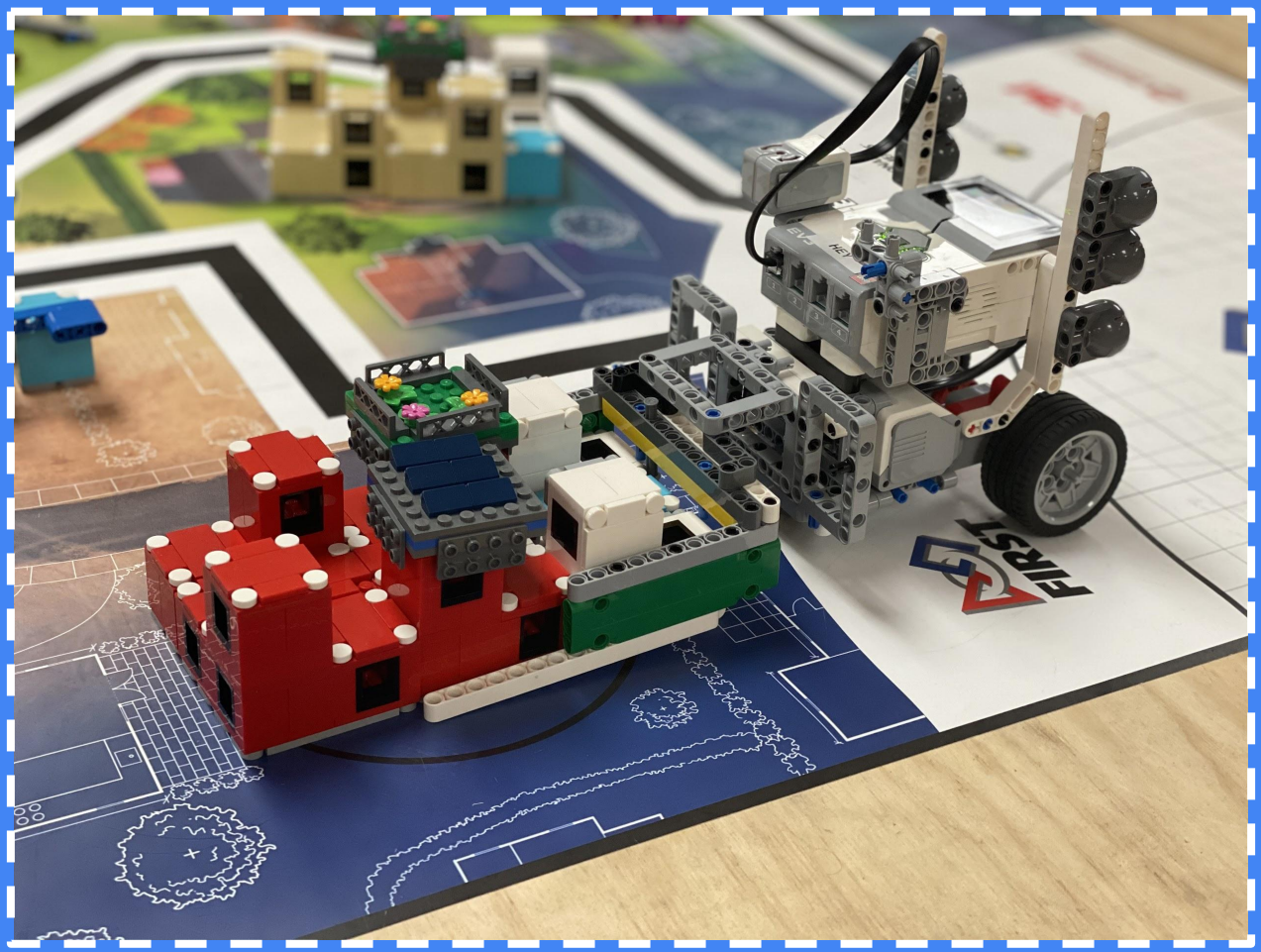
Littleton FIRST Lego League

Summer 2020 Virtual Training Program

Presented by FRC Team 6328 - Mechanical Advantage



Program Overview

In lieu of an in-person summer training program for our FLL teams, we will be running a virtual training program to prepare our students for 2020 FLL and beyond. Here is a breakdown of how the virtual program will work:

- ★ Every Thursday, a new challenge video will be released to team members and their parents via Slack.

- ★ The challenge each week will include 4 parts:
  - Robot building (either with a kit or in VRT)
  - Robot programming (either with a kit or in VRT)
  - Core values worksheet & challenge
  - Project component

- ★ The students will have until the following Wednesday evening each week to complete all 4 parts of the challenge.

- ★ Each weekly challenge will have an accompanying worksheet to go along with it. The worksheets will guide the students through the challenges and provide helpful hints and technical knowledge along the way.

Program Overview

- ★ Each student will have an assigned FRC 6328 Student Coach to go to for help throughout the week. Each Student Coach will host virtual office hours 1-2 times a week to meet with their students and help them as needed.

- ★ All of the robot challenges as well as some of the core values & project challenges will require the students to take video and post it to the team Slack channel. Students can post their videos at any time, but the due date for challenges each week will be Wednesday's 5:30PM. Students are also encouraged to use Slack to collaborate with other team members.

- ★ On Wednesday evenings from 6:30-7:30PM, we will have a virtual full team meeting where students can showcase their work as well as catch up with other team members. The Monday meetings will be very casual and aimed at allowing the students to socialize with one another, as it has been a while since they've seen each other in person.

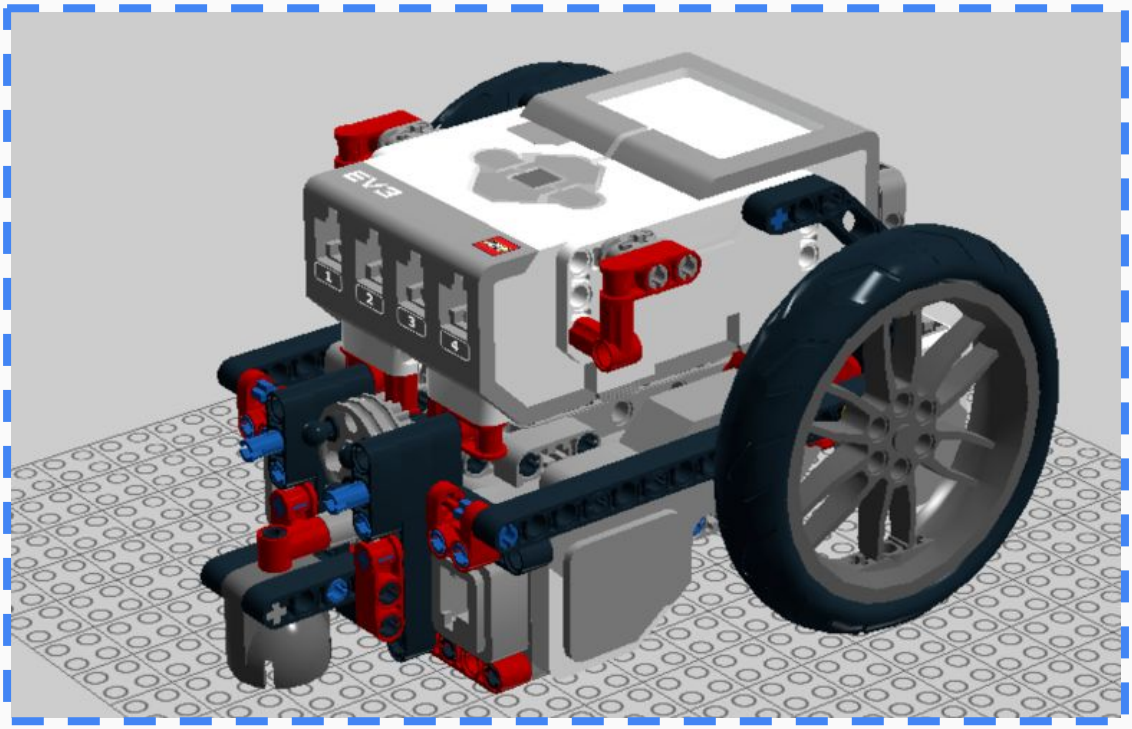
Let's dive into some challenges now!

