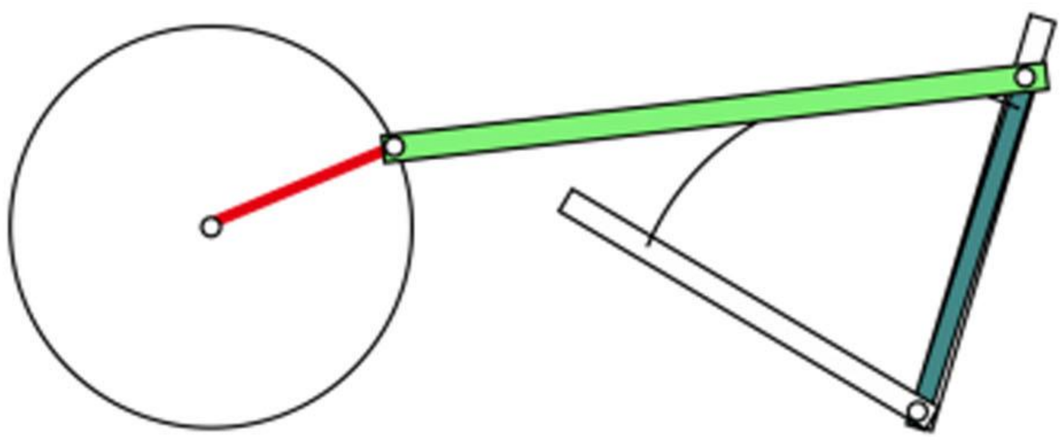


Figure 2. Linkage Structure

To help everyone understand better, here are some everyday examples:

1. Bicycle Pedals: When you pedal, your foot pushes on the pedal, which drives the linkage and turns the wheel. This is a simple linkage structure.

2. Scissors: The two blades are connected by a hinge, forming a linkage. When we squeeze the handle, the blades close and cut the paper.

3. Linkage in Robots: Linkage structures are common in robots, allowing them to perform various actions, such as bending arms, swinging tools, or walking. By precisely controlling each linkage movement, robots can complete complex tasks.

For instance, in the boxing robot, the linkage structure allows the robot to swing its fists. Each time the robot "punches," the linkage transfers energy to the fist through a sequence of movements, ultimately delivering a powerful strike to the target.

IV Summary

Through building this project, we learned several key concepts. Take a moment to review today's learnings and complete the following table:

Harvest	
1. Which sensor controls the robot's punching and retraction?	
2.What are some examples of linkage structures in everyday life? List a few.	

Harvester

I Introduction

Harvesting is a critical step in agriculture. In 1831, Cyrus McCormick invented the mechanical harvester, improving harvesting efficiency and marking the start of agricultural mechanization. With technological advancements, steam- and diesel-powered harvesters were introduced. Modern harvesters not only quickly harvest crops but also automatically thresh and clean, greatly enhancing productivity.

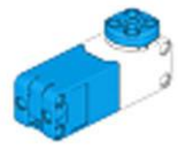
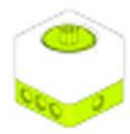
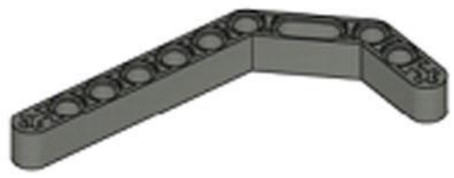
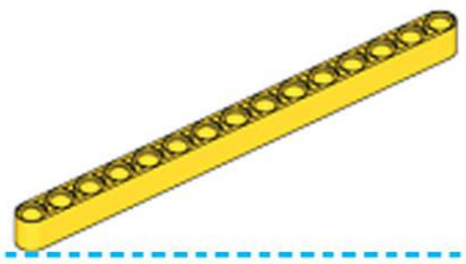
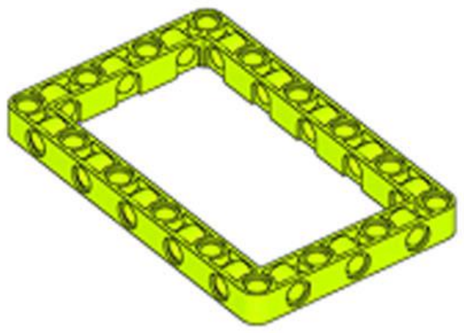
II Key Learning Points

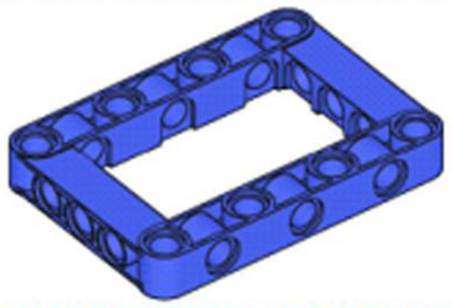
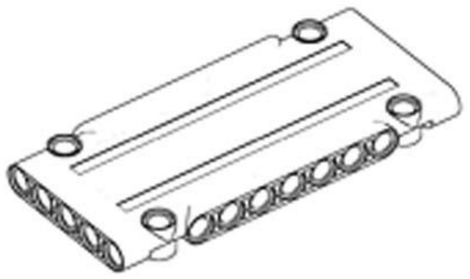
1. Understand the basic principles and functions of a harvester.
2. Build a robot that simulates harvesting actions.
3. Learn about the advantages of the drum cutting system.

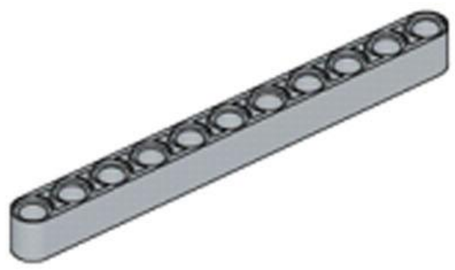
III Building the Project

1. Preparation

Item Name	Quantity	Part Image
Main Control Unit	1	

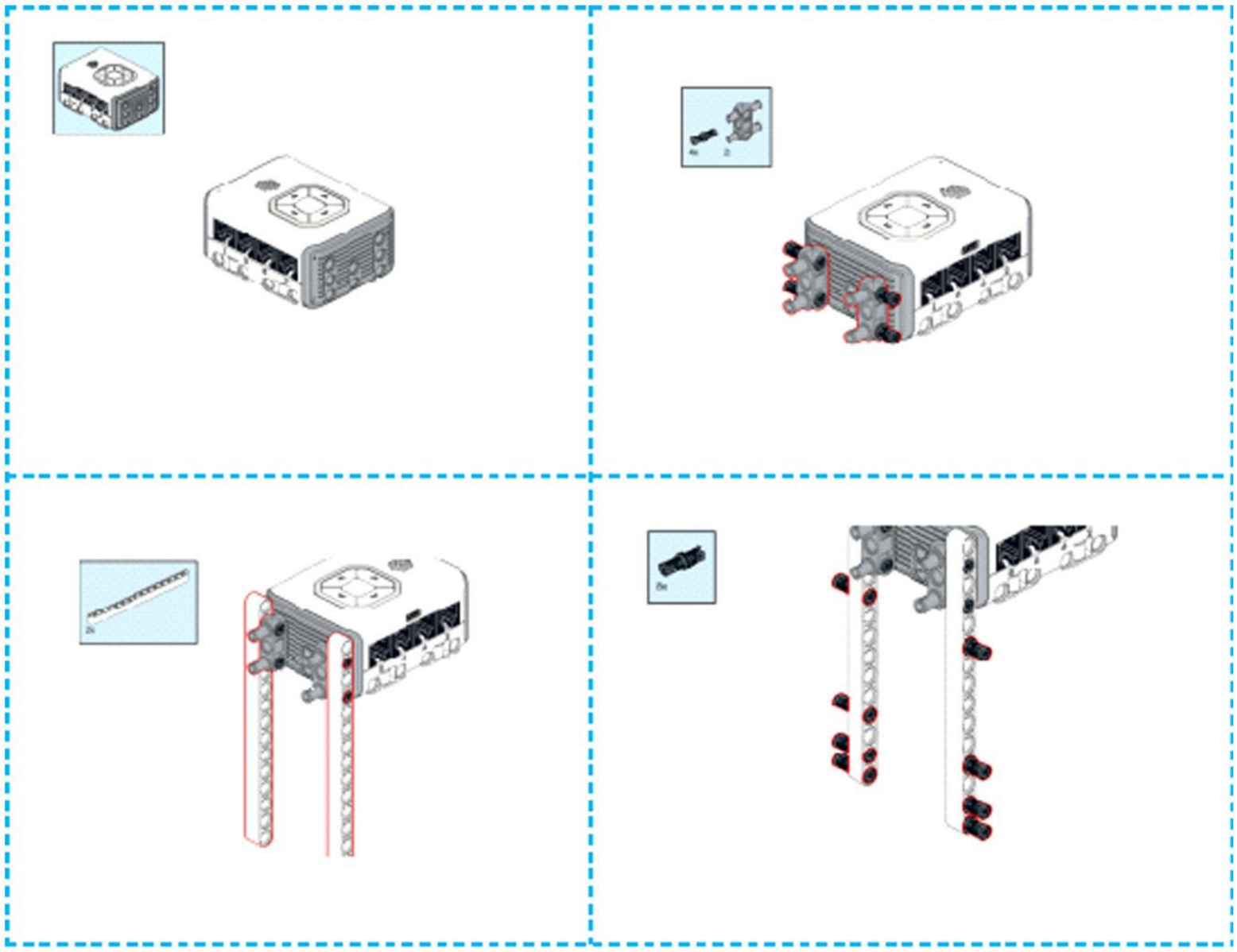
Servo Motor	1	
Encoder	1	
Friction Pins	54	
1x8 Cross Axle	2	
1x10 Cross Axle	2	
1x12 Cross Axle	1	
Axle Connector	1	
11x5 Hole Arm Beam	2	
Full Axle Bushings	8	
1x15 Hole Arm Beam	7	
11x15 Hole Arm Frame	1	

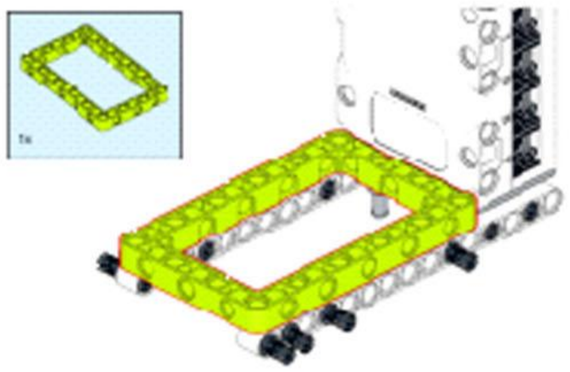
3x5 L-Shaped Arm Beam	4	
5x7 Hole Arm Frame	2	
3x3 T-Shaped Arm Beam	2	
5x3 Pulley	2	
3x3 H-Shaped Connector	4	
Rubber Band	2	
5x11 Mechanical Tech Panel	1	
1x7 Hole Arm Beam	1	
Cross Axle Pins	2	
Wheels	4	

