Robot Simulation Tutorial

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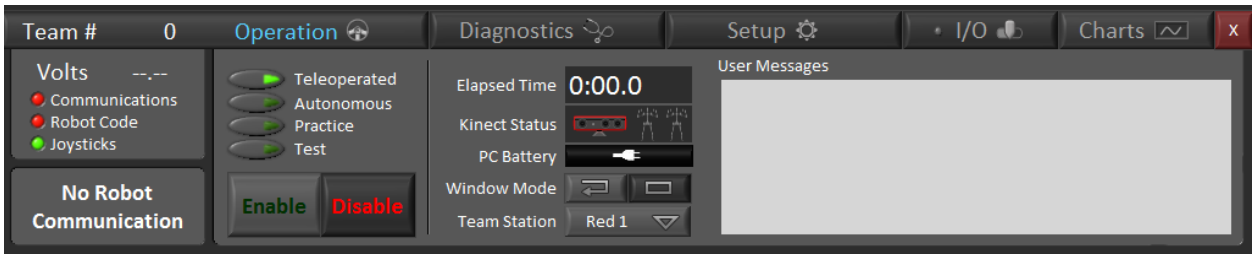
Introduction

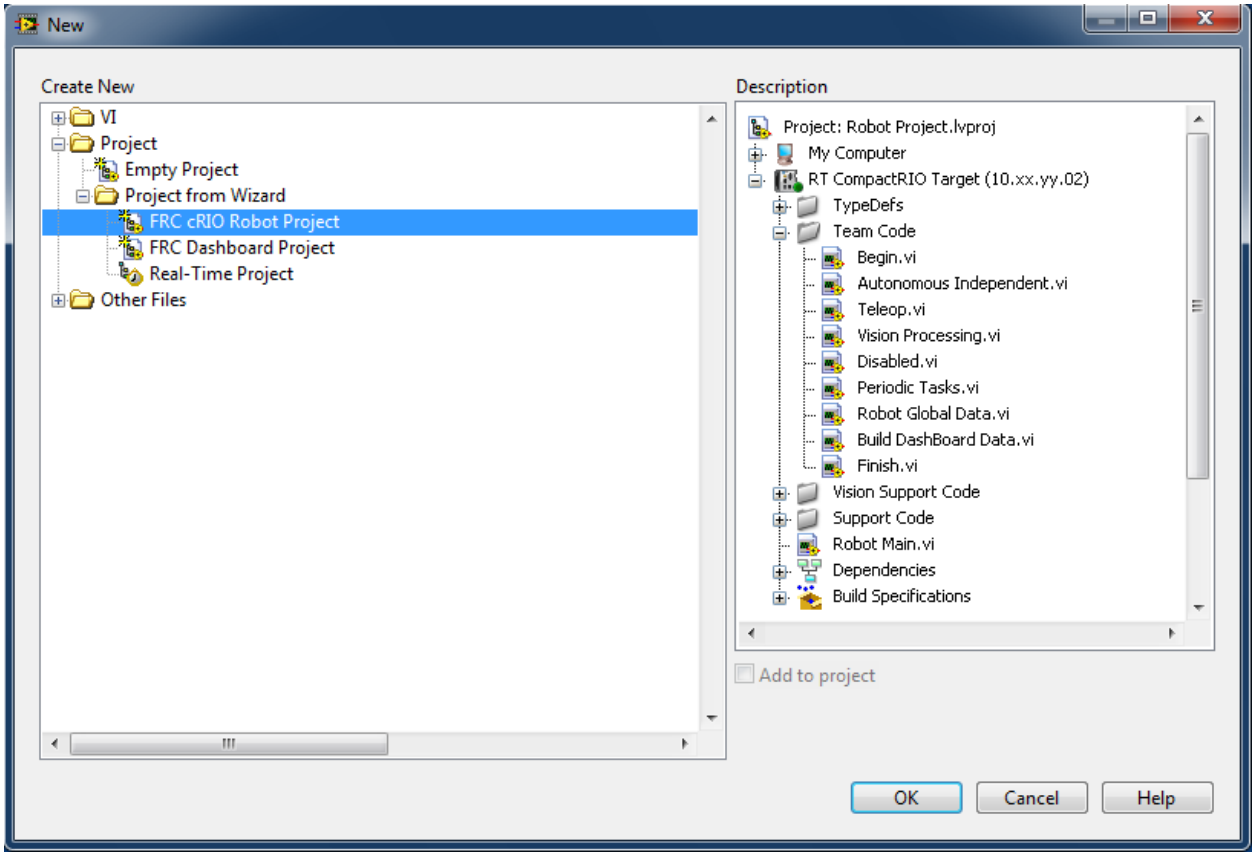
Use the LabVIEW Robot Simulation to program a predefined robot without having an RT CompactRIO Target. This allows multiple developers to concurrently create and test LabVIEW code without requiring each developer to have access to the hardware. Programming is the same, except only the predefined **Actuators** and **Sensors** on the simulated robot are currently supported. Robot code that has been developed and works in simulation mode can be moved to the RT CompactRIO Target and run on a real robot.