Program Overview

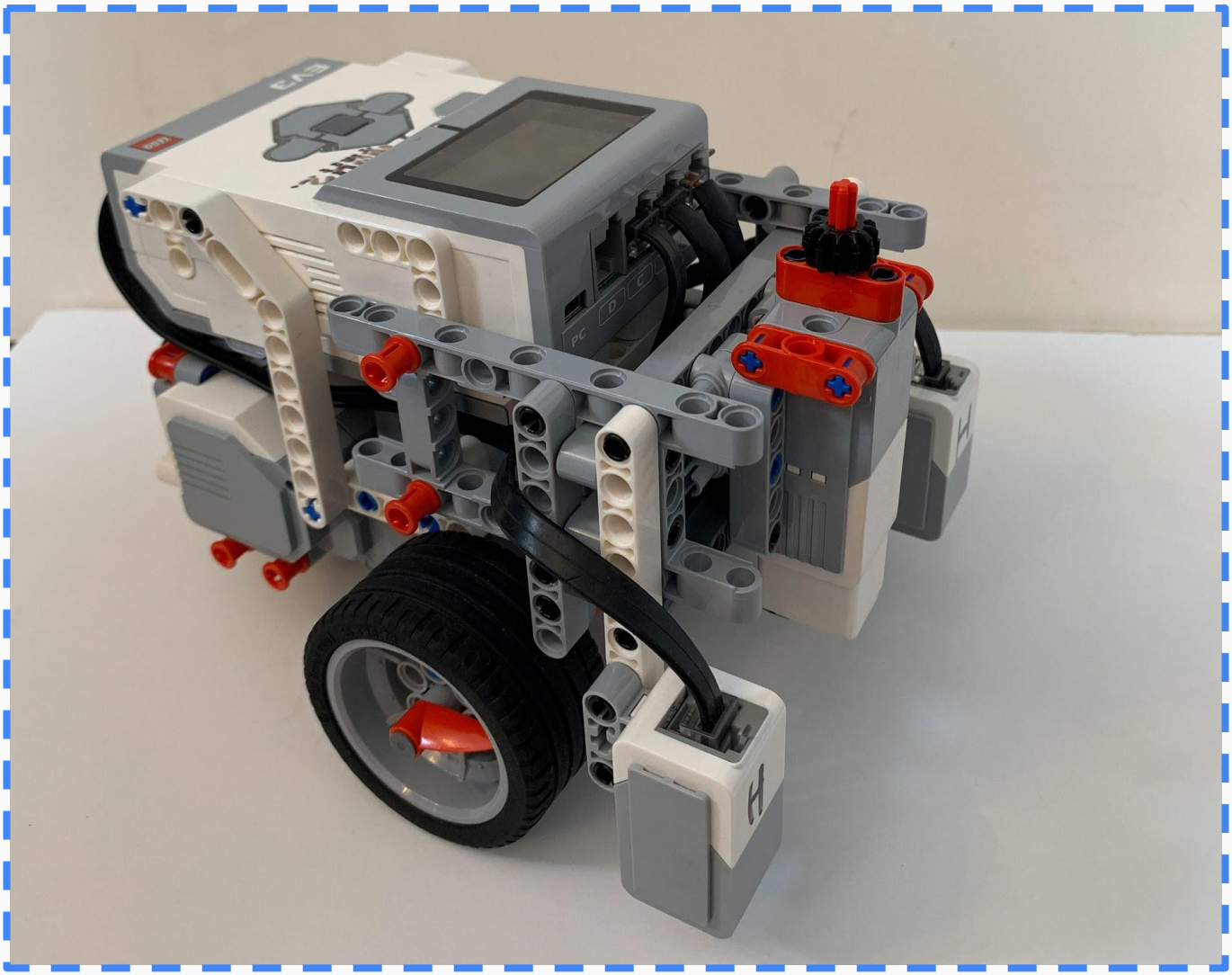
Alternative Virtual Robot Challenge

Don't have an EV3 kit at home? Looking for a less expensive option? No problem! Sign up for the virtual robotics toolkit (VRT)! The software is $65 to use and allows your child to build and program FLL robots virtually. It also gives them access to the 2015 FLL competition game - Trash Trek. In lieu of the normal robot challenges, students can complete the challenges on the VRT or they can try and tackle a Trash Trek mission each week on the VRT - the choice is theirs and the robot worksheet will still apply!

[Virtual Robotics Toolkit Website]