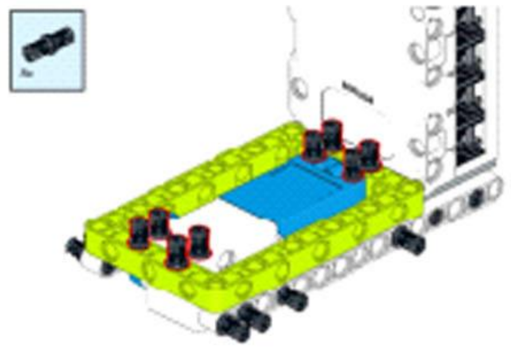
1x5 Hole Arm Beam	4	
1x11 Hole Arm Beam	2	

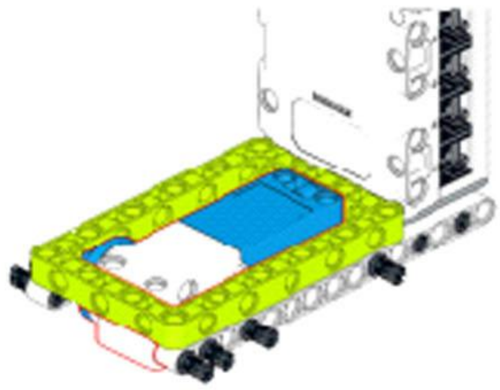
2. Assembly Analysis

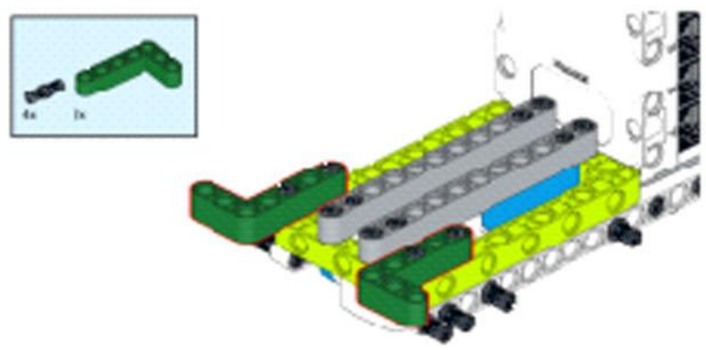
Build the harvester robot whose main action is to mimic the process of harvesting. This robot will have a cross harvesting section that is driven by servo motors to simulate the harvesting action. Also, the robot will have a simple wheel system to simulate the movement of the harvester through the field.

