**Setting up Software for New Season**

**(2023 – CenterStage edition)**

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# Introduction

The full extent of setting up a new environment can be accessed using the [FIRST Tech Challenge Software Development Kit](https://ftc-docs.firstinspires.org/en/latest/ftc_sdk/overview/index.html) link. However, this site does not mention how to layer on the Road-Runner and Dashboard software, created/maintained by ACME Robotics (Team #8367), that make the SDK a fully functioning environment for developing a highly competitive robot.

One requirement for the 2023 season is that we must use version 9.0 of the FtcRobotController software. Unfortunately, it appears as though ACME Robotics has not updated their web site for incorporating their software into this year’s release. All references to their software is for version 8.2 of the FtcRobotController. So, these instructions detail how to start with version 9.0 and add in the 8.2 capabilities of   
Road-Runner and Dashboard.

**Note**: These instructions will be updated, time permitting, so that any references to version 8.2 will be replaced with version 9.0.

# Setting up a New Repository

At the beginning of every season FIRST publishes a new version of the FtcRobotController software. It can be found on GitHub at [FIRST-Tech-Challenge](https://github.com/FIRST-Tech-Challenge).

However, there is a similar piece of software called Road-Runner. Road-Runner is derived from this year’s version of the FtcRobotController software and includes additional software needed to build more robust autonomous solutions.

This software, specifically road-runner-quickstart, must be forked, not cloned, into the FIRST-4030 repository using the following steps:

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| 1. | Before you begin it is helpful to create a local folder on your PC to hold all of the software you will need to create a new repository for the season. |
| 2. | From the [ACMERobotics](https://github.com/acmerobotics)  GitHub site, select the  road-runner-quickstart repository. (The site also include a  road-runner-ftc repository but it is based on Kotlin, not Java.) |
| 3. | Select the Create a new fork under the Fork pulldown |
| 4. | Under the Create a new fork, make sure the Owner dropdown is set to FIRST-4030 |
| 5. | Set the Repository name to a string that is indicative of the competition year (e.g., FTC-2023-<SeasonName>) |
| 6. | From the FIRST-4030 repository, clone the new project onto your PC by select the <> Code button and copy the HTTPS URL to the clipboard |
| 7. | Within Android Studio, use the newly selected URL, and use  Git->Clone… to clone the repository into a separate folder in PC your folder. |
| 8. | If a popup window appears saying Project update recommended then select the upgraded link and then select Begin Upgrade, followed by the Run selected steps button. |
| 9. | Refer back to the FIRST-Tech-Challenge and scroll down to the README/Requirements for the [FtcRobotController](https://github.com/FIRST-Tech-Challenge/FtcRobotController) to find the minimum level of Android Studio that we need to use. |
| 10. | In Android Studio, open the About Android Studio under the Android Studio menu dropdown to verify you are using the proper level. |

Once the repository is completed you need to add in those persons who can access it using the following steps:

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| --- | --- |
| 1. | Select the Insights link at the top of the repository |
| 2. | Select the People button in the left-hand list of options |
| 3. | Add all other developers on the coding team with Write access |

# Installing the Dashboard

Supporting autonomous capability is dependent on using Road-Runner, supported by the Dashboard.

**Note**: The requirement for this year’s competition is to use version **9.0** of the FtcRobotController. However, the instructions for installing Road-Runner was written for version 8.2 of the software.   
  
What this means, for now, is that the master branch of the repo must be augmented with a previous version of Road-Runner so that Method 2: Installing RR on your project can be followed. So these instructions attempt to combine both sources of information.

Installing the Dashboard involves modifying files listed in the IDE under Gradle Scripts.

Update low level files using the following steps:

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| 1. | As a “programming best practice” it is useful to isolate unique work to an individual GitHub branch. This makes it easy to rollback your environment if you inadvertently introduce an error(s) that may be hard to unwind. In Android Studio, use the command Git -> New Branch… to create a local space to keep your changes. For the purpose of this document, name it InstallDashboard. (Make sure the Checkout branch dialog button is checked.) |
| 2. | Open the file build.dependencies.gradle. |
| 3. | At the top of the file add the following lines to the repositories block:  maven { url = 'https://maven.brott.dev/' } flatDir {  dirs rootProject.file('libs') } |
| 4. | At the bottom of the file add the following lines to the dependencies block:  implementation 'com.acmerobotics.roadrunner:core:0.5.6'  implementation 'com.acmerobotics.dashboard:dashboard:0.4.15'  implementation 'org.apache.commons:commons-math3:3.6.1'  implementation 'com.fasterxml.jackson.core:jackson-databind:2.12.7'  **Note:** Update the version numbers for the dashboard and  road-runner with values from the right-hand column of each respective repository on GitHub. |
| 5. | Open the file build.gradle for the Project:<project> |