Challenge #1 - Back to BASE-ics

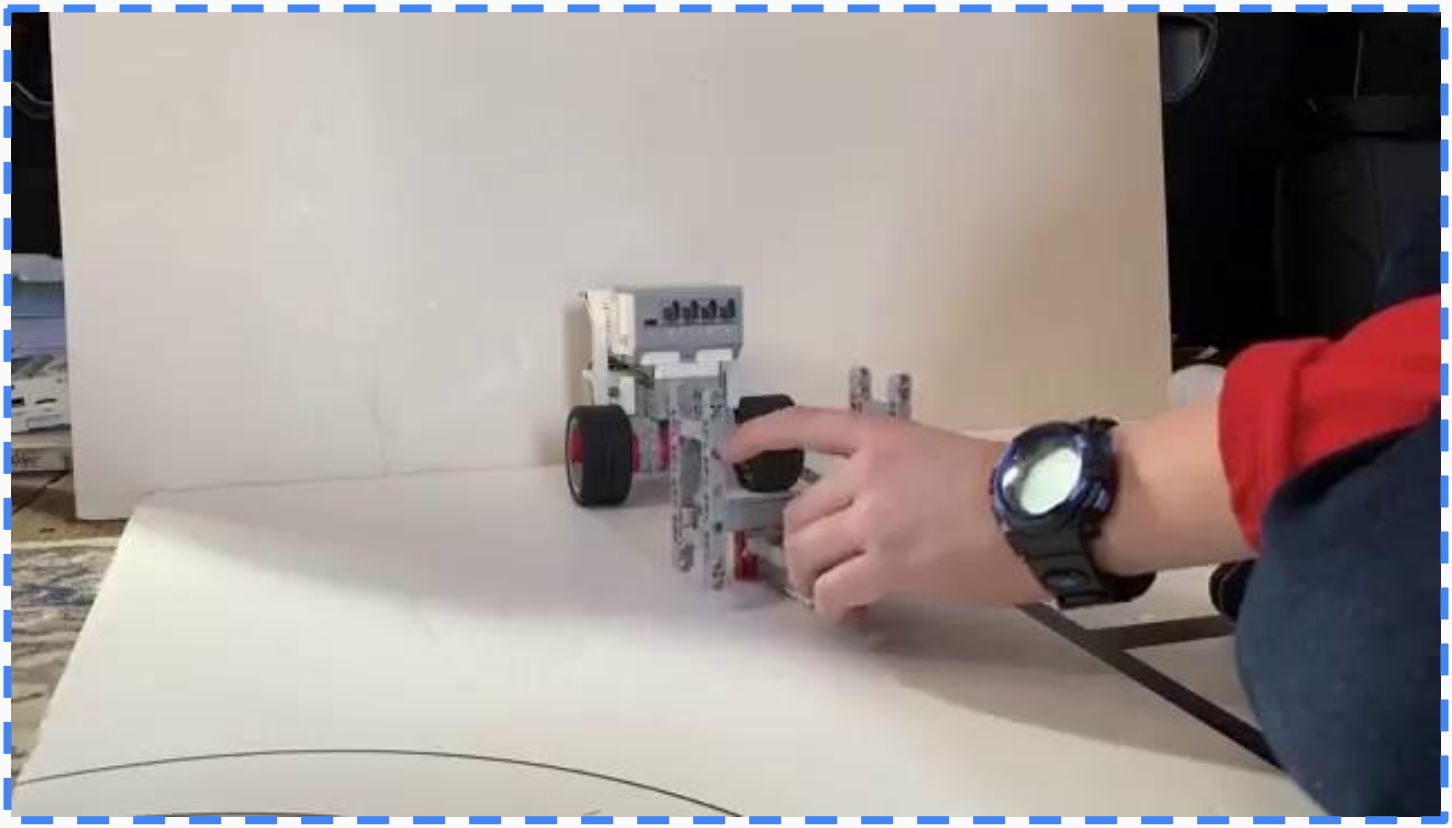


In this challenge, we will be building the robot shown above and programming it to collect an object and bring it back to "base." On the next slide you will find a link to step-by-step images that show you how to assemble your bot!

Challenge #1 - Back to BASE-ics

Click Here for Base-Bot Assembly Photos

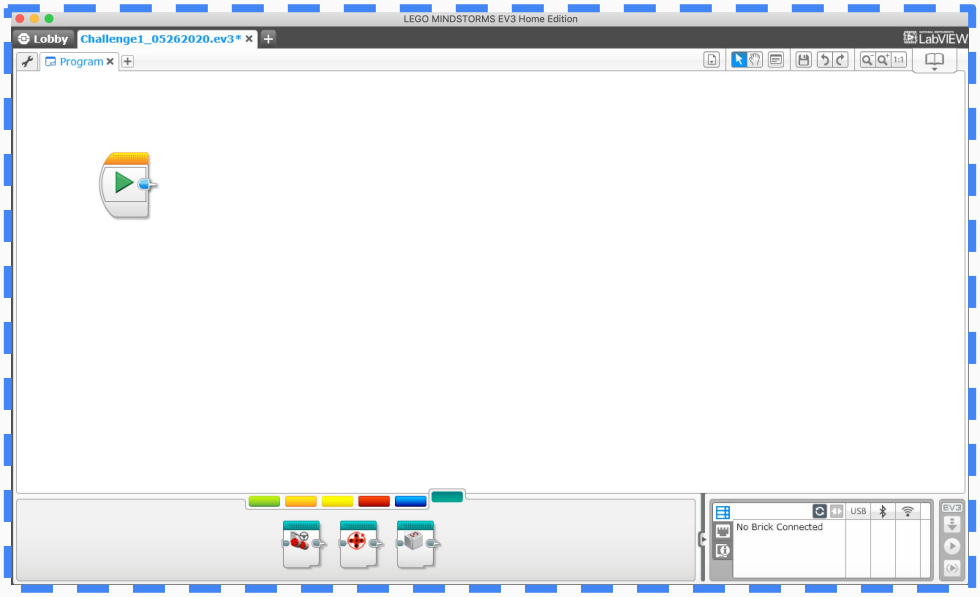
Thank you to Bolton FLL for providing this awesome Base-Bot design and photo instructions!

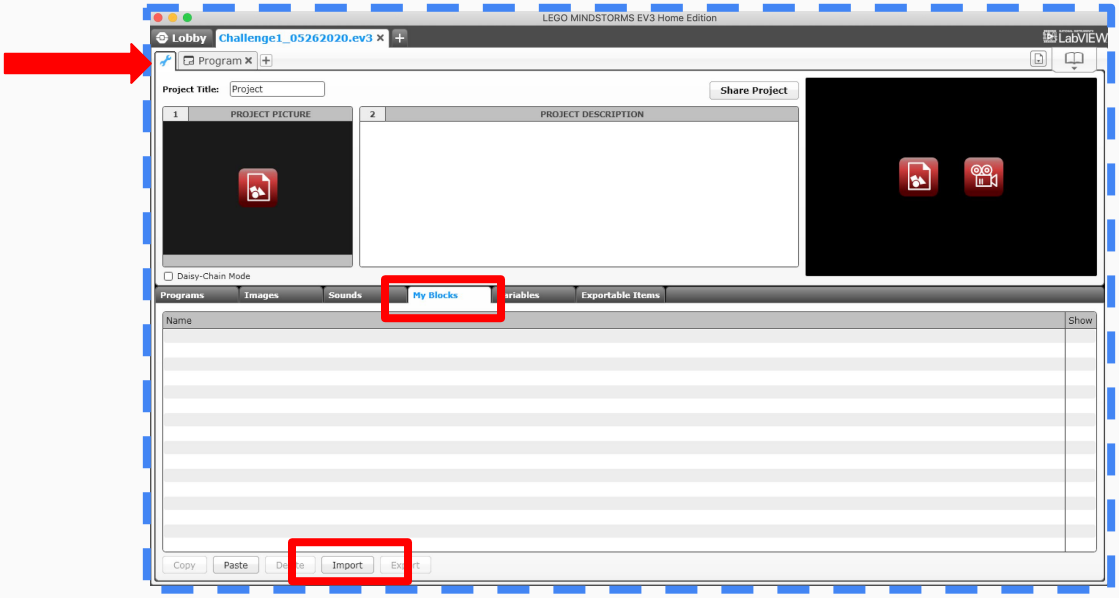


Base-Bot Assembly Timelapse

Challenge #1 - Back to BASE-ics

- ★ We will be using the gyro sensor to make our robots drive more accurately. The gyro sensor tells the robot to drive at a certain angle relative to a 0-degree set-point. We will learn more about the gyro coding blocks later on.
- ★ Download the Gyro Driver 6 (GD6) MyBlocks here:
  - ○ https://drive.google.com/drive/folders/1v45ODrL_2eYIfeYEFxWDO6ANkCzuhSip?usp=sharing
- ★ To start, we need to import the GD6, GS6 and GyroInit MyBlocks to our project. Click the wrench icon in the top left corner, then navigate to "MyBlocks," and select "Import."