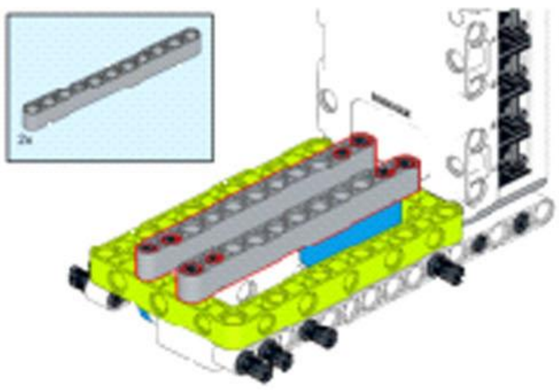


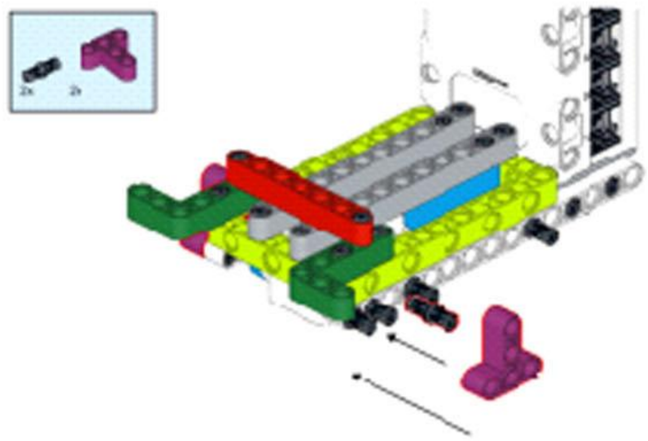


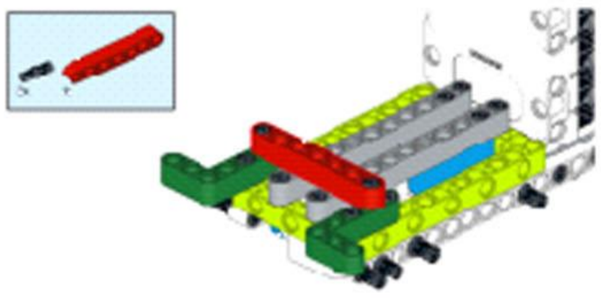


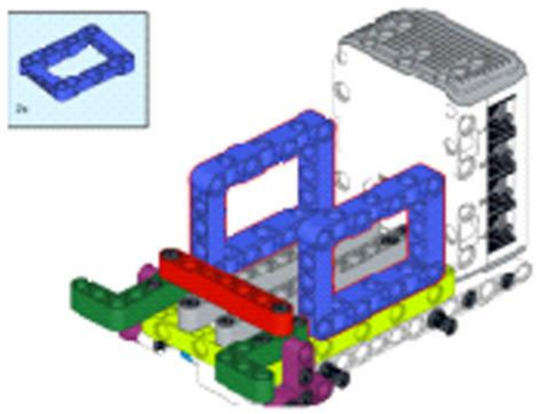


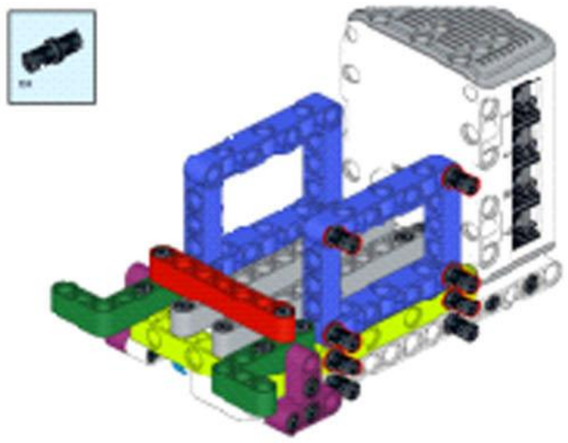


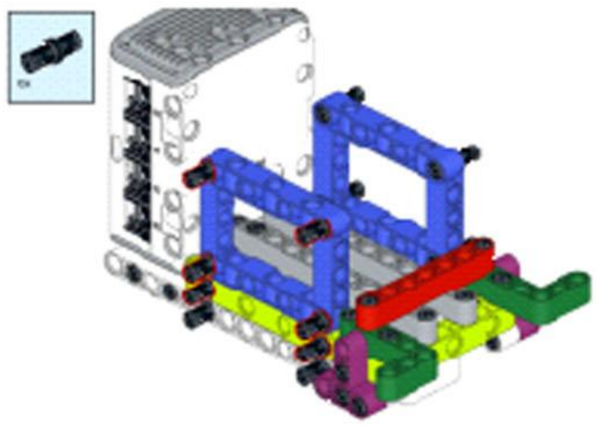


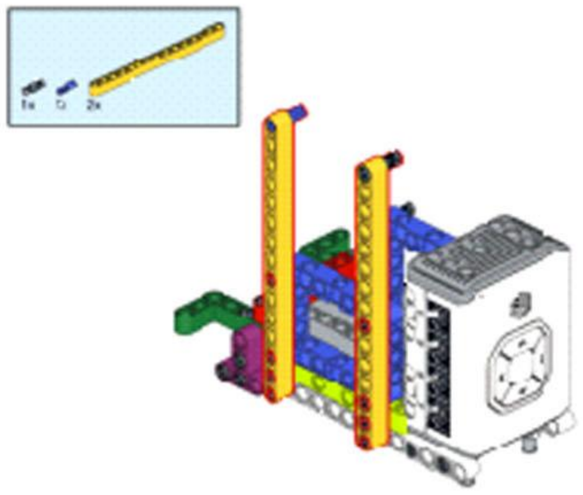


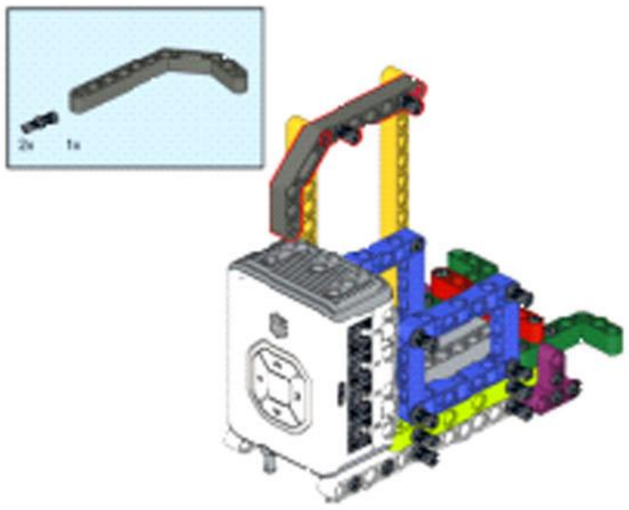


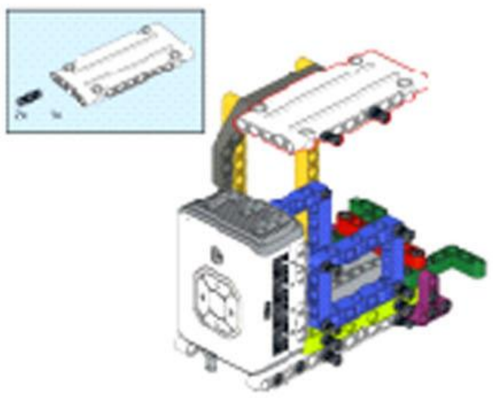


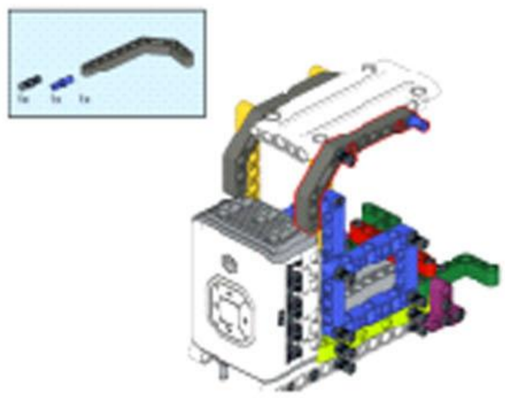


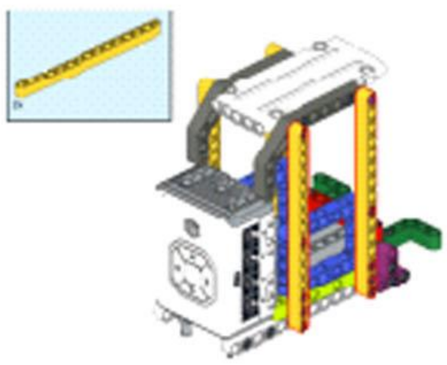


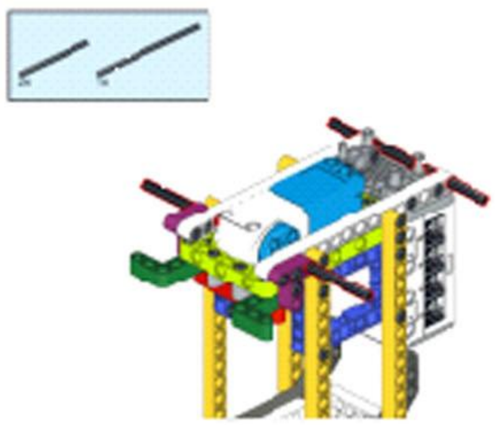


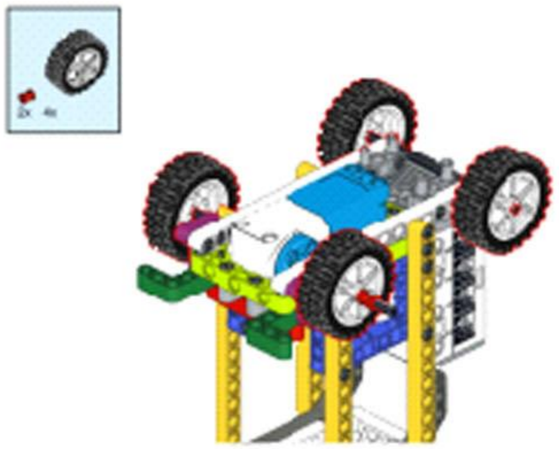


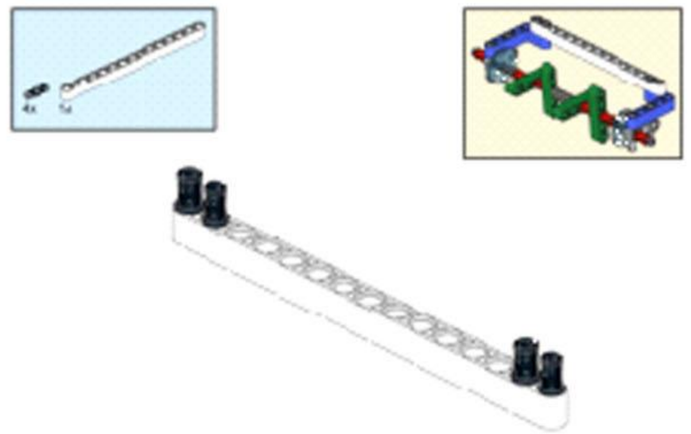


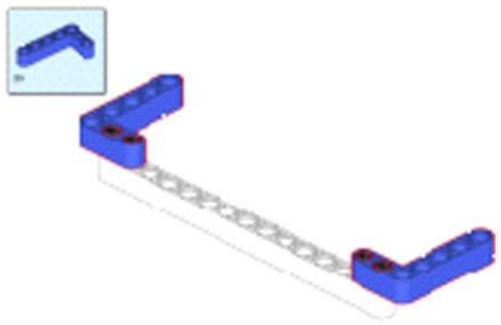


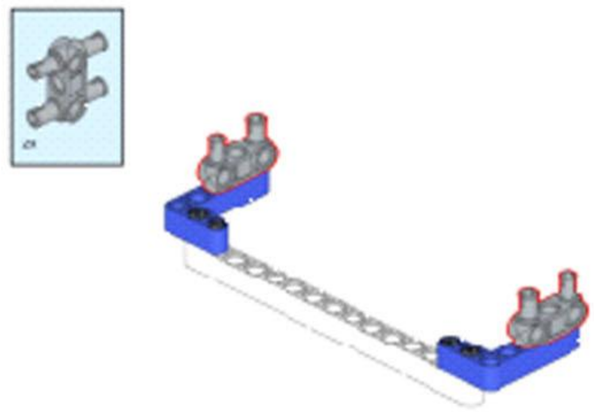


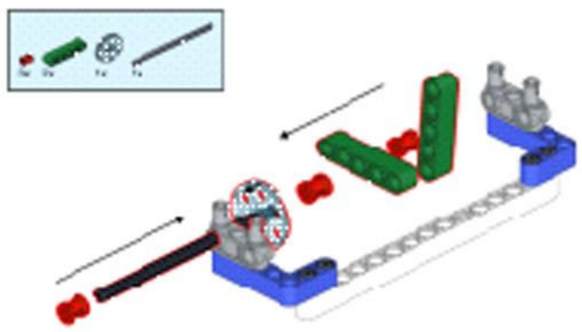


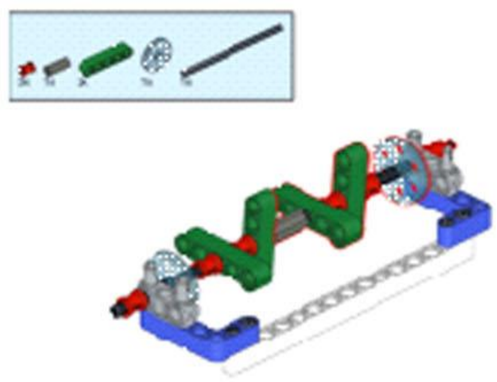


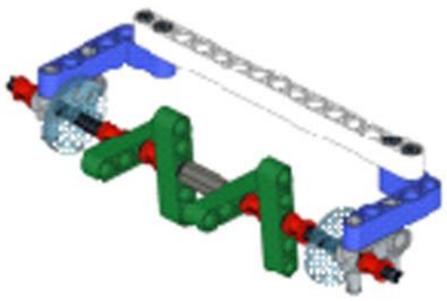










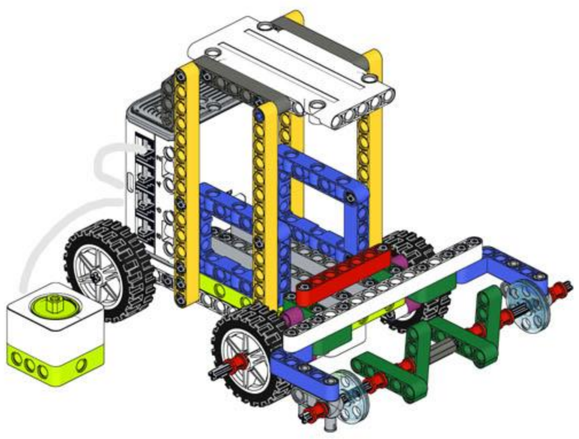


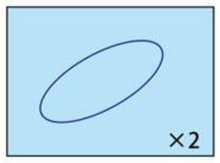


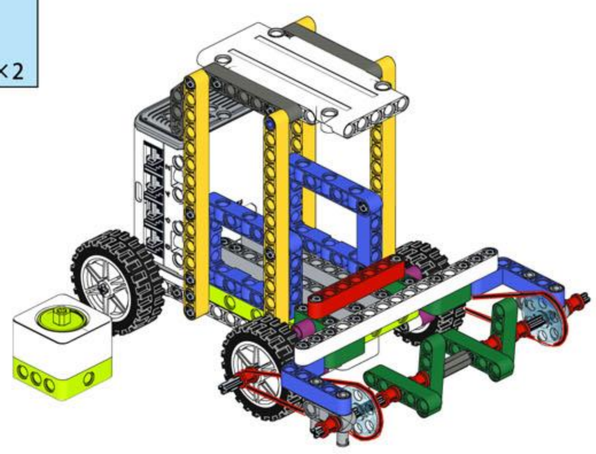












After completing the harvester, connect the servo motor to Port 2 and the encoder to Port 1. Once powered on, the encoder can be rotated to perform the harvesting motions.

The harvester’s cutting mechanism simulates a drum cutting system, with its core component being the drum (also known as the "header drum" or "cutting drum"). This drum is equipped with rotating blades that cut crop stems like scissors, pushing the crops into the cutting area with high efficiency. The drum technology not only handles cutting but also transports and separates the crops. The rotation enhances crop handling efficiency, reduces damage, and optimizes

the harvesting process. A well-designed drum can adapt to various crops, ensuring stable and efficient operation under different working conditions.

IV Summary

In this lesson, you learned about the basic working principles of a harvester and how to use a robotics kit to build one. Harvesters are essential tools in modern agriculture, significantly improving the efficiency of crop harvesting and reducing labor intensity.

Robotic Vacuum Cleaner

I Introduction

Robotic vacuum cleaners have become common smart devices in households, equipped with features like automatic navigation and combined vacuuming and mopping functions. The first robotic vacuum was created in 1985, relying on gyroscopes and ultrasonic radar for positioning. Although bulky, it laid the foundation for future development. With technological advancements, robotic vacuums have become smarter and more compact.

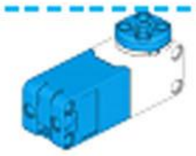
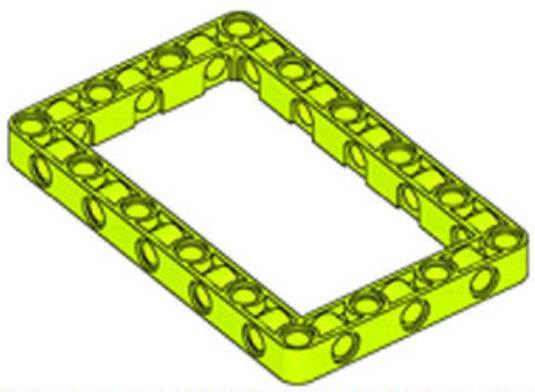
In this lesson, we'll build a robotic vacuum cleaner and program it to complete specific tasks, exploring the intelligent operation principles behind it.

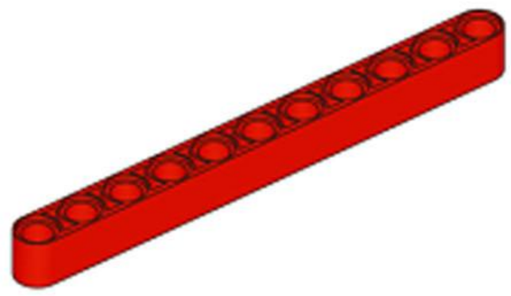
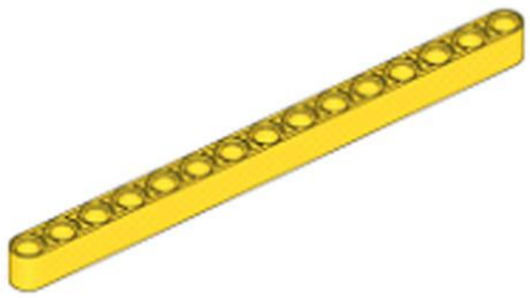
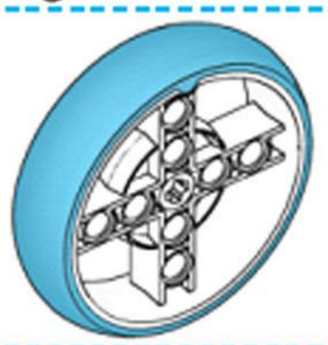
II Key Learning Points

1. Understand the working principles of a robotic vacuum cleaner.
2. Learn to use the programming movement modules.
3. Understand the belt drive structure.
4. Imagine the future development trends of robotic vacuum cleaners.

