D.Frederick
12/1/2016 7:19:00 PM
df20151026_Robotics_Software_Development_processs_using_Eclipse_and_RobotBuilder_v01.docx

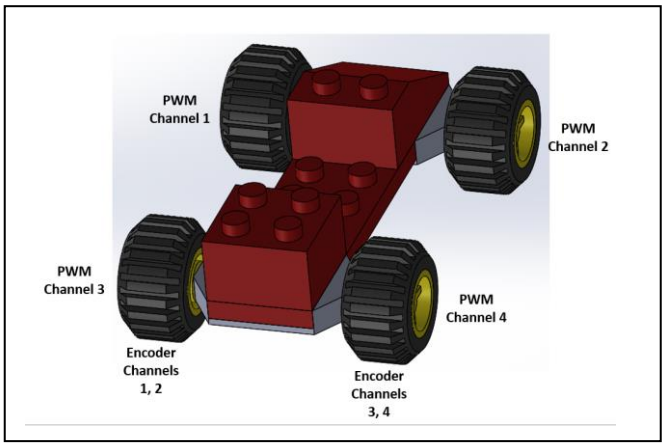
Purpose:

This document describes how to build a simple robot using RobotBuilder Tool and Eclipse.

Reference:

RobotBuider Instructions:

https://wpilib.screenstepslive.com/s/4485



High Level Goal:

Create a basic robot that can be driven with a Joystick.

Assumptions:

Eclipse is installed and has the WPI Add-in

Robot Design:

Four motors controllers:

Where: PWM1=Front Left Wheel PWM2=Front Right Wheel,
PWM3=Rear Left Wheel PWM4=Rear Right Wheel

Encoders: Left side Channels 1 and 2
Right side Channels 3 and 4

Gyro: Analog Channel 0

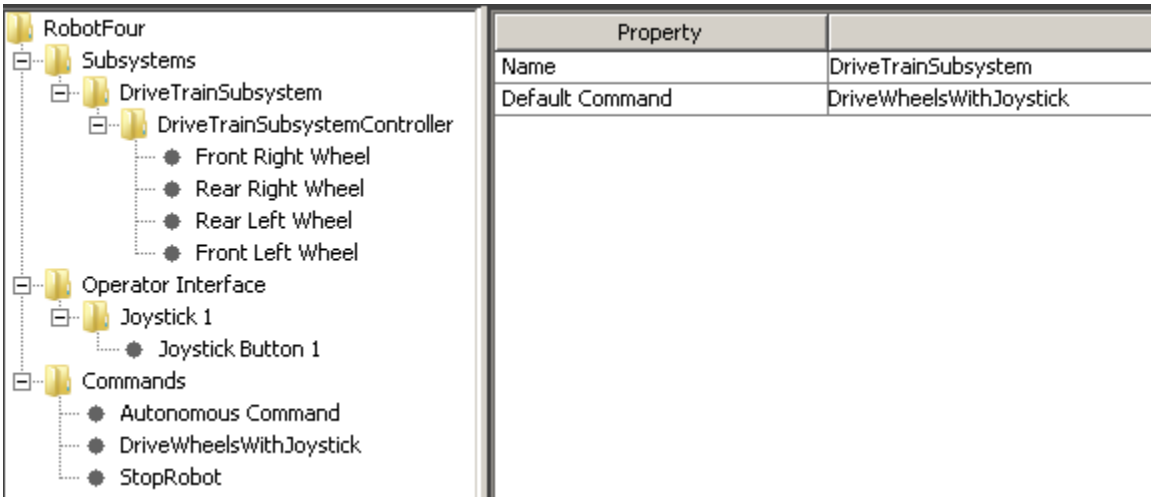
Joystick 1

Implementation:

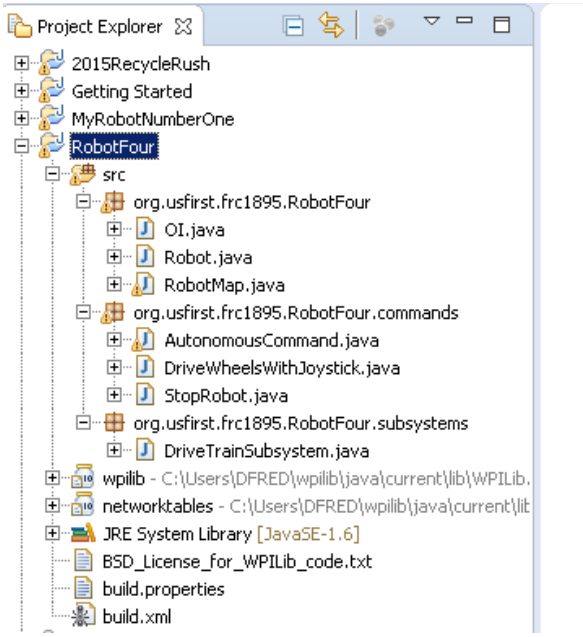
1. Create a folder to store the RobotBuilder project such as "**C:_Robotics\2016\Eclipse_Projects**".
2. Start Eclipse.
3. Start RobotBuilder using the command sequence **Eclipse** => **WPILib** => **Run RobotBuilder**
4. Select **File** => **New**. On Creation of new Robot Project, set:
   - Project Name: e.g.: **RobotFour**
   - Team Number: e.g.: **1895**

   Select **Create Project**
5. In Robot Project, set:
   - Eclipse Workspace: e.g.: "**C:_Robotics\2016\Eclipse_Projects**"
   - Wiring File: e.g.: "**C:_Robotics\2016\Eclipse_Projects\RobotFourWires**"
6. Save the RobotBuilder Project file:
   - Select **RobotBuilder** => **Save As** => "**C:_Robotics\2016\Eclipse_Projects\RobotFour**"
7. Create a drivetrain "**Subsystem**", Right click subsystem and select "**Add Subsystem**"
8. On the right side of the page, rename the subsystem to "**DriveTrainSubsystem**"

9. Add a "**Controller**" by right clicking on the subsystem "**DriveTrainSubsystem**" and selecting "**Add Controller**" then select "**Add Robot Drive 4**".
10. Rename "**Drive Train 4 1**" to "**DriveTrainSubsystemController**". *(Ignore the warnings at this time)*
11. Add four motors to the Drive Train by Right clicking on the "**DriveTrainSubsystemController**" and selecting "**Add Speed Controller**". Perform this four times.
12. Rename "**Speed Controller 1**" to "**Front Left Wheel**"
13. Rename "**Speed Controller 2**" to "**Front Right Wheel**"
14. Rename "**Speed Controller 3**" to "**Rear Left Wheel**"
15. Rename "**Speed Controller 4**" to "**Rear Right Wheel**"
16. Change the "**Front Left Wheel**" type to **Jaguar**, Set **Output Channel (PWM)** to the value of **1**.
17. Change the "**Front Right Wheel**" type to **Jaguar**, Set **Output Channel (PWM)** to the value of **2**.
18. Change the "**Rear Left Wheel**" type to **Jaguar**, Set **Output Channel (PWM)** to the value of **3**.
19. Change the "**Rear Right Wheel**" type to **Jaguar**, Set **Output Channel (PWM)** to the value of **4**.
20. Update the "**DriveTrainSubsystemController**" **Left Front Motor** to "**Front Left Wheel**"
21. Update the "**DriveTrainSubsystemController**" **Left Rear Motor** to "**Rear Left Wheel**"
22. Update the "**DriveTrainSubsystemController**" **Right Front Motor** to "**Front Right Wheel**"
23. Update the "**DriveTrainSubsystemController**" **Right Rear Motor** to "**Rear Right Wheel**"
24. Save the RobotBuilder project. Select "**File**" the "**Save**".
25. Add a command to have the Joystick drive the wheels. Right click on "**Commands**" and select "**Add Command**".
26. Rename "**Command 1**" to "**DriveWheelsWithJoystick**"
27. Update the "**Requires**" field to "**DriveTrainSubsystem**".
28. Add a second command to stop the robot. Right click on "**Commands**" and select "**Add Command**".
29. Rename "Command 1" to "**StopRobot**"
30. Update the command "**StopRobot**" "**Requires**" field to "**DriveTrainSubsystem**"
31. Assign the **DriveTrainSubsystem** Default Command to "**DriveWheelsWithJoystick**", Select "**DriveTrainSubsystem**" and the update the field in the right window.
32. Add a Joystick. Right click on the **Operator Interface** and select "**add JoyStick**"
33. Add a Joystick Button. Right click on the newly created "**Joystick 1**" and select " **Add Joystick Button**" *(Ignore the warning)*
34. Assign the Joystick button to stop the robot. Select **"Joystick Button 1**" and change the command to "**StopRobot**"
35. Save the Project.
36. Export the RobotBuilder project to Eclipse. Select **Export** => **Java**.
37. Close the RobotBuilder Application.