Challenge #1 - Back to BASE-ics

Now that you have your Base-Bot built, let's get to programming!

1. Download the EV3 software onto a computer (Windows or Mac) at the following URL:
   a. https://education.lego.com/en-us/downloads/mindstorms-ev3/software
2. Follow the installation instructions to download the software onto your computer.
3. Once the software is installed, open the program and create a new project. Make sure to name your project and save it in a place on your computer so you can easily find it again. Here is my recommended file structure:
   a. Create a new folder in your documents called "Summer Virtual FLL 2020"
   b. Save your project with the following template:
      i. "Challenge#_Current Date
         1. Example: "Challenge1_06252020"
   c. Everyday you work on your code select "File → Save As → Rename with current date"
      i. This way you have many backup copies of your code if you need to access them later.

Challenge #1 - Back to BASE-ics

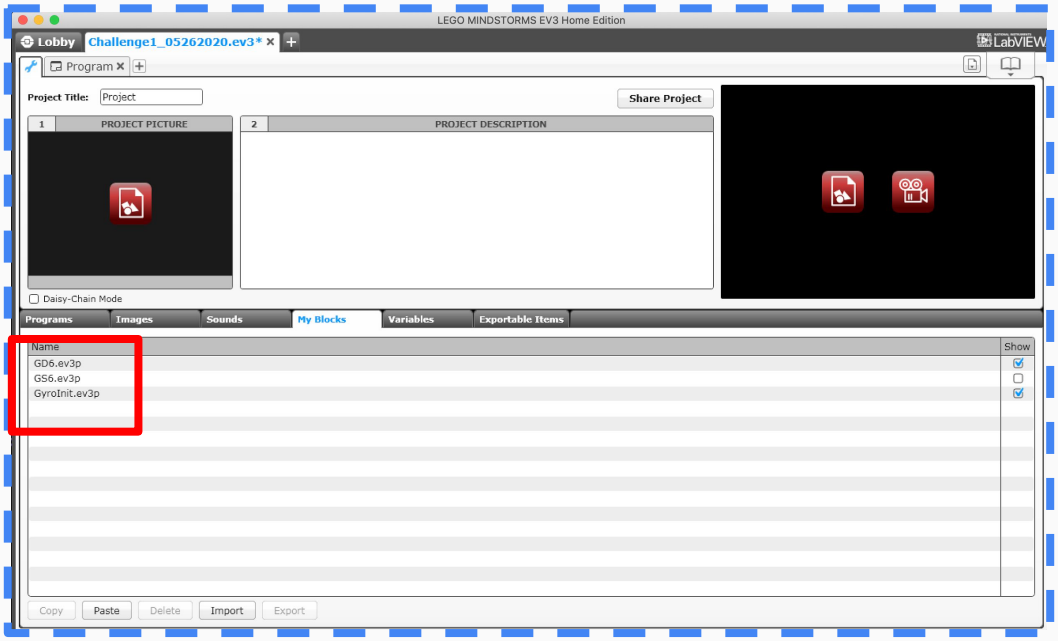
1. Now that you have your first project file ready, we need to learn about the EV3 motors and sensors. Please open the document linked below to read about the motors and sensors we will be working with.

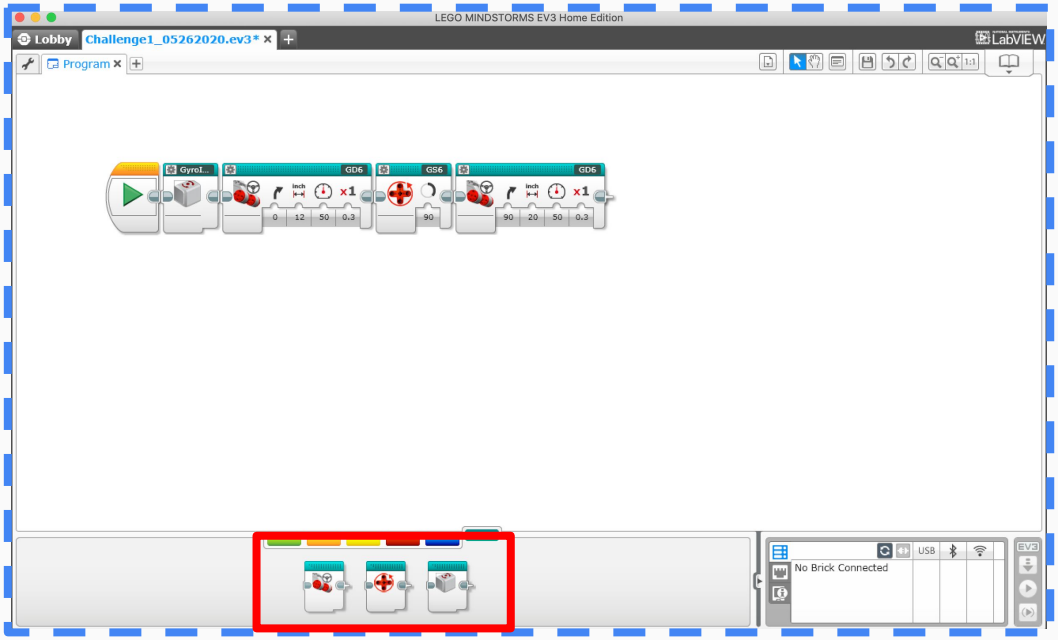
EV3 Motors & Sensors Overview

Challenge #1 - Back to BASE-ics

★ Navigate to the folder where you downloaded GD6 and select the “GD6.ev3s” file.