III Building the Project

1. Preparation

Item Name	Quantity	Part Image
Main Control Unit	1	
Distance Sensor	1	
Servo Motor	3	
11x15 Hole Arm Frame	1	
Half Axle Bushings	2	
1x3 Hole Arm Beam	3	
1x5 Hole Arm Beam	2	
1x9 Hole Arm Beam	2	
Axle Pin	1	

1x11 Hole Arm Beam	4	
1x15 Hole Arm Beam	1	
Ring Gear	2	
28-Tooth Double-Sided Gear	2	
Center Pulley Hub	2	
Rubber Band	1	
1x3 Axle with Stop	1	
56x14 Rubber Wheel Hub	2	

4x4 L-Shaped Connector	2	
Axle Pin Connector #1	1	
Axle #4	1	
Friction Pins	25	
Long Blue Pins	8	
Axle #1	2	
Long Axle with Hole Pin	1	

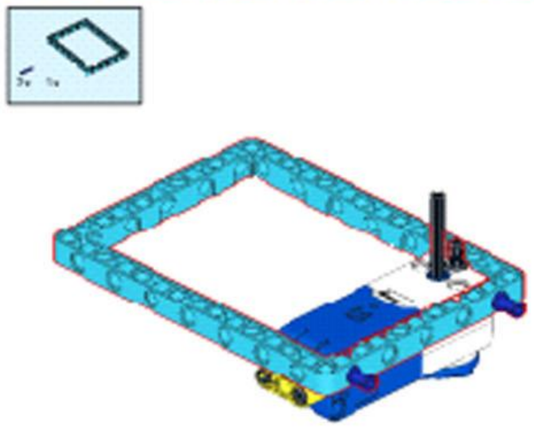
2.Building the Smart Fan

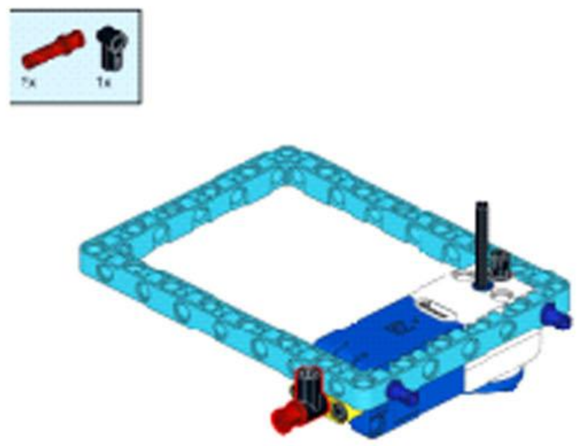


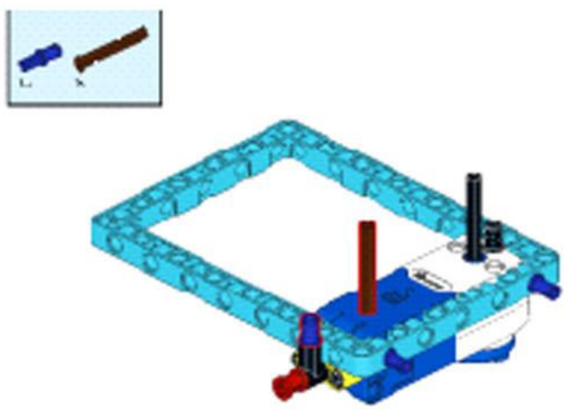


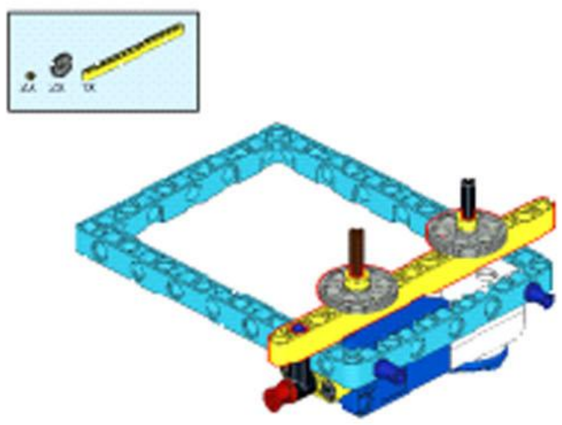


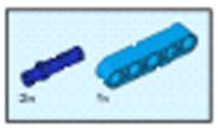


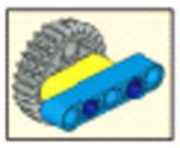






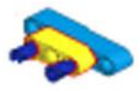




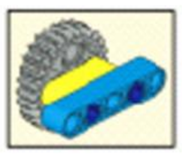


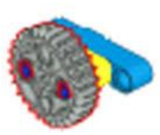


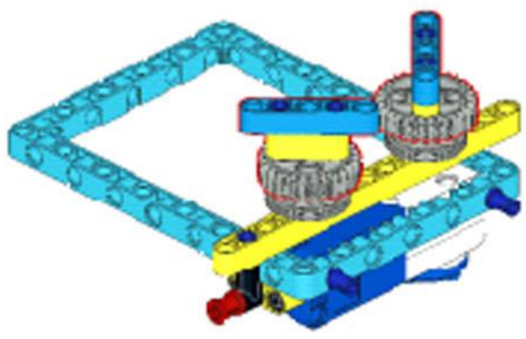


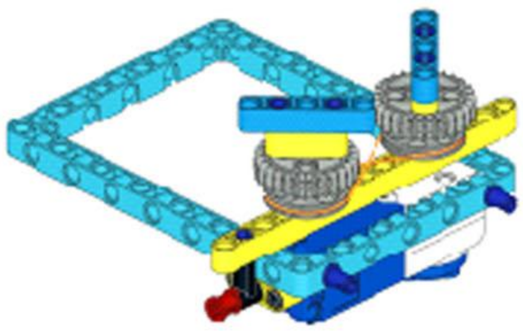


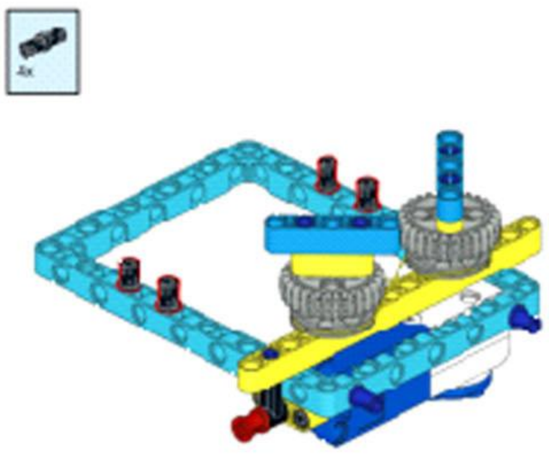


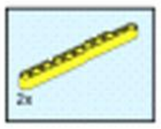


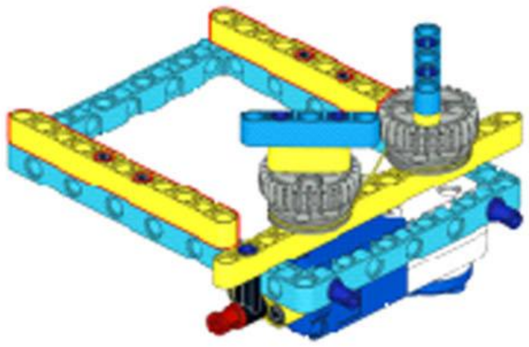


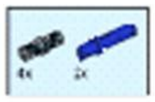


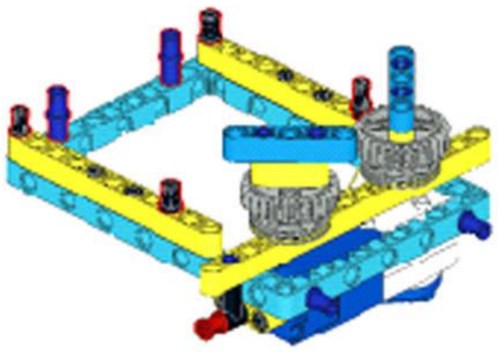




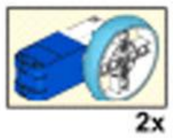








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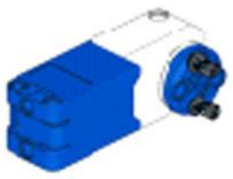
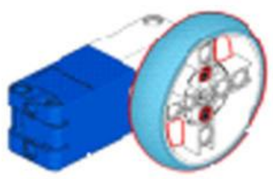
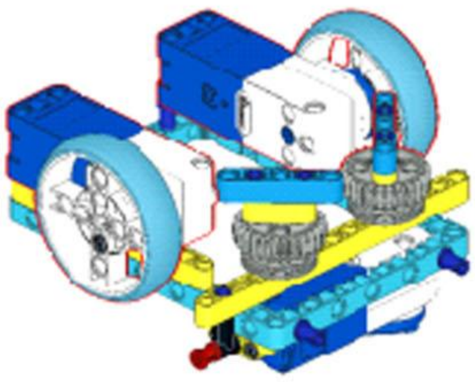
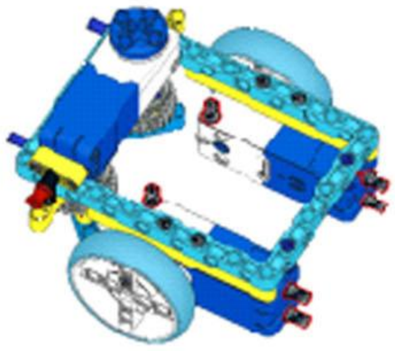