38. Import the Java Project into Eclipse
    - Select **Eclipse** => **File** => **Import** => **General** => **Existing Projects into Workspace,** Select **Next**
    - Select **Browse**. Browse to project folder: e.g.: "**C:_Robotics\2016\Eclipse_Projects\RobotFour**"
    - Highlight **RobotFour** and select **OK**.
    - Select **Finish**.
39. Within Eclipse, expand the "src" (Source code) folder and subfolder. Double-click on the **DriveTrainSubsystem** class.



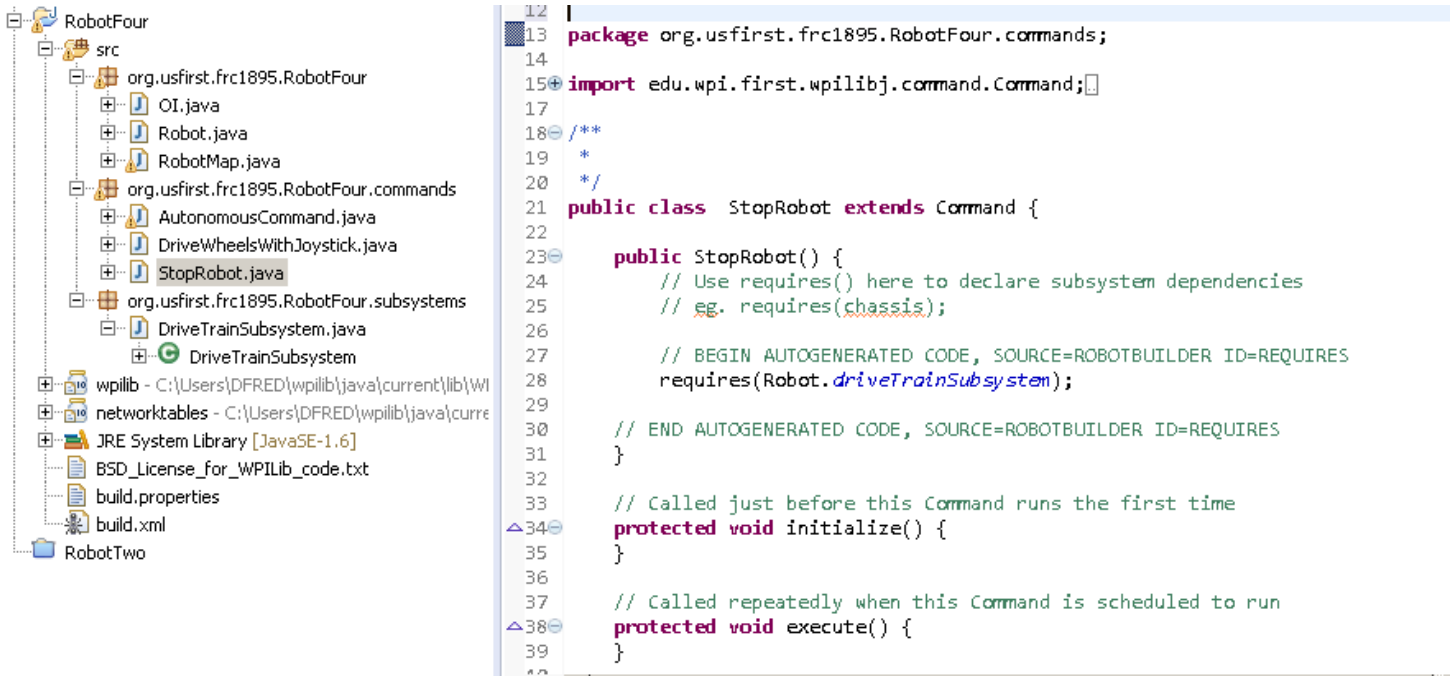
40. Within the "**DriveTrainSubSystem**" class (.java), add methods to control the wheels. Create a "**stop**" method by entering the following code below the *"**// Put methods for controlling this subsystem here. Call these from Commands.**"*:

```
public void stop (){
driveTrainSubsystemController.arcadeDrive(0, 0);
}
```