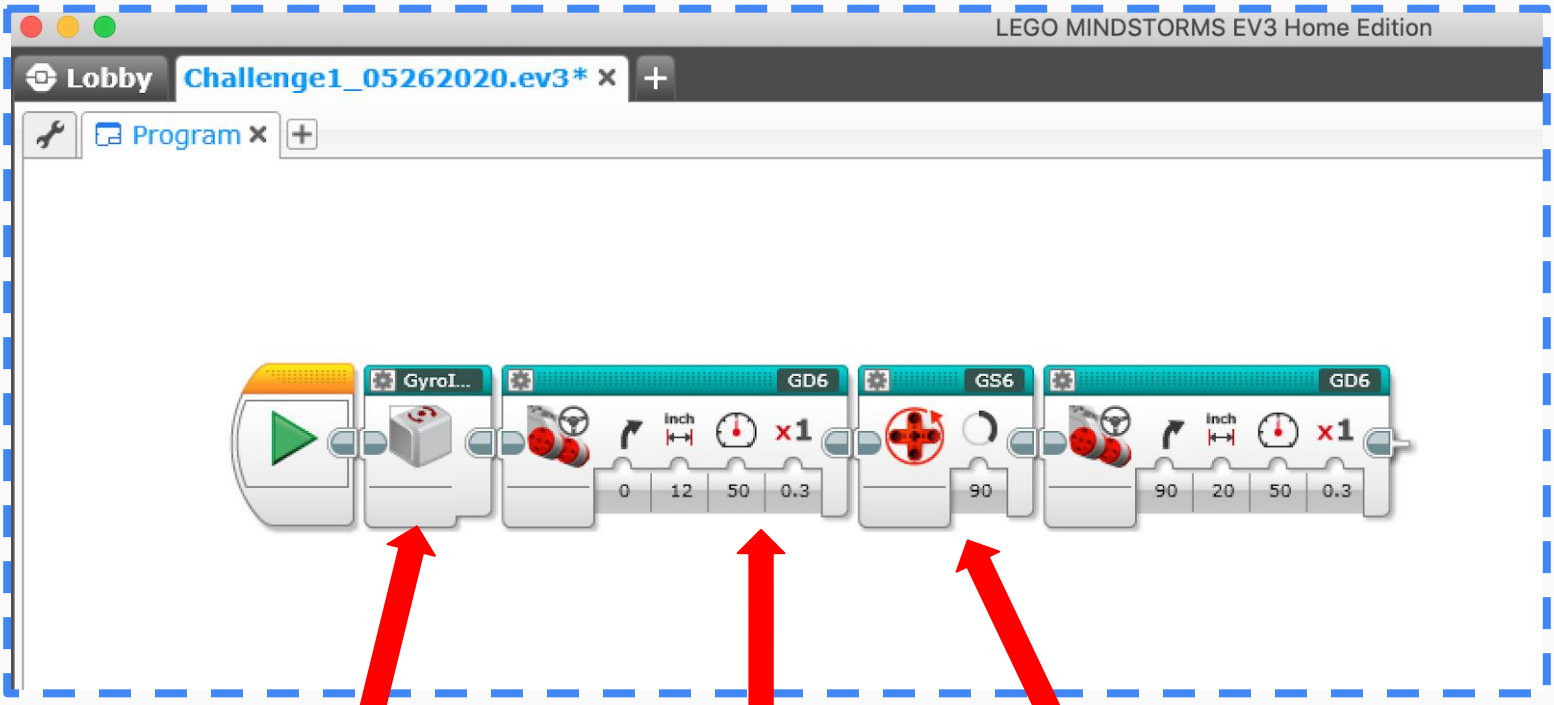
★ Return to the main project screen and click on the turquoise block in the bottom center of the screen. The GD6 blocks should now be available!





Challenge #1 - Back to BASE-ics

Using the gyro myblocks



GS6 - Gyro Spin V6

GD6 - Gyro Driver V6

GyroInit - Gyro Initialize

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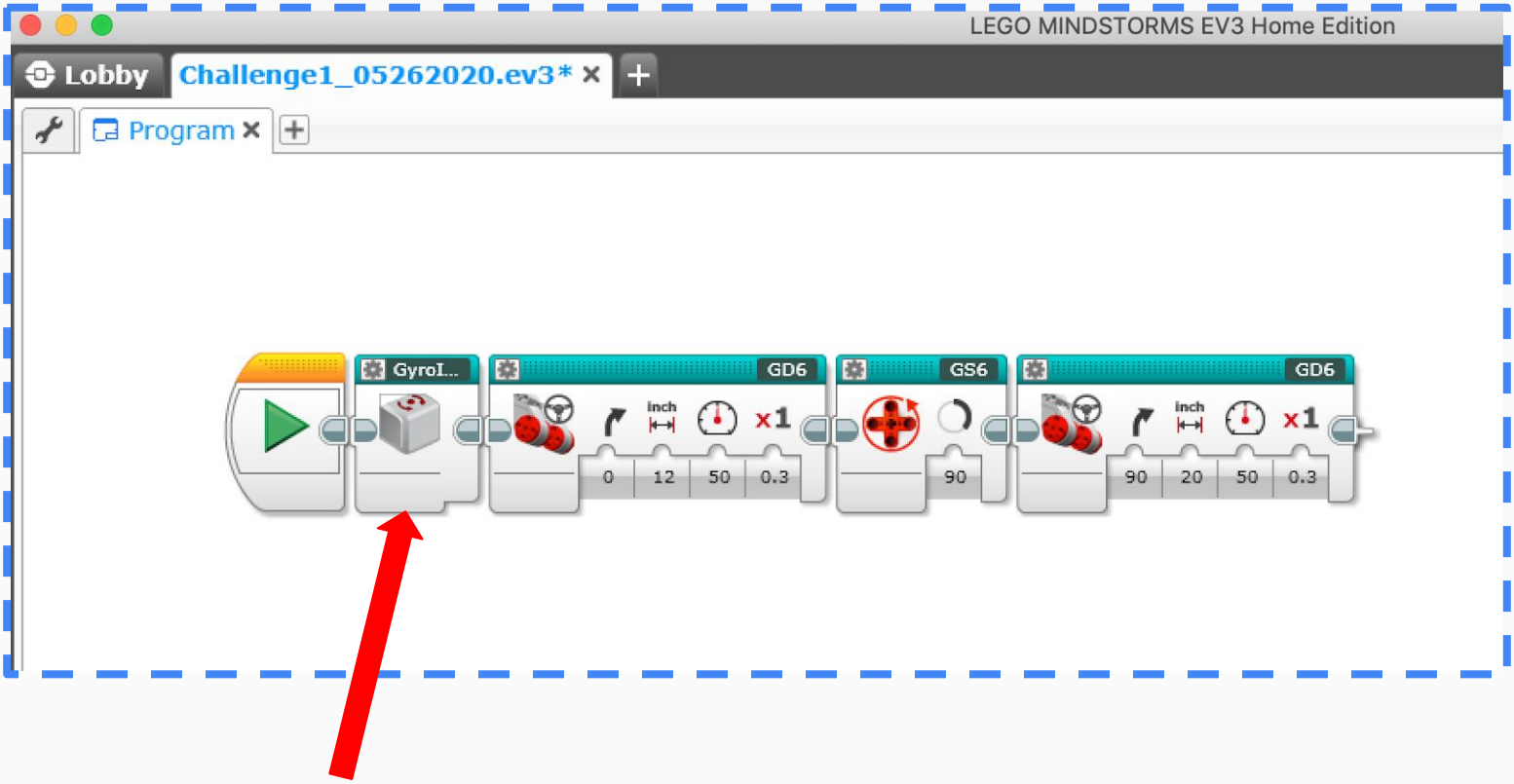
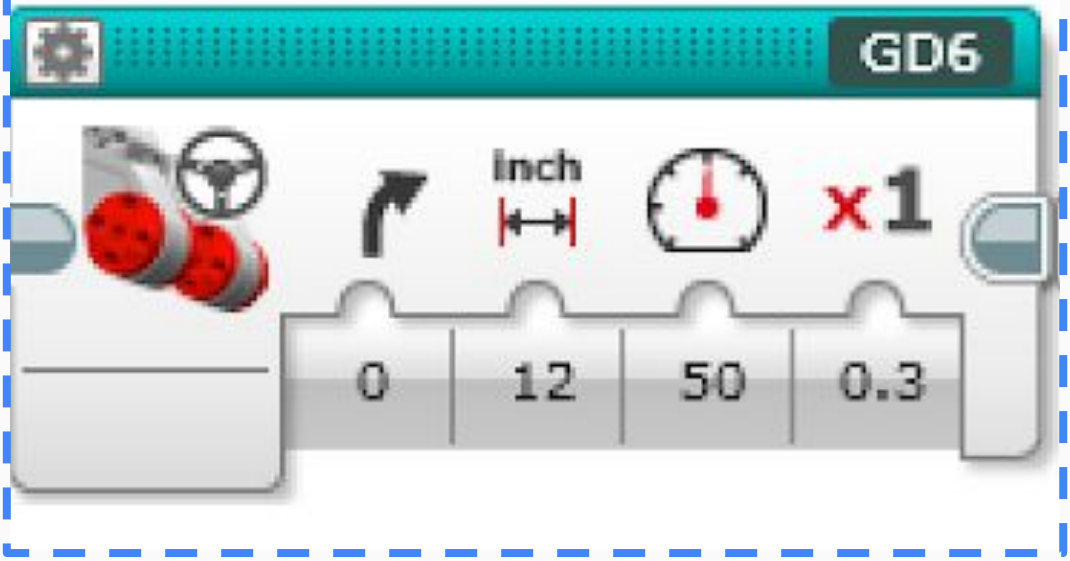