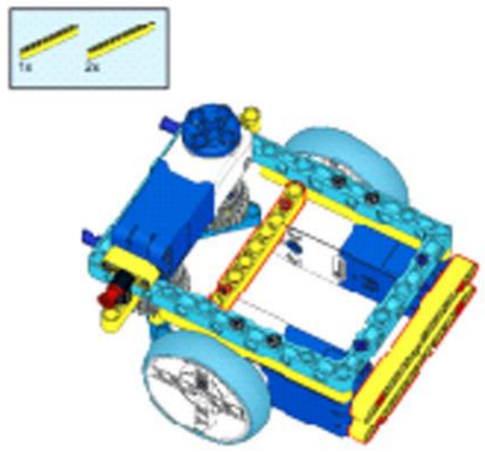


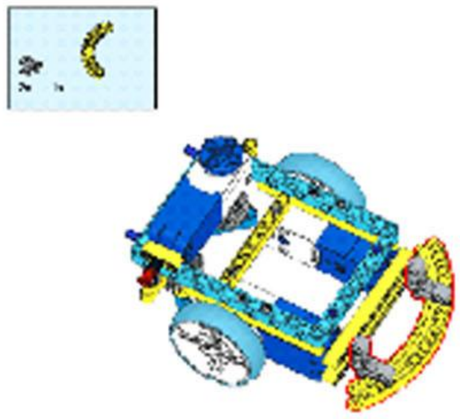




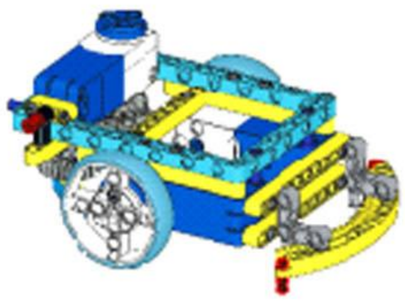


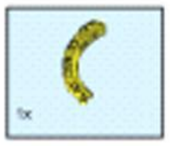


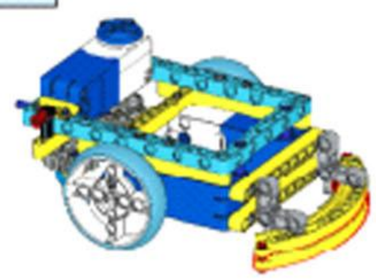


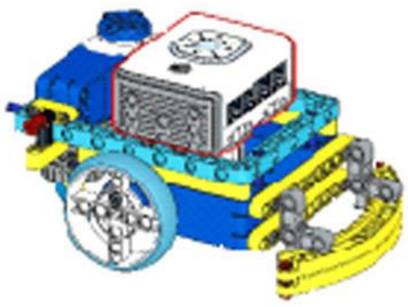


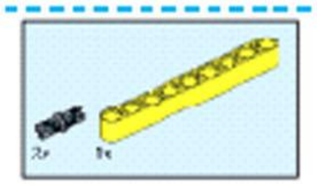


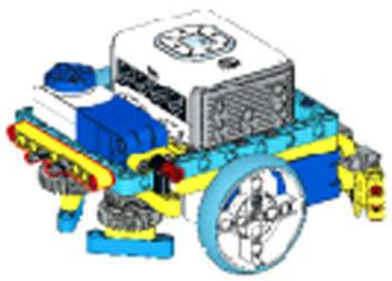






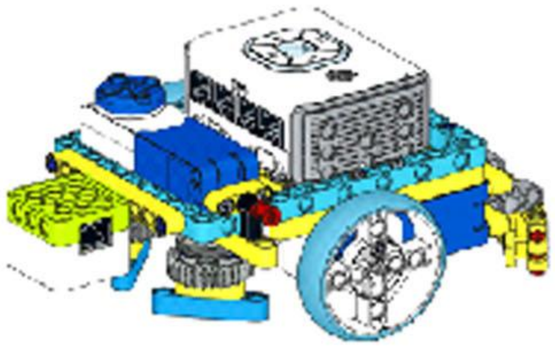










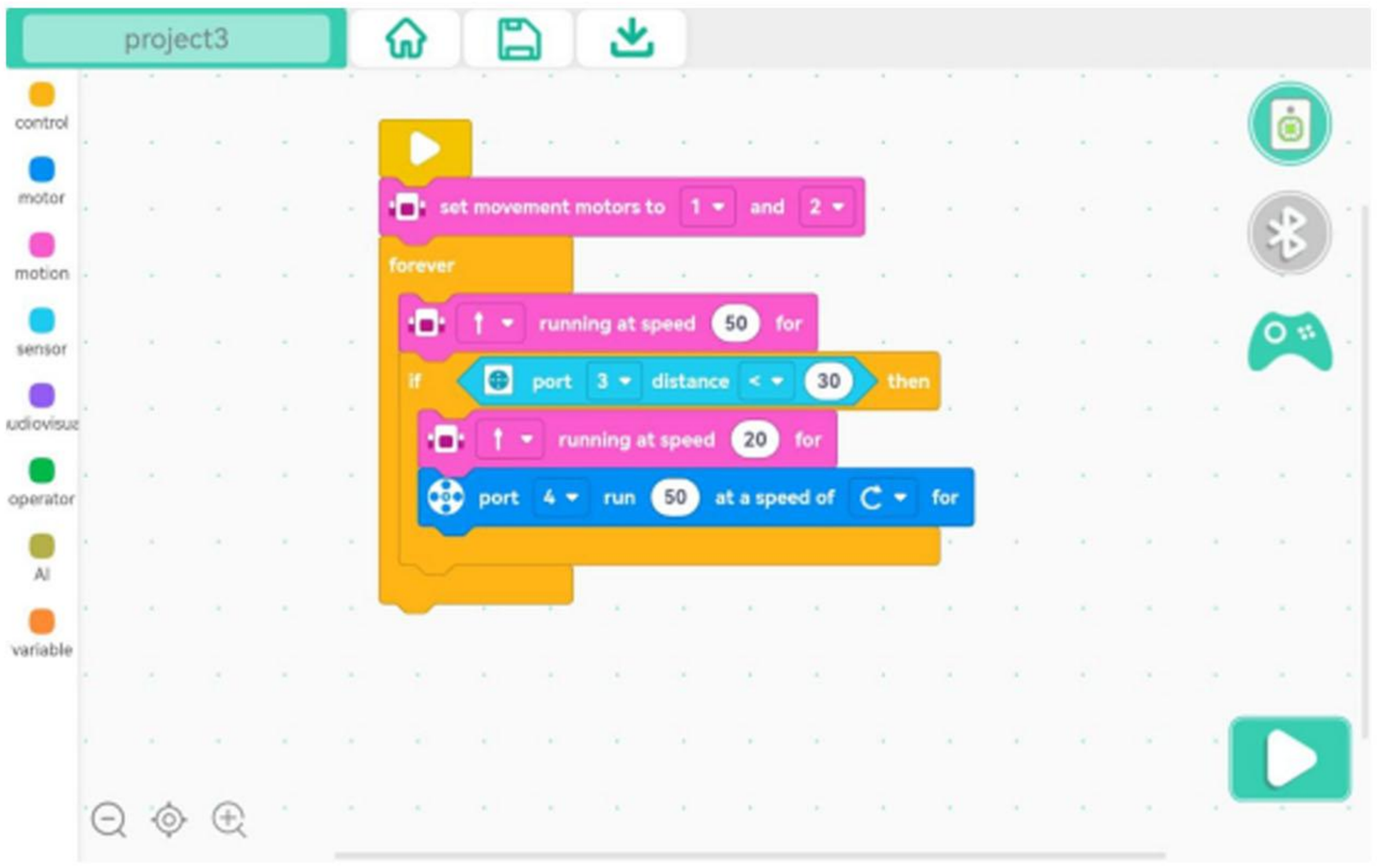


After completing the structure of the robotic vacuum cleaner, connect the wheel control servo motors to Ports 1 and 2, the brush control motor to Port 4, and the distance sensor to Port 3.

To make the vacuum cleaner perform its cleaning task, it needs to:

1. Move its wheels.
2. Detect nearby trash.
3. Move its brushes to complete the cleaning action.

Now, let's program these actions.



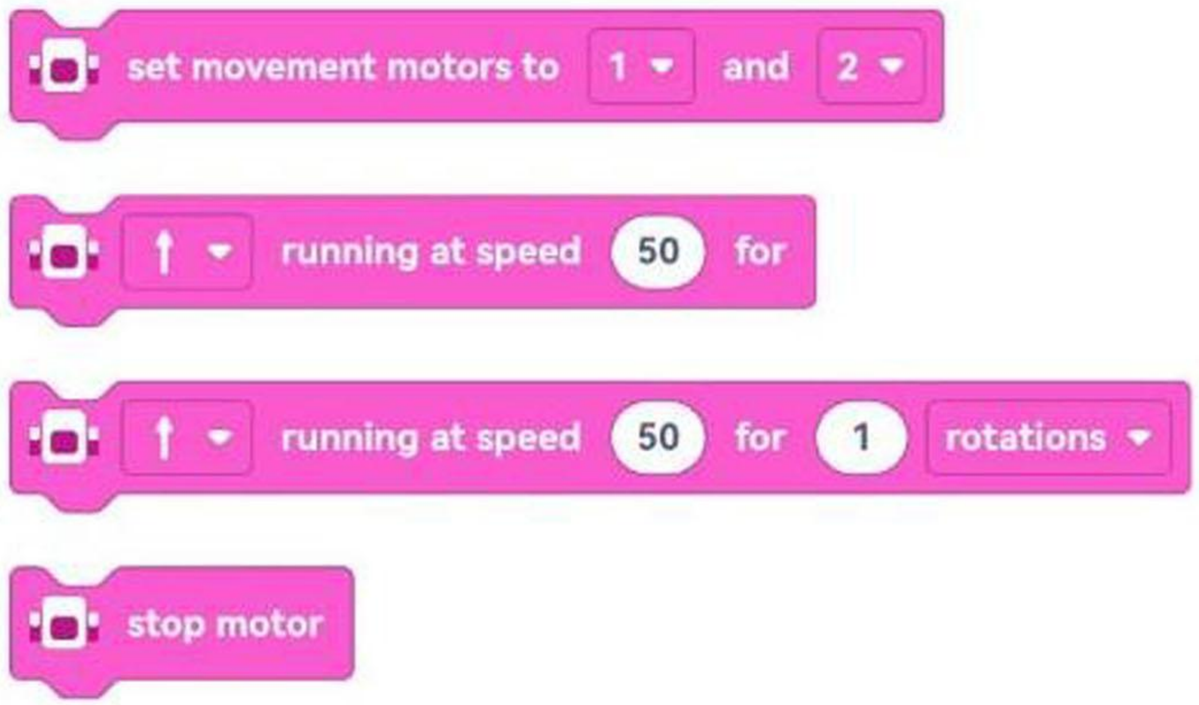
In this program, we use a new module—the Movement Module—to control two motors simultaneously. The movement module contains four functions:

1. Set motor operation.
2. Set the speed for dual motors to move forward/backward or turn

left/right.

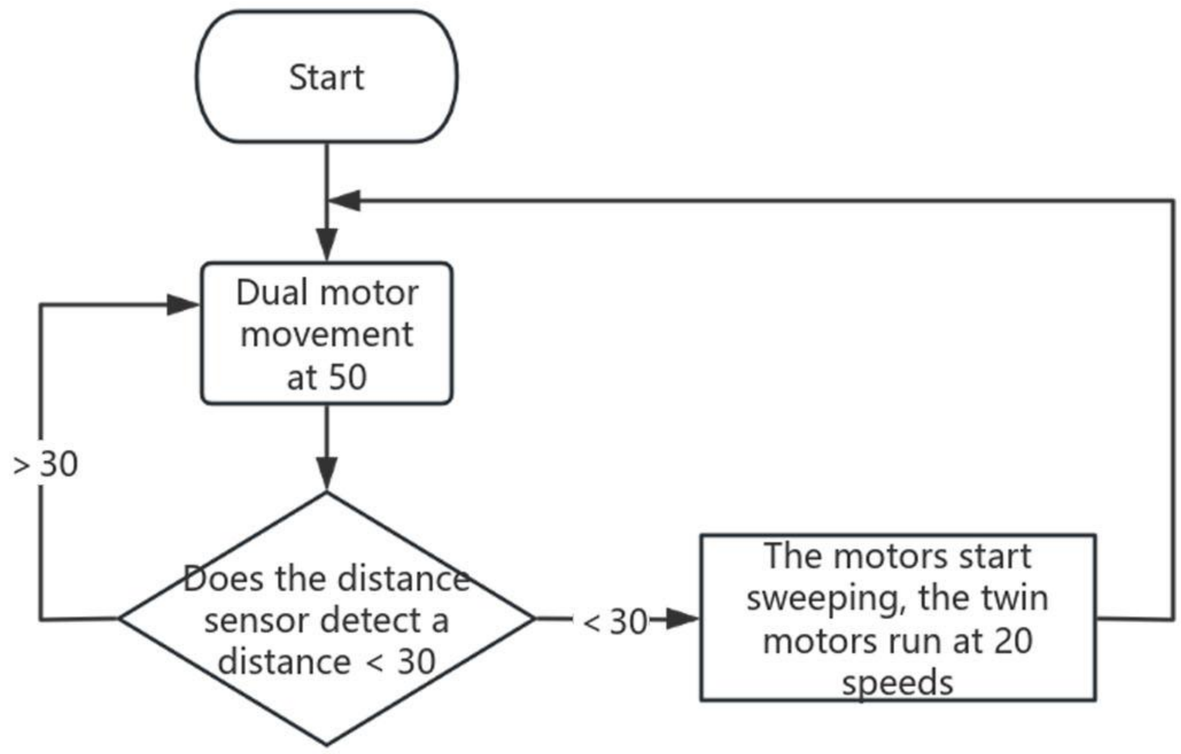
3. Set the number of rotations for dual motors when moving forwa-rd/backward or turning.