Opening the Robot Simulator

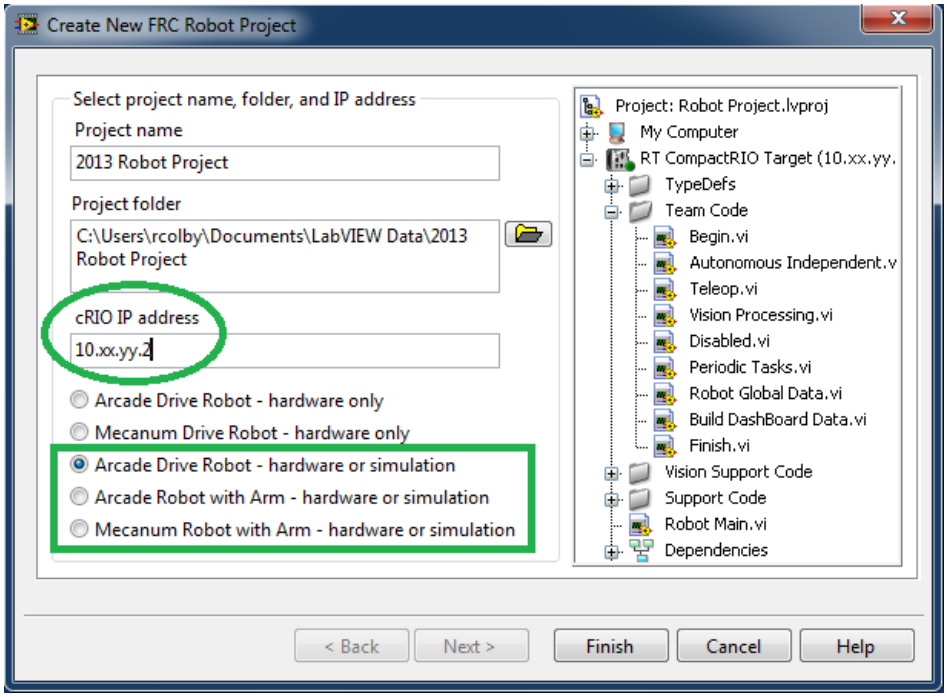
1. Start the **FRC Driver Station**. This is required for both real and simulated robots.