GyroInit: This block of code does what we call "initializing the gyro." This means that the code looks at the change in measured angle of the gyro sensor versus time that has passed. If the measured angle is unchanging, it sets the angle the robot is pointing at to 0. All angle setpoints after the gyro is initialized are relative to that set point.

Challenge #1 - Back to BASE-ics

GD6: This block of code is what you use to make the robot drive.

- ★ The first input is angle. Remember, all angles are relative to your 0 set-point from the GyroInit myblock!
- ★ The next input is distance. The icon says “inches,” but the distance the robot actually drives depends on your robot’s mechanical design and other inputs in GD6, so we call it “relative distance.” This means you need to use a guess and check method to figure out what the right distance might be for your robot. I recommend starting with 12, and seeing whether your robot drives too far and too little past your desired length. Once you have that data you know whether to increase or decrease your relative distance!
- ★ The third input is motor power, which can go from 0-100%. The direction the motors spin can be changed by making your motor power negative. Always use motor power to change direction, never use negative distance (because you can’t have negative inches silly)!

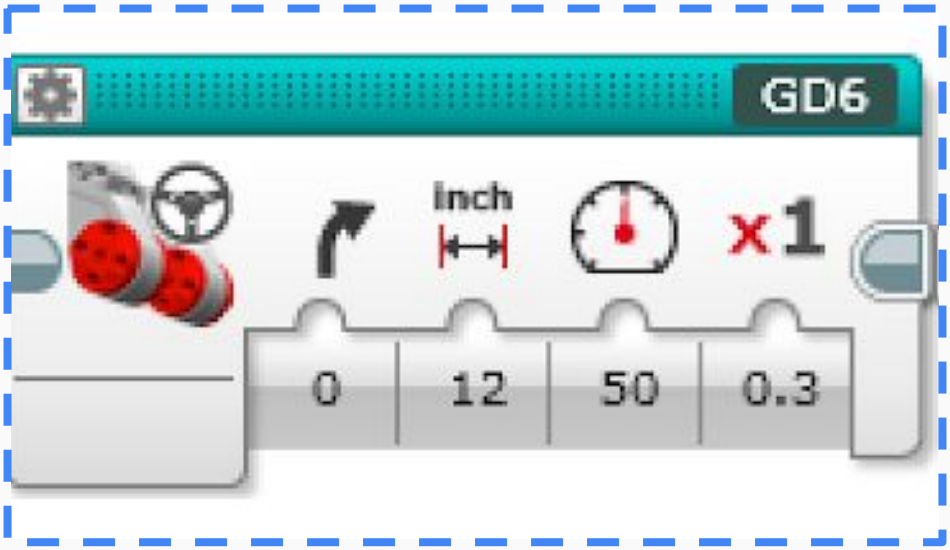


Challenge #1 - Back to BASE-ics

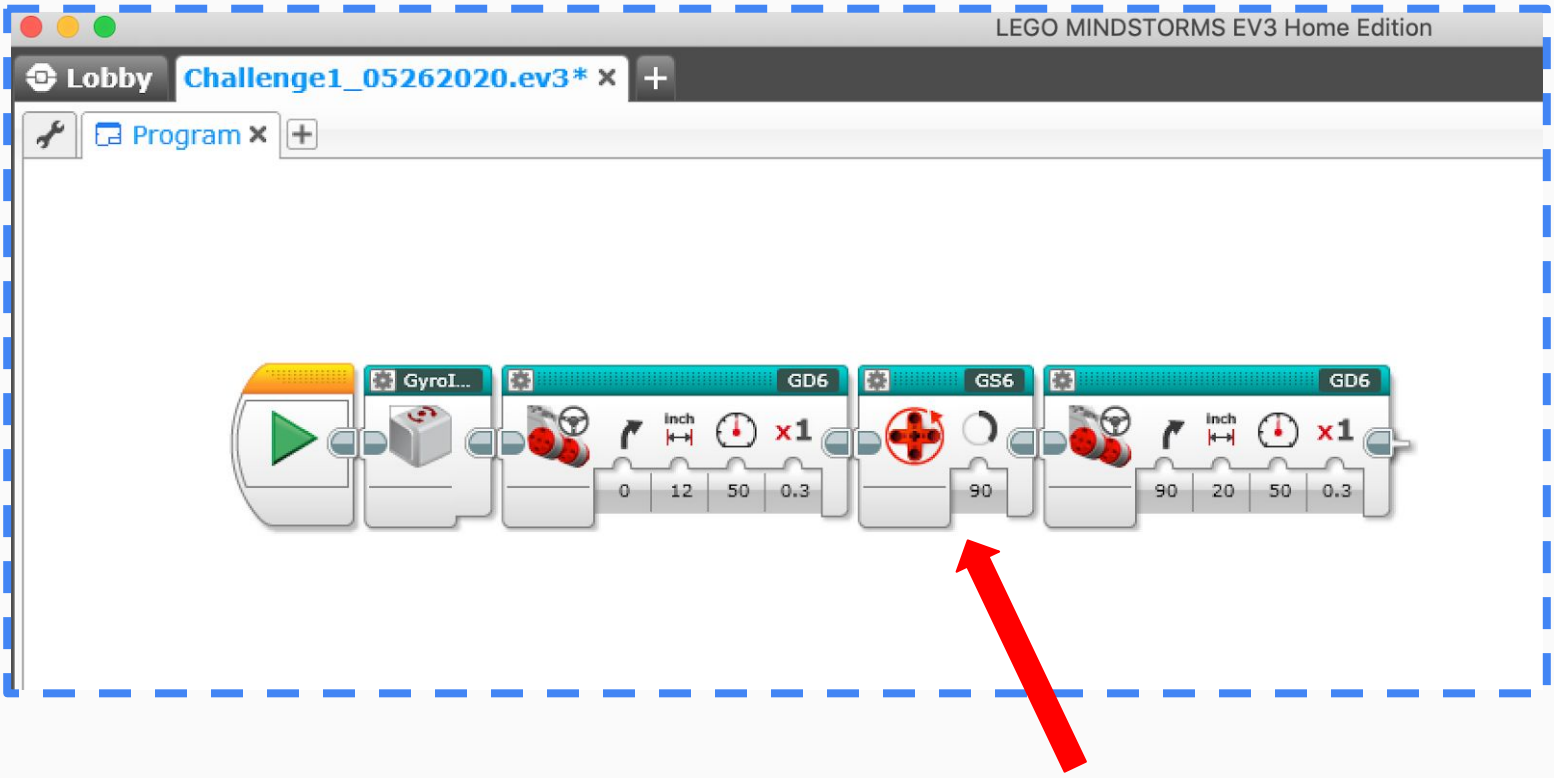
GD6: This block of code is what you use to make the robot drive.