4. Stop the motor.



The robotic vacuum cleaner uses Movement Modules 1 and 2 to control the motors.

Programming Tips:



Sweeping Robot Programming Thinking Flowchart

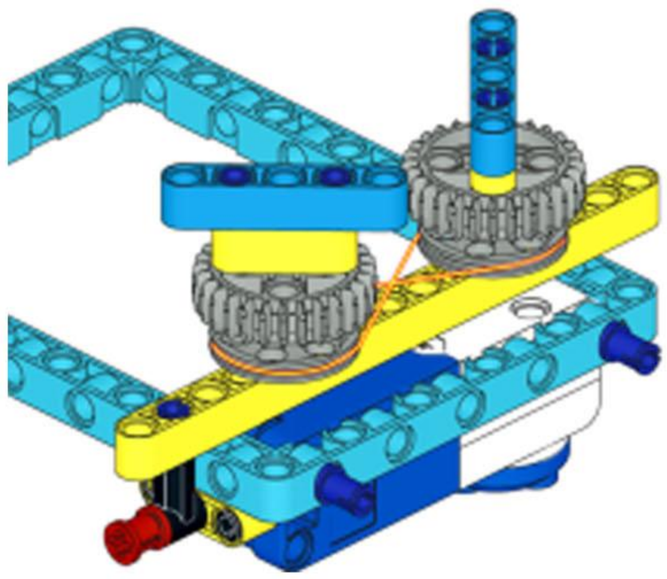
According to the flowchart of thinking and the pre-program, you can drag the needed blocks to the programming area and adjust the values you want to write the program for the robot to clean. You can adjust the values several times to experience the operation state of the robot under different values.

The sweeping robot is up and running successfully! A closer look at the sweeping structure of the sweeping robot will reveal that it uses only one servo motor, but both brush heads are able to run at the same time. Why is this? In fact, this is the use of the principle of belt drive.

A belt drive, also known as a belt transmission, is a common type of mechanical transmission. It consists mainly of one or more belts fastened to two wheels (i.e. "pulleys"). These two wheels are mounted on the main and driven shafts respectively. Through the friction between the belt and the wheels, the belt drive is able to transmit motion and power efficiently.

In the robotic vacuum's cleaning mechanism, belt drive allows a single motor to drive two brushes in sync. This design enhances efficiency, simplifies the structure, and reduces cost.

Diagram of Belt Drive in Robotic Vacuum Cleaner



Where else is belt drive used? In industrial production, it's commonly used to transmit power to conveyor belts, fans, pumps, and compressors. In transportation, belt drive is used in car engines and motorcycle drive systems. In agricultural machinery, it's applied to tractors, harvesters, and other farming equipment.

Through this observation, we hope you gain a better understanding of belt drive principles and its advantages in real-world applications. In future learning and practice, apply this knowledge to create more efficient and practical mechanical devices.

IV Summary

Review the content of this lesson and record your takeaways on a knowledge card.

V Further Exploration

With today's lesson, you now have a deeper understanding of robotic vacuum cleaners. As technology advances, these robots will continue to become more intelligent. Imagine what amazing features future robotic vacuums might have!

Perhaps they will have more precise navigation systems to handle complex environments or even more efficient cleaning technology for a spotless home. They may also incorporate user-friendly features like voice interaction or remote control, bringing more convenience to our lives.

Let's look forward to the future of robotic vacuum cleaners—there's no doubt they will bring us more surprises!

Smart Delivery

I Introduction

Courier trucks are an important means of transportation in our lives, and have undergone tremendous development from early horse-drawn carriages to modern automobiles. With the advancement of self-driving technology, intelligent courier trucks are able to avoid obstacles and deliver packages accurately, and even complete th-eir tasks in a driverless situation.

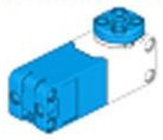
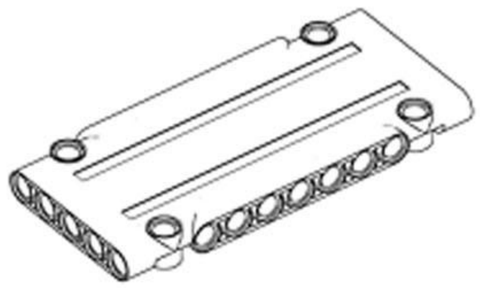
This class will use a robotics kit to build a courier truck robot to sim-ulate the process of transporting a package, experience robotics, and learn how courier trucks play an important role in everyday life.

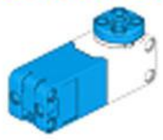
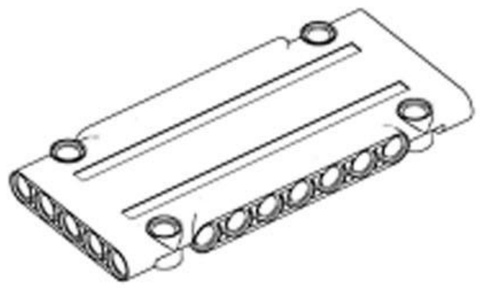
II Key Learning Points

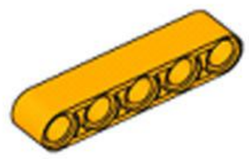
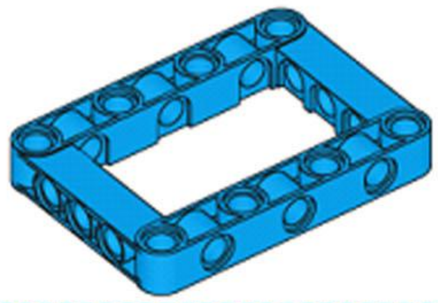
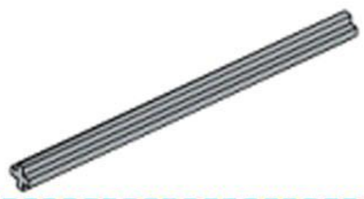
1. Build a smart delivery robot and learn to use the distance sensor.
2. Learn to use programming blocks ("if...then" conditions) and loops.
3. Understand the development trends in delivery vehicles.

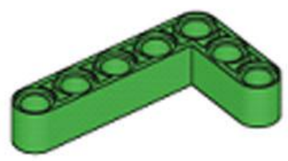
III Building the Project

1. Preparation

Item Name	Quantity	Part Image
Main Control Unit	1	
Distance Sensor	1	
Servo Motor	2	
2# Axle	2	
1x3 H-Pin	5	
5x11 Tech Panel	1	
12-Tooth Bevel Gear	2	
30x3 Tires	4	
1x3 Double Axle Pin	4	
28-Tooth Gear	1	

Item Name	Quantity	Part Image
Main Control Unit	1	
Distance Sensor	1	
Servo Motor	2	
2# Axle	2	
1x3 H-Pin	5	
5x11 Tech Panel	1	
12-Tooth Bevel Gear	2	
30x3 Tires	4	
1x3 Double Axle Pin	4	
28-Tooth Gear	1	

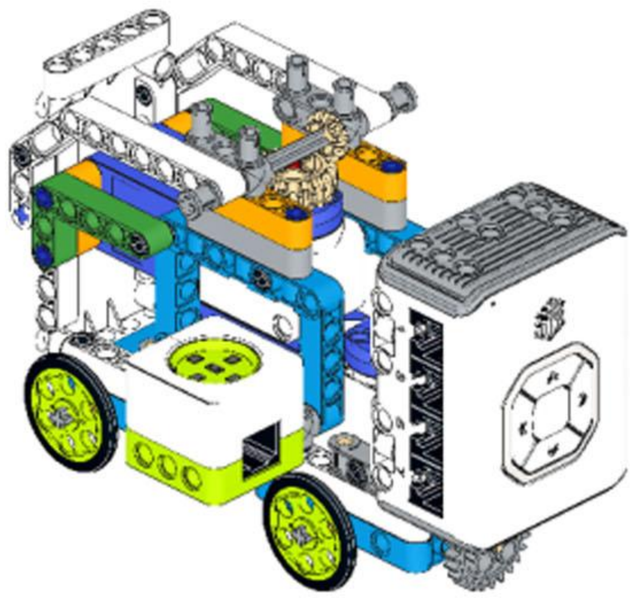
1x15 Hole Arm Beam	2	
Smooth Axle Pins	9	
1x5 Hole Arm Beam	2	
Blue Axle Pins	2	
24 Pulley	4	
Half Axle Bushings	4	
5x7 Hole Arm Frame	4	
1x9 Cross Axle	1	
Long Blue Pins	12	
1x8 Cross Axle	2	
20-Tooth Gear	2	

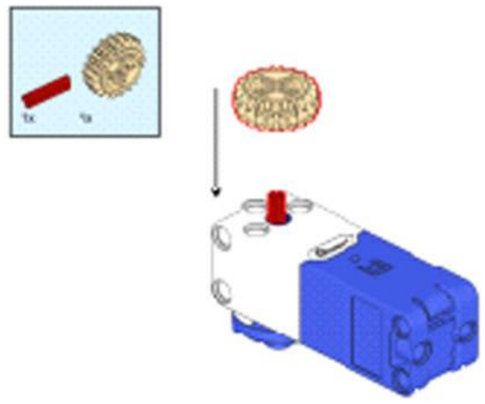
Friction Pins	20	
1x3 Hole Arm Beam	2	
3x5 L-Shaped Hole Arm Beam	2	
Full Axle Bushings	2	
11x5 Hole Bent Beam	2	

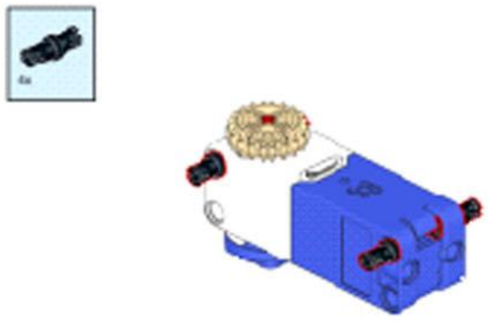
2. Assembly Analysis

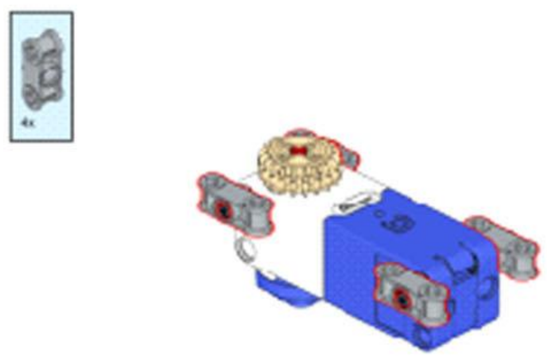
Consider the main structure of the smart delivery robot. It consists of three parts: a moving section, a cargo compartment, and a control system. Think about how its structure differs from traditional delivery vehicles, as it requires automatic door opening and closing after detecting objects.