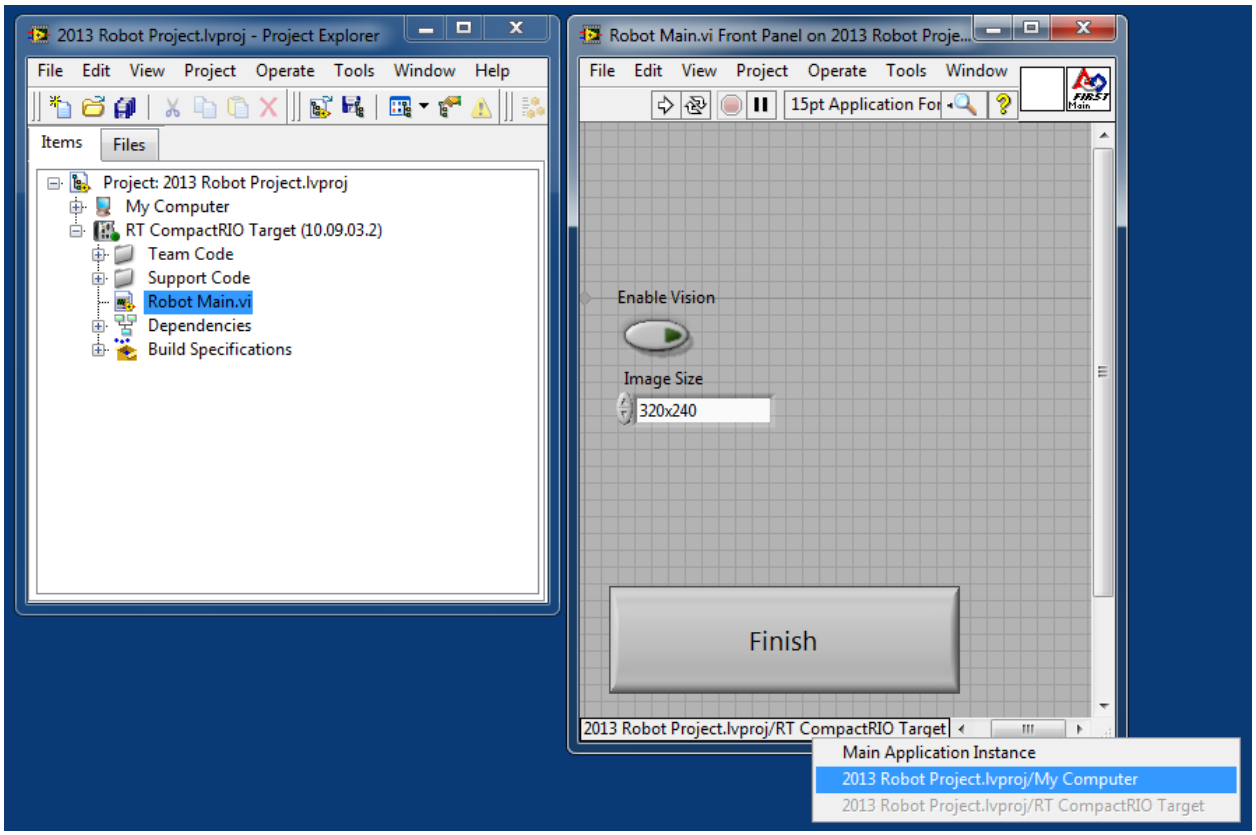
2. Open a New **FRC cRIO Robot Project** either from the Getting Started screen or by going to File>>New…