41. Within the "**DriveTrainSubSystem**" class (.java), add methods to control the wheels. Create a "arcade" method by entering the following code:

```
public void ArcadeDrive (double Yaxis, double Xaxis) {
    driveTrainSubsystemController.arcadeDrive(Yaxis, Xaxis);
}
```

42. Open the "StopRobot" **command** class**.**



43. Link the Joystick button with the stop method in the "DriveTrainSubSystem". Open the "StopRobot" **command** and update the execute methods as follows.

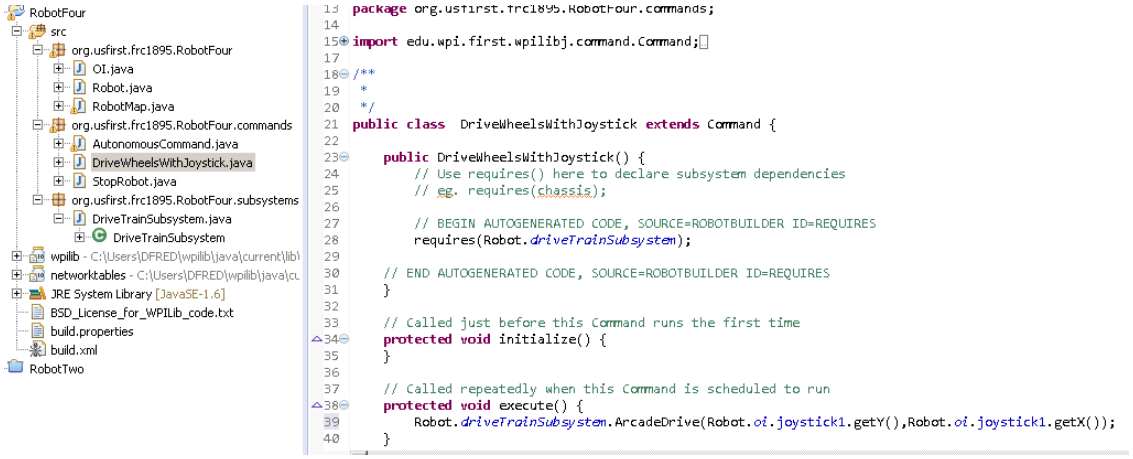
```
protected void execute() {
    Robot.driveTrainSubsystem.stop();
}
```

44. Open the "DriveWheelsWithJoystick " command.

45. Link the Joystick X and Y motions with the arcadeDrive method in the "DriveTrainSubSystem". Update the execute methods as follows.

```
    protected void execute() {
Robot.driveTrainSubsystem.ArcadeDrive(Robot.oi.joystick1.getY(),Robot.oi.joystick1.getX());

        }
```



46. Connect the Workstation to the Robot using a network cable and power on the Robot.
    (THINK SAFETY: Be sure everyone is clear of the Robot)
47. Download the code into the RoboRIO. Select **Run**, then **Run,** then **WPILib JAVA Deploy,** then **OK**
48. Start the FRC Drivers Station.
49. Select **TeleOperated** Mode
50. Select **Enable** to start the Robot.

    (THINK SAFETY: Be sure everyone is clear of the Robot)
51. Test the code by moving the joysticks.