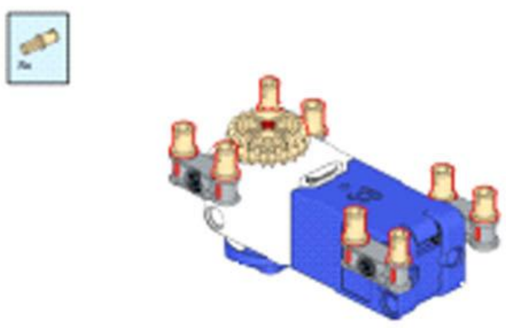
Figure 3. Smart Delivery Robot

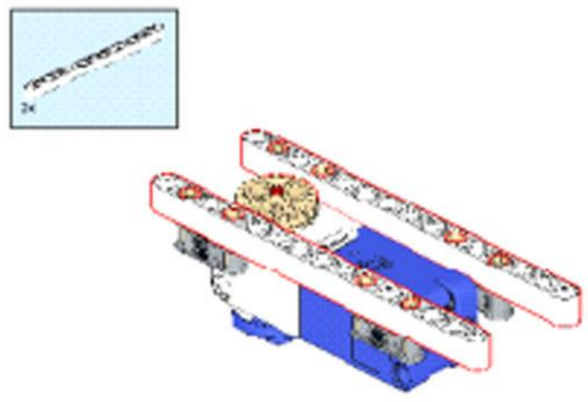


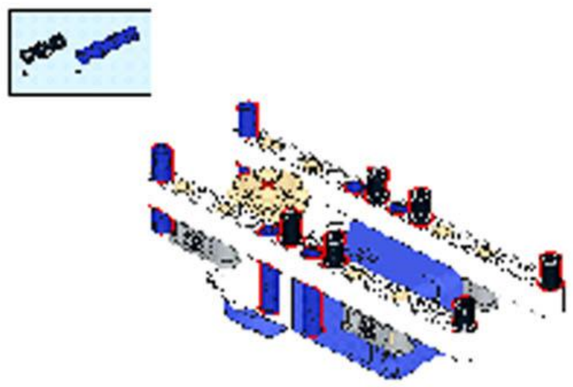


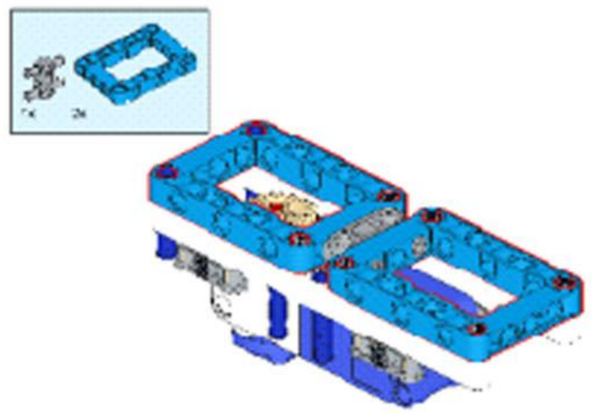


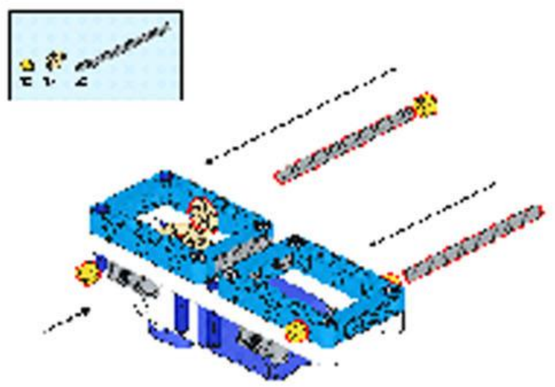


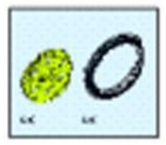


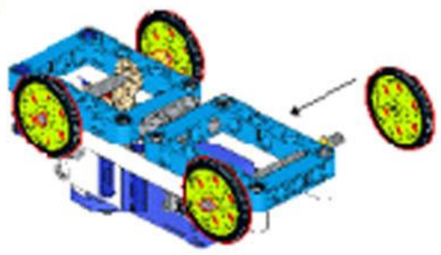


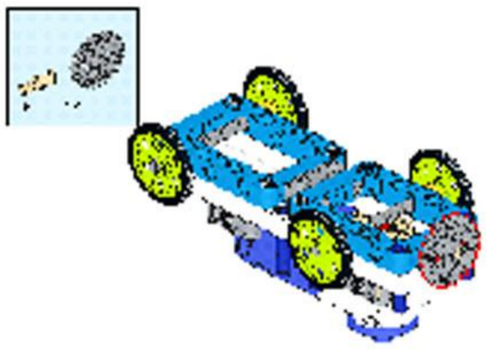


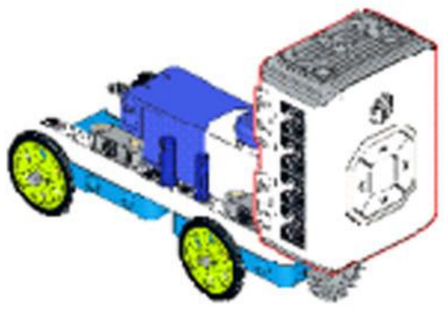


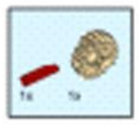


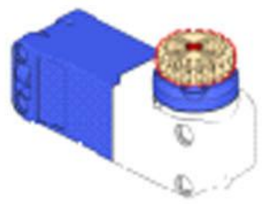


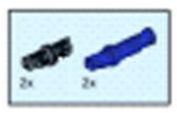


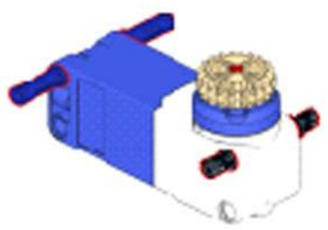




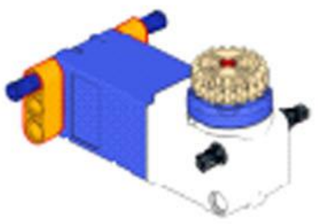


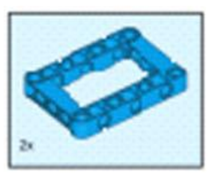


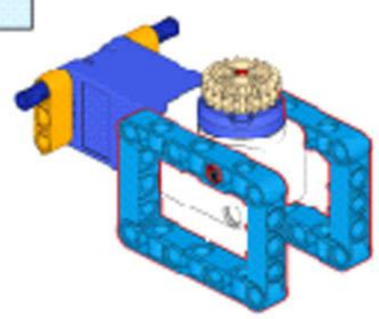


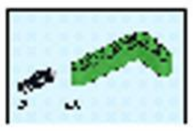


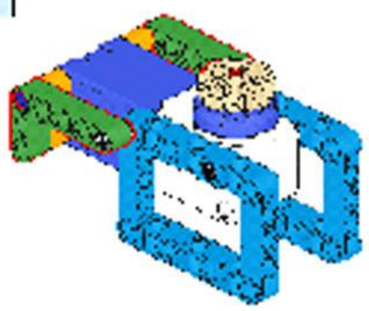


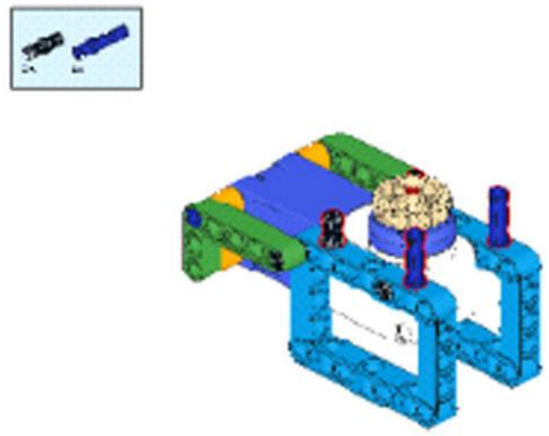


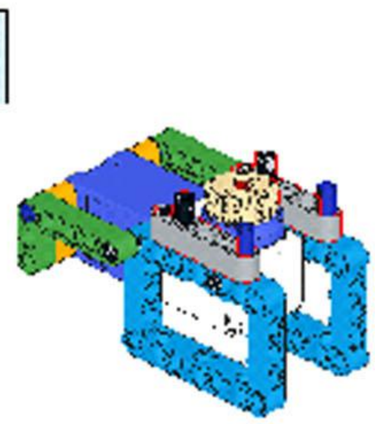




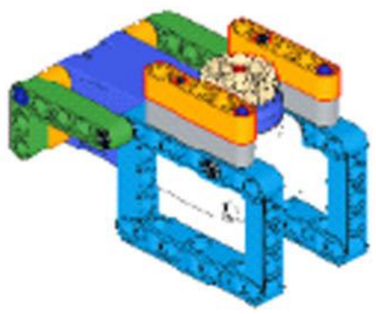


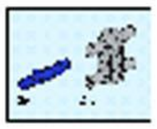




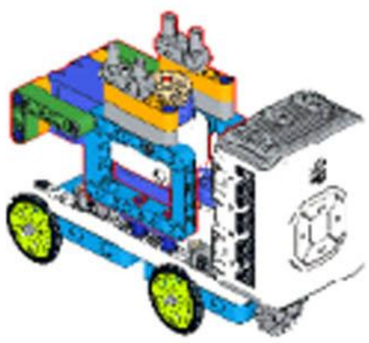










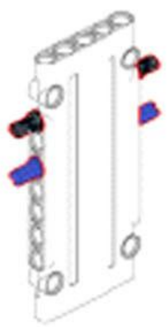


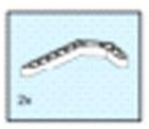


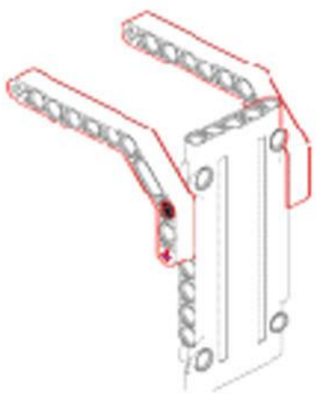


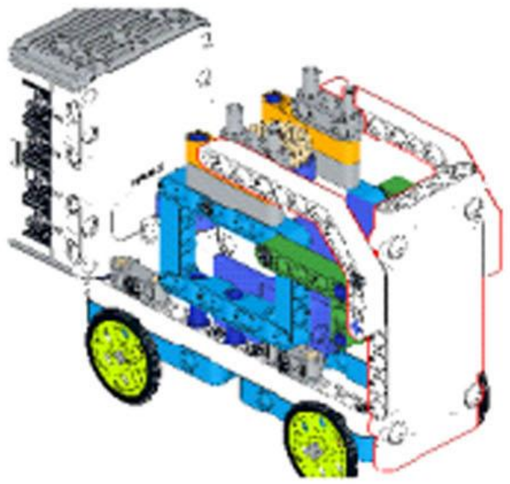


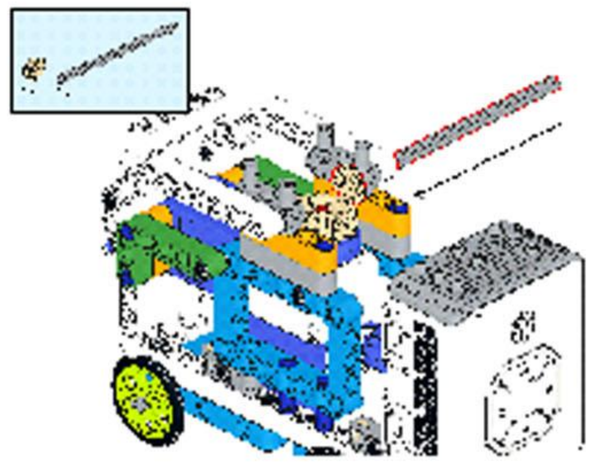


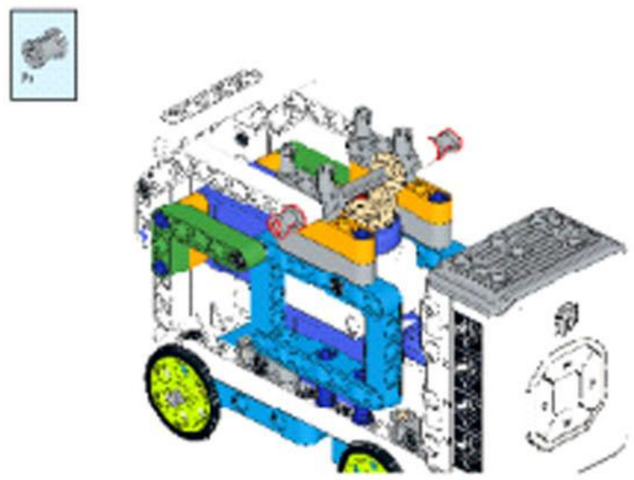


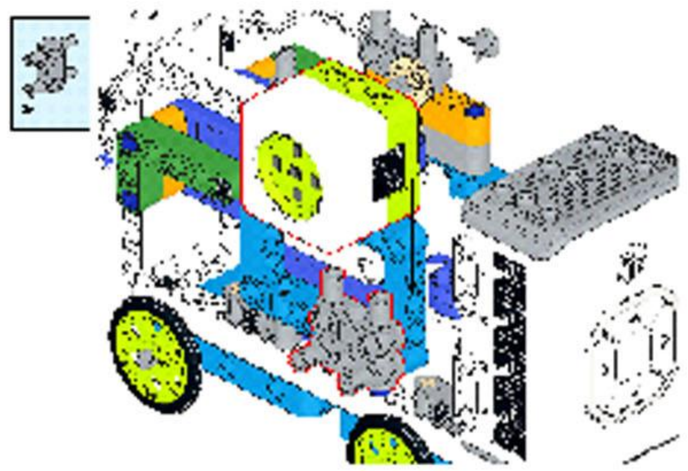














Once the smart delivery robot is assembled, connect the distance sensor to Port 1, the wheel control motor to Port 2, and the door control motor to Port 4. Next, we'll move on to programming.