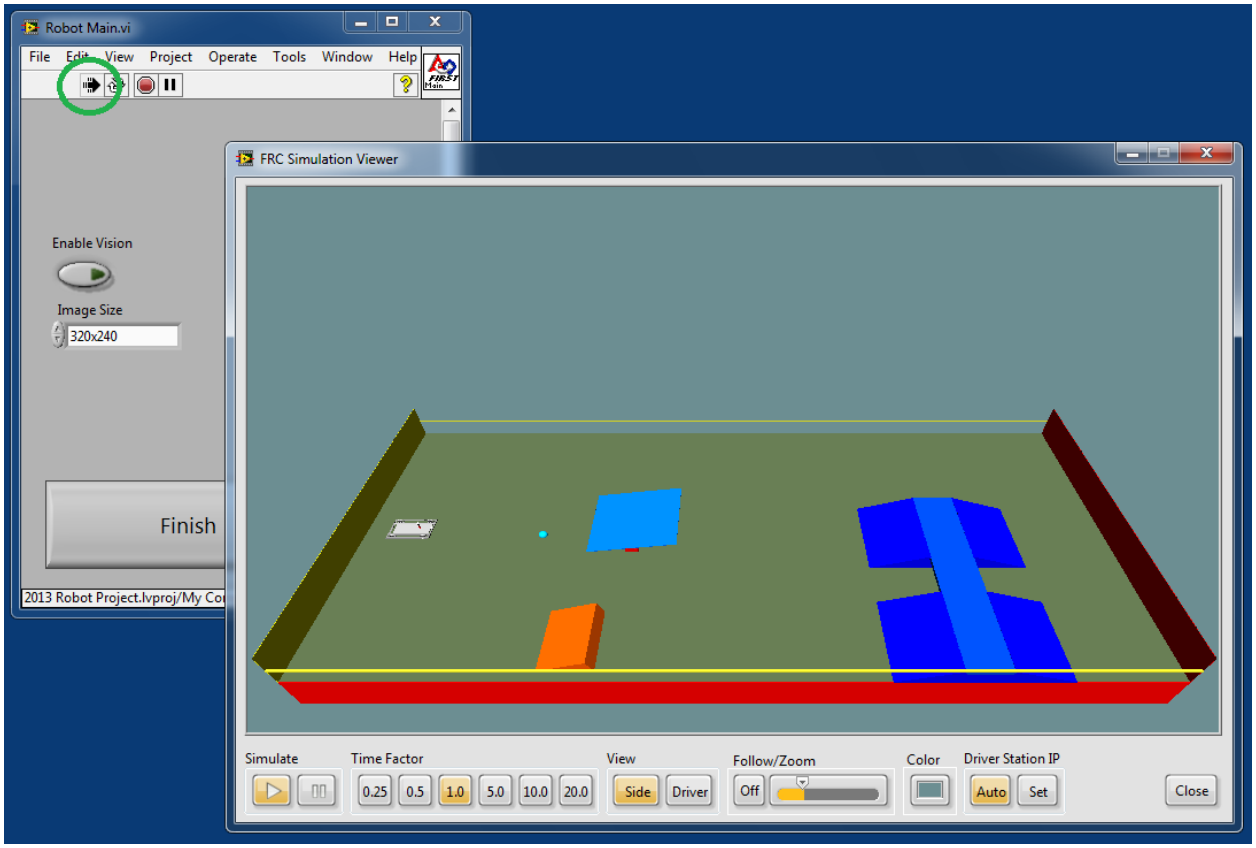
3. Update the **cRIO IP address** based on your Team Number, and one of the options that includes **hardware or simulation**. Note that you can choose one of the **hardware only** options if you are not using the Simulator and would like the project files to load up quicker.



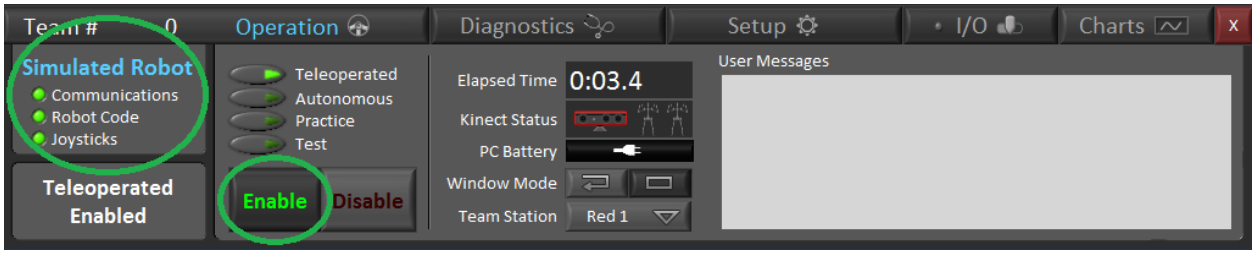
4. When the LabVIEW Project opens, select and open **Robot Main.vi**.
5. Right-click in the lower left corner of **Robot Main.vi** and choose **2013 Robot Project.lvproj/My Computer**. Wait a moment while the subVI's reload.