- ★ The fourth and final input is called "Gain." Gain is a term that ranges from 0-1 that reflects how hard the robot works to get to the angle setpoint. Let's say you set your robot to drive at 30 degrees. If you set gain to 0, the robot won't work at all to turn to 30 degrees. If you set the gain to 1.0, the robot will work as hard as it can to turn to 30 degrees. You may be thinking, "why just not set the gain to 1 all the time then?" This is because if the gain is too high, the robot might overcorrect and spin past 30 degrees over and over. However, if the gain is too low, the robot might give up trying to turn to 30 degrees before it even gets there! That is why we need to calibrate gain to our robot, as well as the motor power. Higher motor powers tend to need higher gain values, while lower motor powers tend to need lower gain values.
- ★ My starter recommendation for using GD6 is the following:
  - Motor Power = 30%
  - Gain = 0.3

Start with those values and increase or decrease values based on the results. Try and only change 1 variable at a time as well when programming your robots. This will make debugging and troubleshooting a lot easier.



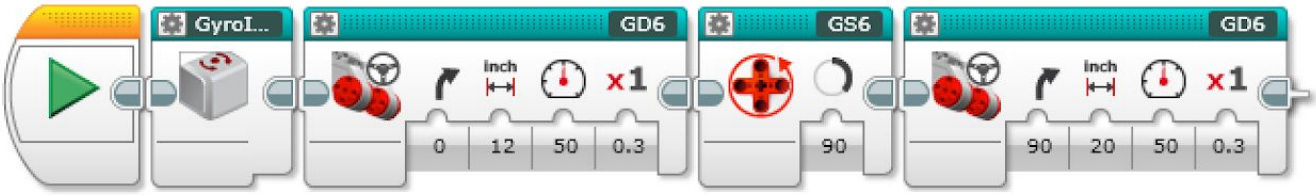
Challenge #1 - Back to BASE-ics

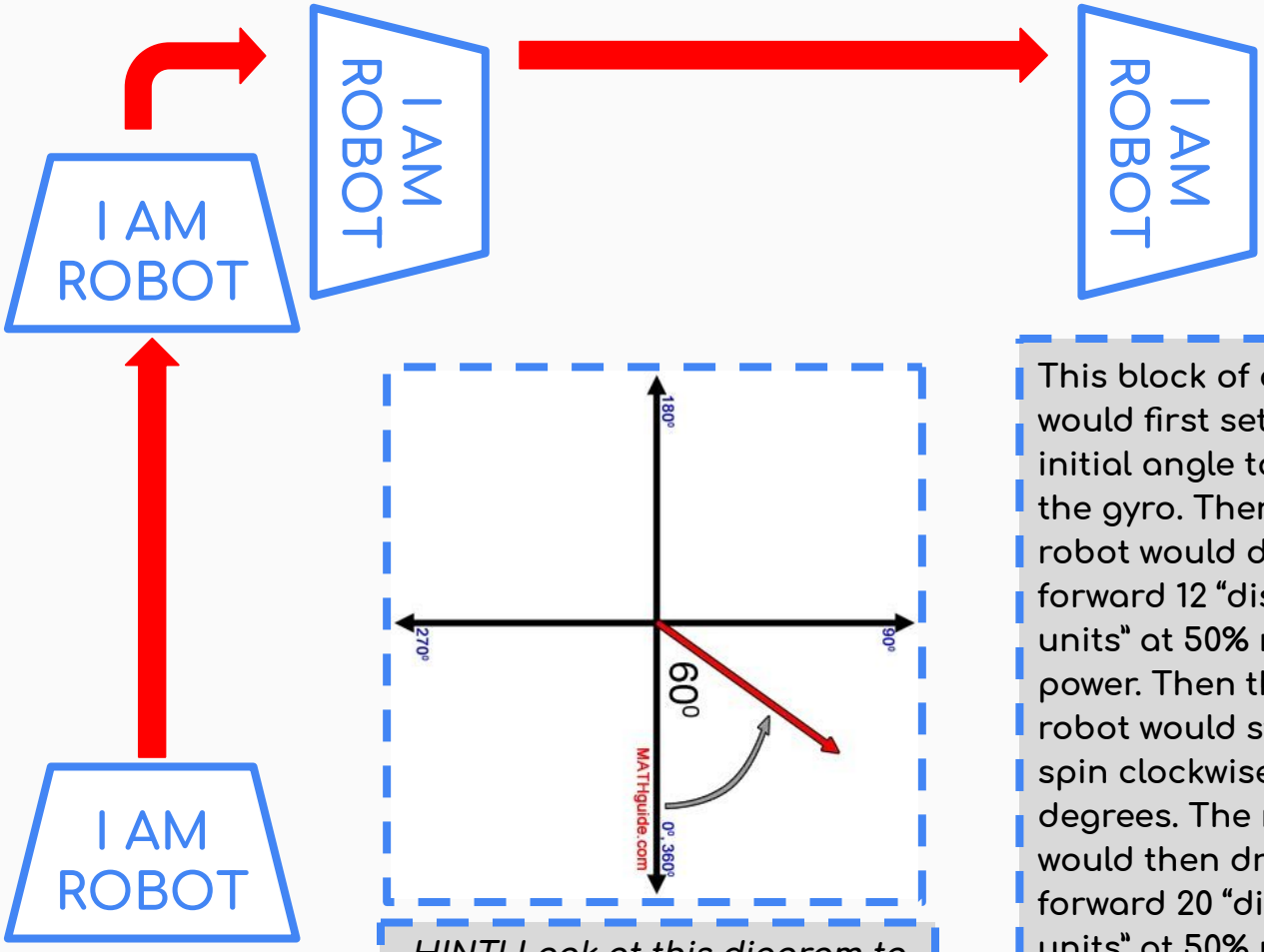


GS6: GS6 is a very simple myblock. All it does is turn your robot to the angle setpoint you type in. GS6 is very good at making precise turns. Consider using it with GD6 when you need your robot to drive very precisely.

Challenge #1 - Back to BASE-ics

What would this block of code do?





HINT! Look at this diagram to see how positive and negative angles work.

This block of code would first set its initial angle to 0 on the gyro. Then the robot would drive forward 12 "distance units" at 50% motor power. Then the robot would stop and spin clockwise to 90 degrees. The robot would then drive forward 20 "distance units" at 50% motor power.

Challenge #1 - Back to BASE-ics

Now we have a built robot and we know to write code to make our robot drive with the gyro sensor. Let's add the gyro to our robot and wire it up!

- ★ Attach the gyro to the side of your robot with the gyro oriented horizontally, and the red part facing up. The gyro needs to be in this physical orientation to work properly.
- ★ Plug a cable into the gyro and wire it to Port 1 on the EV3 brick. The gyro myblocks will not work if the gyro is not in port 1.
- ★ Wire your drive motors to ports B&C on the EV3 brick. If you don't use ports B&C the gyro myblocks will not work properly.