Expand the Project: (Add a Gyro and Shaft Encoders)

52. Open the RobotBuilder Application.
53. Highlight the **DriveTrainSubsystem**, Right-click and select **Add Sensors**.
54. Select **Add Analog Gyro**, Update the name to **gryo**.
55. Verify the **Input Channel (Analog)** is set to **0**.
56. Highlight the DriveTrainSubsystem, Right-click and select **Add Sensors**.
57. Select **Add Quadrature Encoder**.
58. Rename **Quadrature Encoder 1** to **LeftEncoder**.
59. Set **Channel A Channel (Digital)** to a value of **1**.
60. Set **Channel B Channel (Digital)** to a value of **2**.
61. Select **Add Quadrature Encoder**.
62. Rename **Quadrature Encoder 1** to **RightEncoder**.
63. Set **Channel A Channel (Digital)** to a value of **3**.
64. Set **Channel B Channel (Digital)** to a value of **4**.

65. Save the Project.
66. Export the RobotBuilder project to Eclipse. Select **Export** => **Java**.
67. Close the RobotBuilder Application.
68. In Eclipse, refresh the project. In the Package Explorer window, select the class **Robot.java** then select **File => Refresh** or press **F5**. The new subsystem and command should appear in the Eclipse workspace.
69. In the DriveTrainSubSystem Class, add methods to read and print the Gyro and Encoders BEFORE the stop method.

```
public void printGyro() {
   System.out.println ("Gyro: " + gyro.getAngle());
   }

public void printEncoders() {
   System.out.println ("Encoders: " + leftEncoder.getDistance() + " " +
   rightEncoder.getDistance());
   }
```

70. Within the ArcadeDrive method, call the gyro and encoder print methods by adding the following lines after the arcadeDrive.

```
printGyro();
printEncoders();
```

71. Save the Eclipse files. Select "**File**" then "**Save All**".
72. Download the code into the RoboRIO. Select **Run**, then **Run,** then **WPILib JAVA Deploy,** then **OK**.
73. Bring up the RoboRio Console to see the output of the print statements.
    (Windows -> Show View -> Other -> General -> RioLog)
74. Select **TeleOperated** Mode
75. Select **Enable** to start the Robot.

Resources:

WPI Library JAVA Docs

http://first.wpi.edu/FRC/roborio/release/docs/java/

Appendix – A One Time setup of Eclipse:

- Initial Configurations (One Time)
  - Set Team Number
    - **Eclipse** => **Windows** => **Preferences** => **WPI Lib Preferences** = **Team Number**
  - Configure Eclipse to sync with RobotBuilder
    - Updates in RobotBuilder are automatically added to the Eclipse Project
    - **Eclipse** => **Windows** => **Preferences** => **General** => **Workspace** = Enable Refresh using Native hooks or Polling
  - Display Console Window
    - **Eclipse** => **Window** => **Show View** => **Other** ... => **General** => **RioLog**
  - Create Workspace in Eclipse to hold Robot Project
    - **Eclipse** => **File** => **New** => **Project**… **=>** WPILib Robot Java Development => Example Robot Java Project
      => Getting Started with Java => Getting Started => Finish

Appendix – B FRCSIM

Resources:

https://wpilib.screenstepslive.com/s/4485/m/23353

http://first.wpi.edu/FRC/roborio/release/simulation/

Limitations:

1) The FRCSIM can take a few tries to start.
2) Joystick methods are not working correctly (getX(), getY() and getZ())

   Use: Robot.oi.joystick1.getRawAxis(0)

```
//      Robot.driveTrainSubSystem.ArcadeDrive(Robot.oi.joystick1.getY(),Robot.oi.joystick1.getX());
        Robot.driveTrainSubSystem.ArcadeDrive(Robot.oi.joystick1.getRawAxis(0), Robot.oi.joystick1.getRawAxis(1));
```

   Notes: Joystick

   - Axis 0 - Left(-) and Right(+)
   - Axis 1 - forward (-) and Back (+)
   - Axis 2 - Rotate forward (-) and Back (+)

   Seems like getX(), getY() and getZ() are not working - wrong order

3) The Analog Gyro does not support the “setSensitivity” method. Comment out in RoboMap.
4) Needed to rename a few sensors (one Time).

```
/home/robot/wpilib/simulation/plugins/
cp libencoder.so libgz_encoder.so
cp libgyro.so    libgz_gyro.so
```