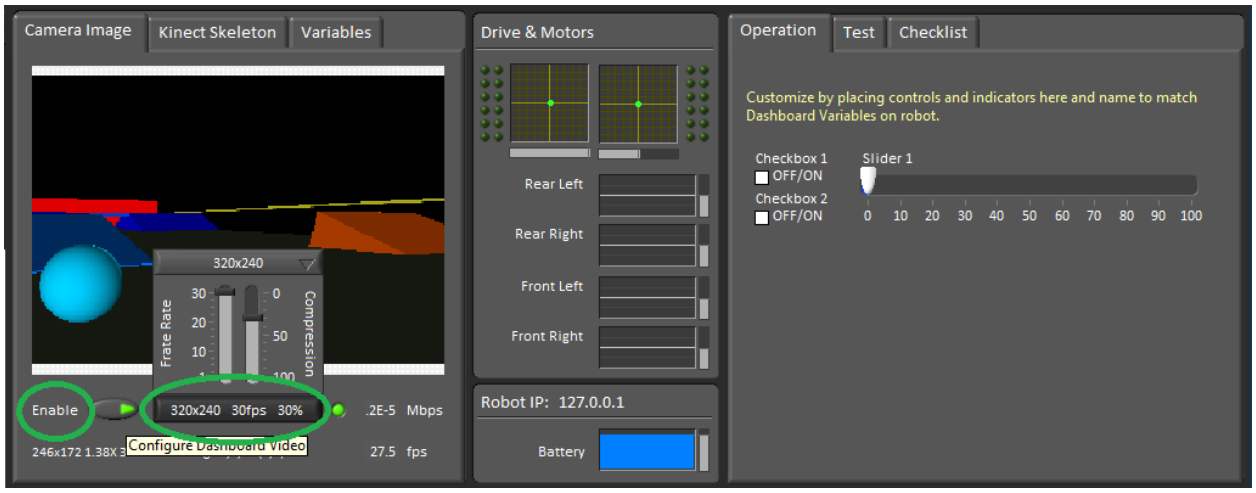
6. Run **Robot Main.vi** and the **FRC Simulation Viewer** opens.



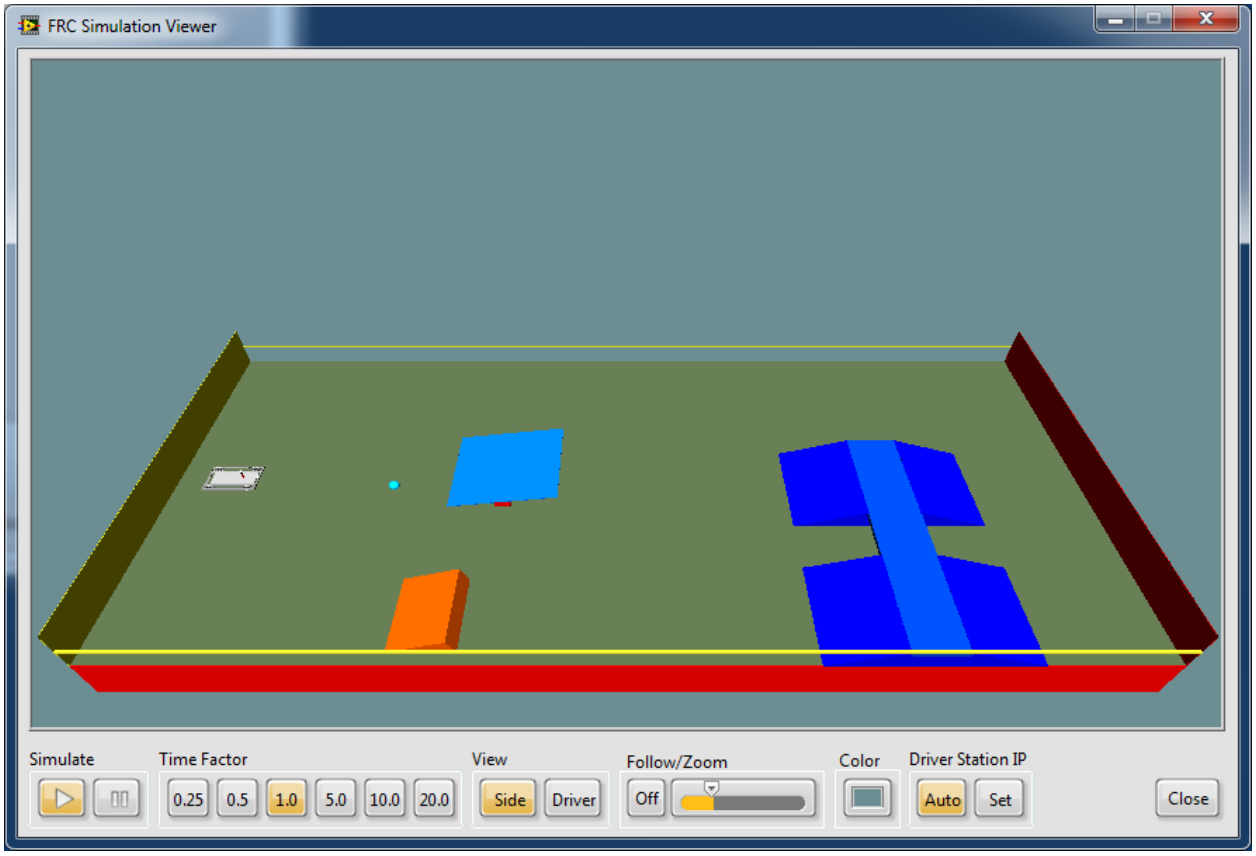
7. The **FRC Driver Station** should now show that you are in **Simulated Robot** Mode. Click **Enable** to place the robot in **Teleop Enabled** Mode.