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| 6. | At the bottom of the file add the following lines to the repositories block:  flatDir {  dirs '../libs'  } |
| 7. | Open the file build.gradle for the Module :TeamCode |
| 8. | At the bottom of the file add the following line **below** the dependencies block:  apply from: '../build.dependencies.gradle' |
| 9. | Delete the following lines from the dependencies block:  implementation "com.acmerobotics.roadrunner:ftc:0.1.8"  implementation "com.acmerobotics.dashboard:dashboard:0.4.13" |
| 10. | Open the file build.common.gradle |
| 11. | At the bottom of the file add the following lines to the repositories block:  flatDir {  dirs '../libs'  } |
| 12. | Select the Sync Now button at the top of the IDE |
| 13. | Build the project to make sure there are no errors before you add in some selected software. |

**Note1**: Keep in mind, if ever you make a change to any gradle file then you **must** do a Sync Now to have that change recognized before doing a Build->Make Project.

**Note2**: As of 2024, the background image of the dashboard will appear once the Start button is selected. If the displayed image is not current for the current year then check the Git repository and update the gradle settings for an updated version number.

# Installing Selected Road-Runner Routines

Up until this point, all work has been relative to version 9.0 of the FtcRobotController. Use the following commands to replace some version 9.0 routines with those from version 8.2:

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| 1. | Delete the tuning folder.  **Note:** Normally you should use the Refactor->Safe delete… option so that you ensure that you do not introduce a ripple effect of broken links that may be difficult to unwind. |
| 2. | Delete the following files (in this order): TankDrive, MecanumDrive, TwoDeadWheelLocalizer, ThreeDeadWheelLocalizer, Localizer, and Drawing. |
| 3. | Move the file PoseMessage out of the messages folder and into org.firstinspires.ftc.teamcode folder. |
| 4. | Delete all other files in the messages folder. |
| 5. | Delete the messages folder. |
| 6. | Open PoseMessage. |
| 7. | Add the string .geometry after roadrunner in the import statement. |
| 8. | Replace  .position.x with .getX(),  .position.y with .getY(), and   .heading.toDouble() with .getHeading() found in the body of the routine |
| 9. | From the [ACMERobotics](https://github.com/acmerobotics)  GitHub site, select the  road-runner-quickstart repository. |
| 10. | Change the view of the repository from master to quickstart1. |
| 11. | Select the <> Code button and copy the HTTPS URL to the clipboard |
| 12. | Within Android Studio, use the newly selected URL, and use  Git->Clone… to clone the repository into your folder on the PC.  **Note**: Do not worry about the name of the repository. It will only remain around long enough to copy/paste software from it to your current project. |
| 13. | In the lower right-hand corner, change the checked out branch name from master to origin/quickstart1. |
| 14. | From the TeamCode folder, copy the drive, trajectorysequence, and util folders. |
| 15. | Return to your project and highlight the org.firstinspires.ftc.teamcode folder. |
| 16. | Select the Paste button. You will be prompted for a folder to paste the files in. |
| 17. | Select the OK button |
| 18. | You can select either the Cancel or Add button and select Add. This will place all files into the branch of the git repository on your PC.  **Note:** Selecting Cancel will keep the files under the folder structure of the project but outside the repository. (Ultimately, you will have to add them to the git repository.) |
| 19. | Within the drive folder is a file called DriveConstants. The values in this file are all generic (i.e. not useful) and must be replaced with values specific to your robot for this year. Go thru the defining of constants found at this [link](https://learnroadrunner.com/drive-constants.html#drive-constants) found on the Road-Runner web page and generate new constants for this year’s robot.  Replace the DriveConstants file with the one you just generated.  **Note:** We maintain a [spreadsheet](https://docs.google.com/spreadsheets/d/1uediPz9TUtBo7C0gruGBC34jXajBtIbBwtPTtERR_30/edit#gid=0) on our Google Drive of all of our past/current values that should also be used as a reference. |
| 20. | Surprisingly, the newly generated DriveConstants file does not contain entries for the orientation of the Control Hub and Expansion Hub. Add the following 2 lines to the DriveConstants file:  public static RevHubOrientationOnRobot.LogoFacingDirection   LOGO\_FACING\_DIR =  RevHubOrientationOnRobot.LogoFacingDirection.RIGHT;   public static RevHubOrientationOnRobot.UsbFacingDirection  USB\_FACING\_DIR =  RevHubOrientationOnRobot.UsbFacingDirection.UP; |
| 21. | Open SampleMecanumDrive and modify the names of the motors so that they match those in your configuration file. |

# Verifying the SDK via Road-Runner

Presumably all of the above work will result in working robot. The only way to know is to download the project onto a robot and calibrate it using Road-Runner.