4. Knowledge Explanation

The smart delivery robot is designed to autonomously deliver packages. What actions does it need to perform?

1. The wheels must start moving.
2. When detecting a nearby object, the robot must stop.
3. It must open the storage compartment door and close it afterward.

Based on the analysis of the robot's movements, let’s look at the program necessary for the smart delivery robot to perform these tasks.

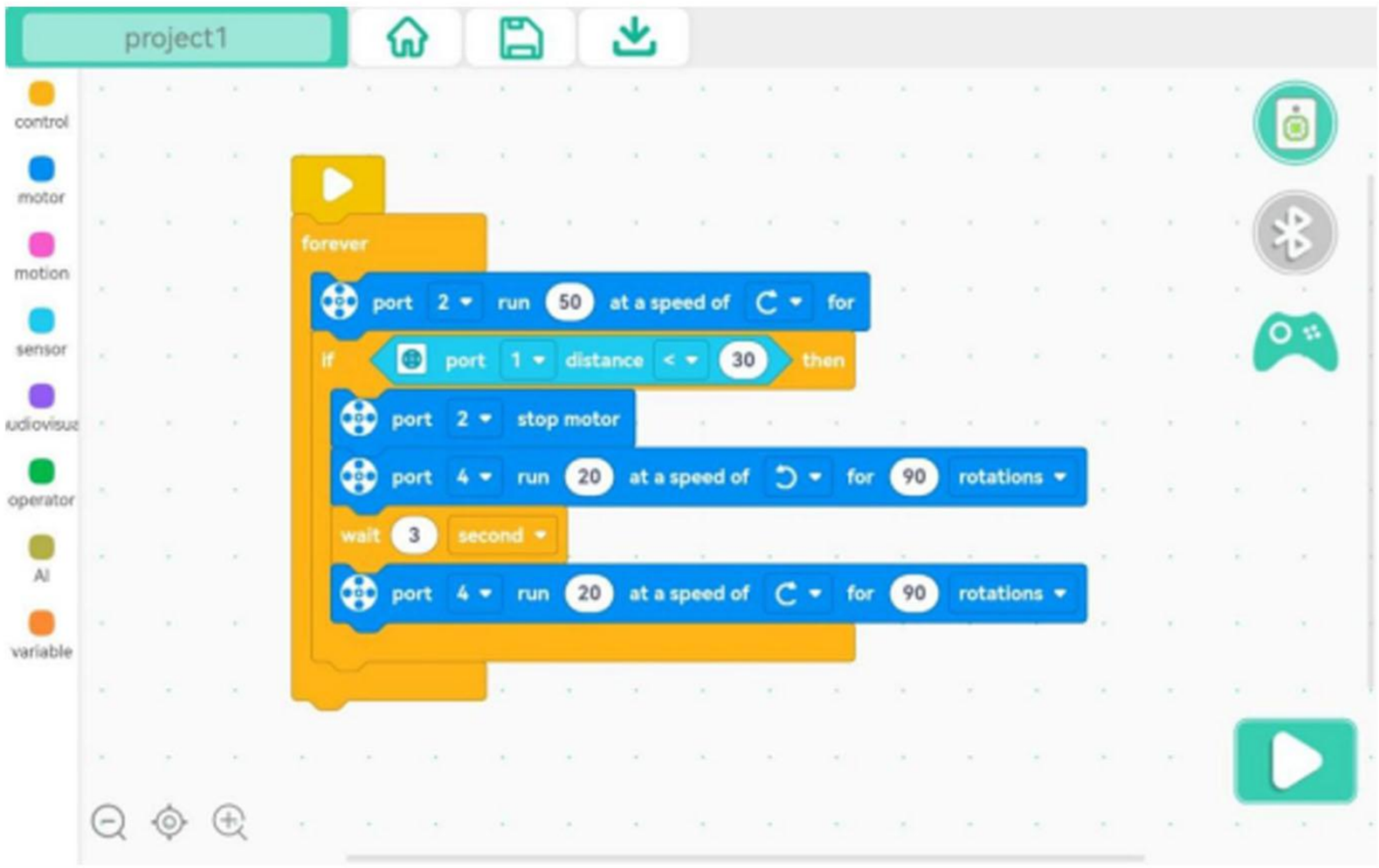
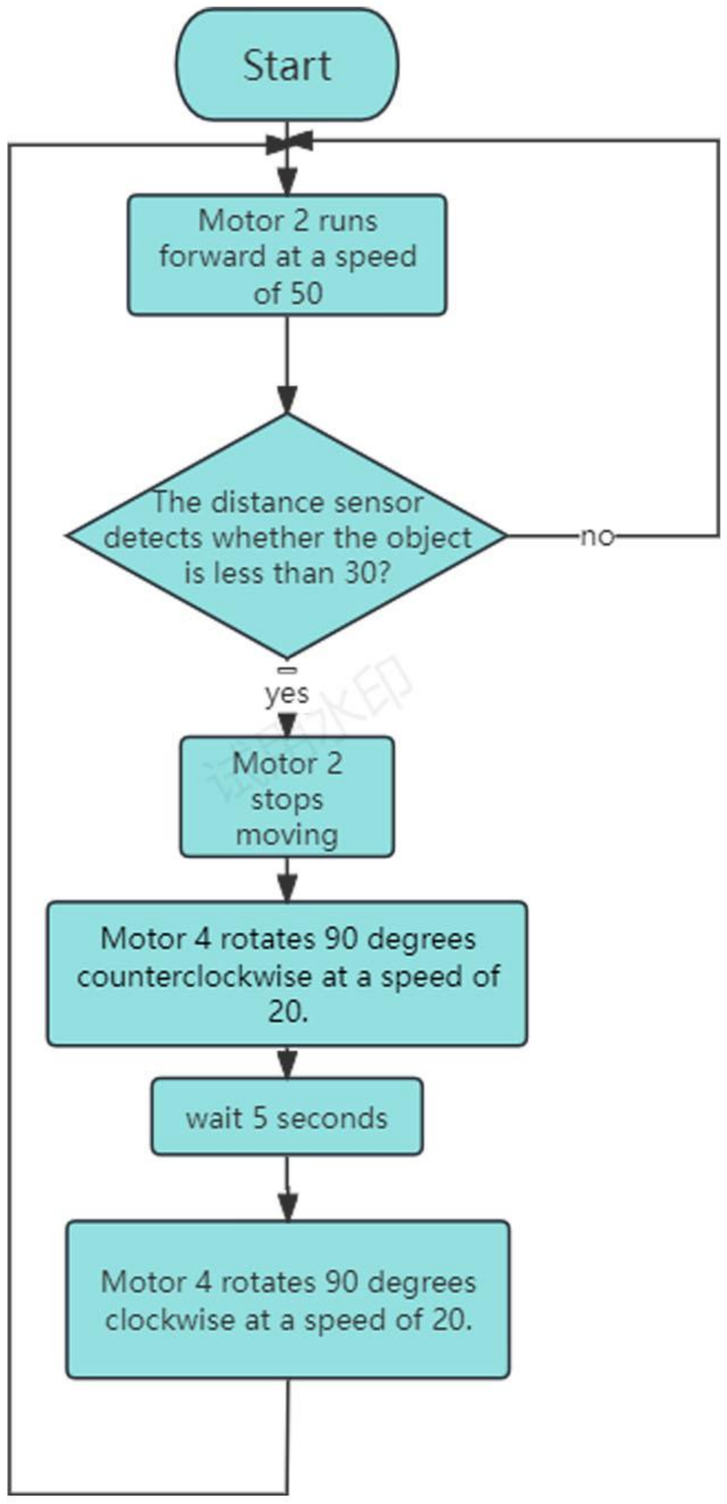


Figure 4. Smart Delivery Robot Program

Before we create the new program, let’s learn about a few new blocks:

Block Name	blocks Icon	Function
Wait Block		Set the waiting time
Motor Block		Select motor port, speed, and rotation angle
		Select motor port and stop the motor
		Select motor port, set speed for forward or reverse rotation
Distance Block		Select distance sensor port, set conditions (greater than, less than, or equal to)

Programming Tips



Using these programming ideas, you can complete your program, allowing your smart delivery robot to operate. Work with a partner to simulate a delivery competition with your smart delivery robots.

IV. Summary

In this lesson, we built a smart delivery robot and learned new programming blocks. List the programming blocks you've learned and write down what you gained from this lesson.

Programming Blocks	Name

Learning Gains:

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