8. You should now be able to use a joystick to drive the robot in the **FRC Simulation Viewer**.
9. The **Camera Image** and **Drive & Motors** can be monitored in the **FRC PC Dashboard**. Click **Enable** under **Camera Image** to view the Camera, and left-click the resolution to change the **Frame Rate** and the **Compression**. It is possible that changing to lower frame rates and higher compression will help with a smoother camera image for slower computers.



Using the FRC Simulator Viewer



Aside from Teleoperation of the simulated robot using the joystick, there are several options in the **FRC Simulator Viewer** to help customize your simulation environment:

- **Simulate**—**Run** and **Pause** buttons are available.

- **Time Factor**—This value will allow you to run the dynamic model of the system slower than real time (minimum 0.25) and faster than real time (maximum 20.0). A Time Factor of 1.0 will be representative of the system in real time.
- **View**—**Side** or **Driver** will enable you to default back to one of the two traditional points of view. If **Follow** is **Off**, left-clicking and panning in the Viewer window will allow you to choose a custom viewing angle.
- **Follow**—If you turn Follow **On**, the Viewer will keep the robot centered in the screen from whichever **View** you have selected. If you turn Follow **Off**, left-clicking and panning in the Viewer window will allow you to choose a custom viewing angle, but zooming is no longer possible.
- **Color**—Select the background color.
- **Driver Station IP**—**Auto** should be set to connect with the correct IP Address based on the RT CompactRIO Target properties in the LabVIEW Project Explorer, but there is also an option to **Set** the IP address manually.
- **Close—**Close the FRC Simulation Viewer and stop Robot Main.vi.

Supported Actuators on the Simulated Robot

These depend on which of the following three Robot Project options you choose:

- **Arcade Drive Robot** – hardware or simulation
- **Arcade Robot with Arm** – hardware or simulation
- **Mecanum Robot with Arm** – hardware or simulation

Note: If you run a robot in simulation mode and it has actuators or sensors that are not supported in simulation mode, errors will be generated that slow the simulation performance. You can check these errors under the Diagnostics tab of the FRC Driver Station.

The following actuators are currently supported in Simulation Mode:

1. Left Motor
    - Digital Module = Digital Module 1
    - PWM Channel = PWM 1
2. Right Motor
    - Digital Module = Digital Module 1
    - PWM Channel = PWM 2

Supported Sensors on the Simulated Robot

These depend on which of the following three Robot Project options you choose:

- **Arcade Drive Robot** – hardware or simulation
- **Arcade Robot with Arm** – hardware or simulation
- **Mecanum Robot with Arm** – hardware or simulation