Begin with opening a web browser to the [Road-Runner web site](https://learnroadrunner.com/). This is a “cookbook” of steps to follow that are pretty self-explanatory.

If this is the first time that you have used Road-Runner then select the Before You Start! Button and review the terminology and tips.

Select the [High Level Overview](https://learnroadrunner.com/quickstart-overview.html#are-you-using-drive-encoders) header in the left-hand column. It will display the steps you will go thru.

The first step in calibrating a robot is to generate [Drive Constants](https://learnroadrunner.com/quickstart-overview.html#drive-constants). After that, follow the steps in the order shown on the chart.

# Preserving Changes Back into GitHub

Your local environment now needs to be rolled up into a comprehensive release and pushed back up to the FIRST-4030 GitHub repository. All of the files in the project that appear in green have changed since the last commit. Those in red are new to the repository.

Within Android Studio, use the following steps to commit your changes to the team wide GitHub repository:

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| --- | --- |
| 1. | In the left-hand column of the project window, right-click on the TeamCode folder. |
| 2. | From the dropdown menu select Git -> Add. |
| 3. | From the dropdown menu select Git -> Commit Directory... |
| 4. | A new window will be displayed showing all of the files that will be committed to the local master repository. |
| 5. | Make sure all of the files are selected. (The gradle files may not be selected but they should be.) |
| 6. | Add a brief text string in the Commit Message window that explains why the commit is being done. |
| 7. | Select the Commit button. (**DO NOT** select the Commit and Push… button since you are presumably working on a local branch and the “push” will not do what you think it should.) |
| 8. | Android Studio will analyze the code one last time and display its results. Assuming **no** **errors** are generated, then push the Commit Anyway button. |
| 9. | At this point all of your changes have been committed to your local InstallDashboard branch. These changes now need to move to your local master branch. |
| 10. | From the dropdown menu select Git -> Branches... |
| 11. | Select the master branch and Checkout. (You will see the branch name change in the lower right-hand corner of the IDE.) |
| 12. | From the dropdown menu select Git -> Merge... |
| 13. | Select the InstallDashboard branch. |
| 14. | Select the Merge button. |
| 15. | Move all changes up to the team wide repository by selecting  Git -> Push button. |
| 16. | A new window will be displayed listing all files that will be committed. Assuming every looks right select the Push button. |

# Connecting Repository to Discord Server

Now that you have a repository it is useful to establish a webhook from the repository to our Discord #github channel. (Establishing a webhook results in a notice to everyone in the #github channel being notified whenever there is a change to the repository.)

Before you begin, it is assumed that you have the proper privileges (e.g., webhook, moderation, admin, etc.) in Discord to complete the process. (You will know if you have the proper level of privileges if you **can** complete step #1.)

Use the following steps to establish a webhook between our GitHub repository and Discord:

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| 1. | In Discord, right-click on #github and select Edit Channel. This should display a list of options, in a column, on the left-hand side. |
| 2. | Select Integrations and then View Webhooks. |
| 3. | Select the New Webhook button. |
| 4. | Expand the view of the new webhook and change the name of it to something meaningful to this year’s work. |
| 5. | Select the Save Changes button to save the name change. |
| 6. | Select the Copy Webhook URL button |
| 7. | In GitHub, select the newly created repository |
| 8. | Select the Settings button at the top of the window |
| 9. | Select the Webhooks button in the left-hand set of buttons |
| 10. | Select the Add webhook button |
| 11. | Log in to the repository, if requested |
| 12. | Paste the string into the Payload URL field in GitHub |
| 13. | Append the string /github to the Payload URL |
| 14. | Set the Content type to application/json |
| 15. | Select the Send me everything radio button under the Which events would you like to trigger this webhook |
| 16. | Select the Add webhook button |
| 17. | Select the Starred option in the upper right-hand page which will send a minimalist message to Discord to show that the webhook is working. |

# Troubleshooting

In building this procedure there were a number of errors/issues that arose that took many hours to track down. Here are those errors and possible fixes for them.

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| --- | --- |
| Error / Issue:  Solution: | When building the software the error “Unsupported class file major version 63” occurred.  Check all of the supporting libraries to make sure there versions are compatible. That is, comment out each library and substitute in one of a lower version. Be sure to do a Sync Now before compiling. |
| Error / Issue:  Solution1:  Solution2:  Solution3: | During checkout of the robot the Start and Stop button do not stay on when you hit the Init button.  Check the values in DriveConstants for legitimate numbers.  Make sure that the motor declarations in SampleMecanumDrive match those in the robot’s config file..  Run the opmode using a Driver Station to see if there is a thrown exception |