



1

Robot Prototyping

Look at the layout of the mat and where the models are. What type of robot would be useful? How wide can the robot be? Are there lines to follow or align on? What sensors would help with navigation (e.g. color/gyro)? Where should the sensors go on the robot? What type of wheels should you use?

Use the pre-season to build different robots and test them. It is okay to start with a basic design that you modify to suit your goals. Document your tests and results. FLLutorials Robot Design Worksheets has examples of how to document these tests.

Robot Testing	Name:		
Instructions: 1. If you design more than one robot, use this chart to compare them. At the top of each column, describe your robot. 2. Come up with some basic tests to compare the robot designs. Can this robot move straight accurately? Can it turn consistently? Can it follow a line? Can it detect a line? Did the robot move as intended? 3. Discuss which robot performed the best to help you pick the best design for your team.			
Robot 1:	Robot 2:	Robot 3:	
Wheels:	Wheels:	Wheels:	
Size:	Size:	Size:	
Sensors:	Sensors:	Sensors:	
Motors:	Motors:	Motors:	
Move Straight 50cm			
Overall: Speed Balance			

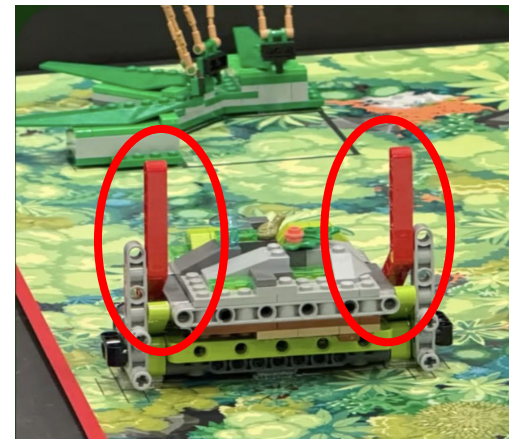
- [EV3 Base Robot Designs](#)
- [Spike Prime Base Robot Designs](#)
- [Additional Robot Designs](#)
- [Lessons about Wheels/Sensor Placement](#)

2

Mechanism Prototyping

Generally, *FIRST LEGO* League missions require similar actions – e.g., pull, push, lift, turn, or drop off. Take a close look at the BIOGLOW [teaser video](#) and watch for how the models are activated. The teaser actually reveals many of the actions that will be needed. Also look at images released. For example, what do you think the red liftarms/connectors on the different mission models are for?

Learning to build simple mechanisms that might achieve similar tasks can help you prepare for any season.



How do these and other models move in the [teaser video](#)? What gets released or open? What objects might you have to move? Are there objects with loops?



- [Books by Yoshihito Isogawa](#)
- [Technic Builder's Guide](#)

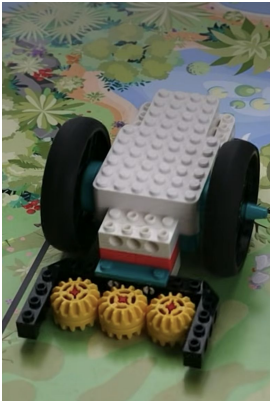
Robot and Mechanism Prototyping

1

Look carefully at the [Future Edition Showcase](#) video. What types of robots/mechanisms are needed for each role and how can you prepare? Although the actual rules are not released yet, the video reveals some of the actions that may be needed and the size of the objects that will need to be moved or delivered. Use this information to practice building skills.

Note: The suggestions below are not based on the official game rules. The words and descriptions below are directly from the Showcase video linked above and are being used to help identify some skills to learn in the off-season.

2



Driver: Uses the robot and controller to navigate the field. Robot and attachments deliver resources and keystone species to the rest of the gamefield

→ Practice designing different drive bases with your CS&AI set and programming the controller. Build some attachments to collect, move, and deliver small objects.



Operator: Uses a mechanical tool to supply resources to the rest of the game field

→ Practice building manually-operated tools that launch small objects.



Technician: Uses a robotic tool to transport keystone species and trigger actions

→ Practice building a mechanism that can launch small objects.



Resources and Keystone Species in the Showcase video

Try building some of these mechanisms. You will have to adapt the designs to use LEGO parts you have or modify them to fit the size/shape of what you want to launch/move. Think about how you could add motors or sensors from the CS&AI kit to create a robotics tool.

- LEGO Catapult: [Frugal Fun](#), [Knorr LEGO](#), [LEGO Edu Simple Machines](#), [Technic Catapult](#)
- LEGO Trebuchet: [Brick Science](#),
- LEGO Kickers: [BricQ Motion Free Kick](#)
- LEGO GBC: [NXT](#), [Akiyuki](#), [LEGO GBC](#), [Dual Liftarm GBC](#), [Catapult GBC](#), [Catapult by Dunes](#),
- Other Launchers - [JKBrickworks](#)

Other things to practice: Learn how to convert from LEGO System bricks to Technic bricks.

3

Programming Skills

Look at the Future Edition set and Showcase Video. What skills might be worth learning?

You can see the color sensor being used to activate a robotic tool that launches keystone species, and you can see the controller being used to move a robot. You also see the Grand Tree turning. Without any additional details, the following skills can be useful:

- Programming the controller
- Using a color sensor to activate a motor/launcher
- Controlling separate actions with each motor on the double motor
- Programming preset movement patterns to minimize fully manual control

Programming Skills

Look at the Founders Edition set. What skills might be worth learning? Discuss how some of these techniques can help you navigate the mat reliably. Some techniques may be more useful than others.

- Moving Straight and Turning - basic movements needed for any navigation
- Moving Until a Line - allows the robot to know where it is on a mat
- Squaring on a Line - allows the robot to straighten out to a perpendicular line
- Wall Following - allows the robot to be straight along a wall
- Backing into a Wall - allows the robot to straighten out if it is crooked