Challenge #1 - Back to BASE-ics

GD6 Troubleshooting Tips

★ If you are using the gyro myblocks and you notice the robot is not working properly try the following:

- Switching the cables plugged into ports B&C on the EV3 brick. The gyro myblocks require the right/left motors to be in a certain order relative to the ports. Redownload your code and try again. If your robot isn't moving or moving sporadically when you run your code this is likely the issue.
- Navigate to the "Port View" screen on the EV3 and page over to the gyro tab. The measured gyro angle should not be changing if the robot isn't moving. If the number is changing rapidly and the robot is still, the gyro is drifting. To reset the gyro, try unplugging it and plugging it back in. Check the gyro tab again to make sure the angle is not changing. You may need to unplug and replug multiple times to get drifting to stop. If your robot starts spinning in circles when you run your code this is likely the issue.

Challenge #1 - Back to BASE-ics

Connecting the Robot & Downloading Code

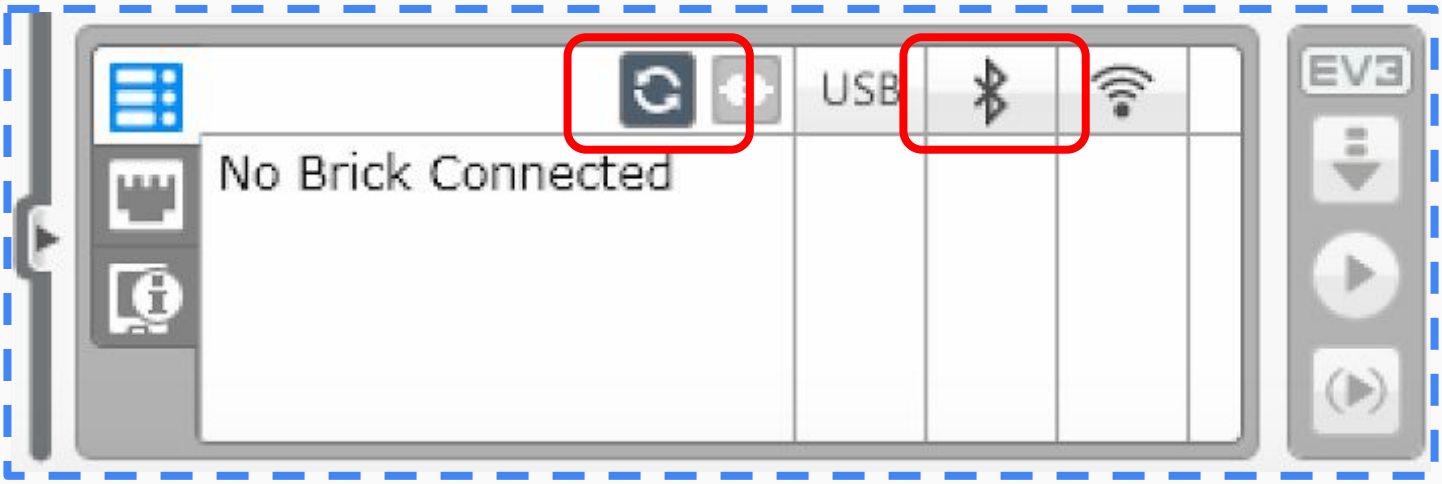
- ★ You can connect your EV3 robot to your computer via Bluetooth or USB.
- ★ If using a USB cable:
  - Simply plug the cable into the EV3 brick, then plug the other end into a USB port on your computer.
  - The download button should pop up in the lower right corner of the screen once the connection is established (takes ~10-20 seconds).
  - From here you can download code, delete files off the brick as well as see the motors and sensors currently plugged into your robot.

Challenge #1 - Back to BASE-ics

Connecting the Robot & Downloading Code

★ If using Bluetooth:

- navigate to the settings tab on the EV3 brick and make sure the bluetooth and visibility settings are on. The current name of the EV3 brick will show up in the top center of the brick screen.
- From here, go to your computer and click the refresh button on the tab in the lower right corner of the screen. After searching, your robot's name should pop up. Click on the bluetooth button adjacent to your robot's name to establish the connection.
- Once the connection is established, you download code, delete files off the brick as well as see the motors and sensors currently plugged into your robot (very helpful when checking for gyro drift



Challenge #1 - Back to BASE-ics

Connecting the Robot & Downloading Code

- ★ Once your code is downloaded, you can either run it from the computer or from the brick itself
- ★ Running from the computer:
  - Click the play button in the bottom right hand corner of the screen to download and run code
- ★ Running from the brick
  - Navigate to the second tab on the brick and search for the folder that matches your project name
  - Once you are in the project folder scroll down until your find your program's name
  - Select it to run it!

Challenge #1 - Back to BASE-ics

Now we have fully built & wired robots, we know how to program our robots with the gyro myblocks, and we know how to download and run our code! I think we are finally ready for Challenge #1!

Please Click Here to Download & Print The Base Template

Challenge #1 - Back to BASE-ics

Robot Challenge

Supplies: Basebot w/ gyro installed, LEGO mindstorms building parts or virtual robotics toolkit account, eraser, tape, printed base template, ruler, sticky notes

Setup: Print out and tape the base template to a hard, smooth floor. If your house doesn't have a hard floor, you can lay out a piece of plywood, or try outside on a sidewalk or paved area. Base is where your robot starts in every challenge. Measure out 2-feet from the front edge of base and mark it with a sticky note. Measure 1-foot to the left of the first sticky note, and place another sticky note. Tape down both sticky notes on all 4 edges. Place the eraser on top of the second sticky note.

Challenge: Start your robot in base. Collect the eraser from the sticky note and bring it back to base. You will need to design a mechanism for carrying the eraser, and write a program using the gyro myblocks. When you complete the challenge, take a video and upload it to Slack!

Reflection Worksheet: Complete the worksheet linked below after you complete the challenge.

Click Here For Robot Worksheet 1

Challenge #1 - Back to BASE-ics

Project Challenge

This year's FLL game theme is all about sports, sports technology, and how sports are evolving over time. This week's project challenge is to get outside (safely and within social distancing guidelines), play your favorite sport or activity, and post a funny picture or video of yourself to Slack while doing it! Have lots of fun with this one (:

Challenge #1 - Back to BASE-ics

Core Values Challenge

- ★ Complete this week's core values worksheet at the link below (google form)
- ★ Complete the following core values challenge with your family and upload a video of your family completing the challenge to Slack:
  - Supplies: One sheet (full/queen/king)
  - Challenge - The Folded Sheet: See how many times you can fold a sheet in half before your whole family can't all stand on the sheet. Every family member has to be touching the sheet for the fold to count!

Click here for core values worksheet #1!

Challenge #1 - Back to BASE-ics

In Need of Assistance?

- ★ Check your student coach assignment at the spreadsheet below. You can message them on Slack or attend their virtual office hours.
- ★ If your student coach is unavailable, feel free to message Dee on Slack.
- ★ If something comes up and you can't complete a challenge for the week, message Dee and your student coach to let them know! We know this is a crazy time and things happen.

Click Here For Student Coach Assignments & Office Hours Schedule