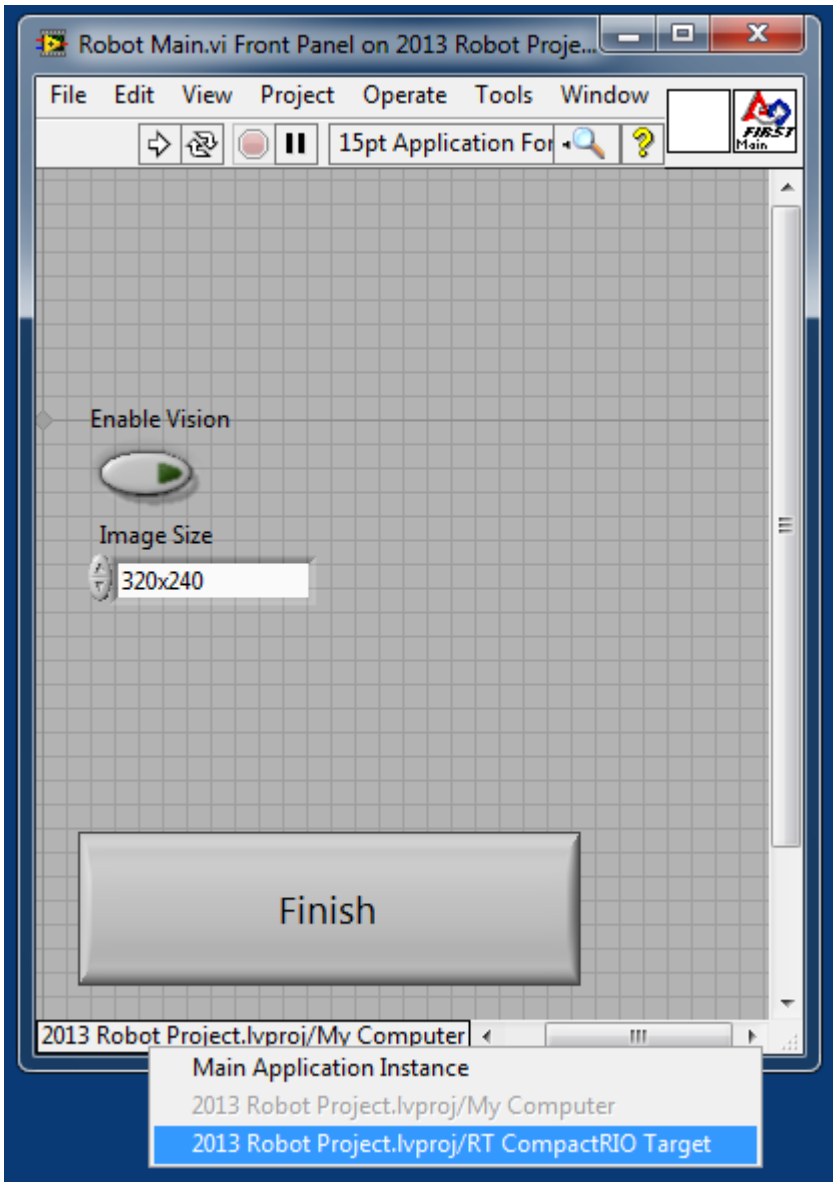
Note: If you run a robot in simulation mode and it has actuators or sensors that are not supported in simulation mode, errors will be generated that slow the simulation performance. You can check these errors under the Diagnostics tab of the FRC Driver Station.

The following sensors are currently supported in Simulation Mode:

1. Encoder on Right Motor
    - Digital Module = Digital Module 1
    - A Channel = DIO 3
    - B Channel = DIO 4
2. Encoder on Left Motor
    - Digital Module = Digital Module 1
    - A Channel = DIO 5
    - B Channel = DIO 6
3. Gyro
    - Analog Module = Analog Module 1
    - Analog Channel = AI 1
4. Ultrasonic
    - Ping Digital Module = Digital Module 1
    - Ping DIO Channel = DIO 1
    - Echo Digital Module = Digital Module 1
    - Echo DIO Channel = DIO 2
5. AXIS M1011 Camera

Other Caveats

1. To change the **Robot Main.vi** to be able to run on the target again, you will need to right click in the lower left corner of **Robot Main.vi** and choose **2013 Robot Project.lvproj/My Computer**. Wait a moment while the subVI's reload.



2. The E-Stop (space bar) works in Simulation Mode. To reset it, simply wait 5 seconds and the reset **Robot main.vi**.