USING VUFORIA IN FTC

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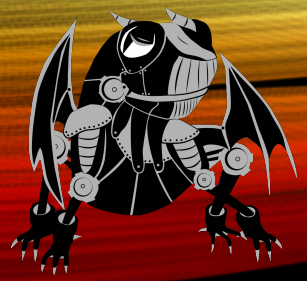
vuforia™



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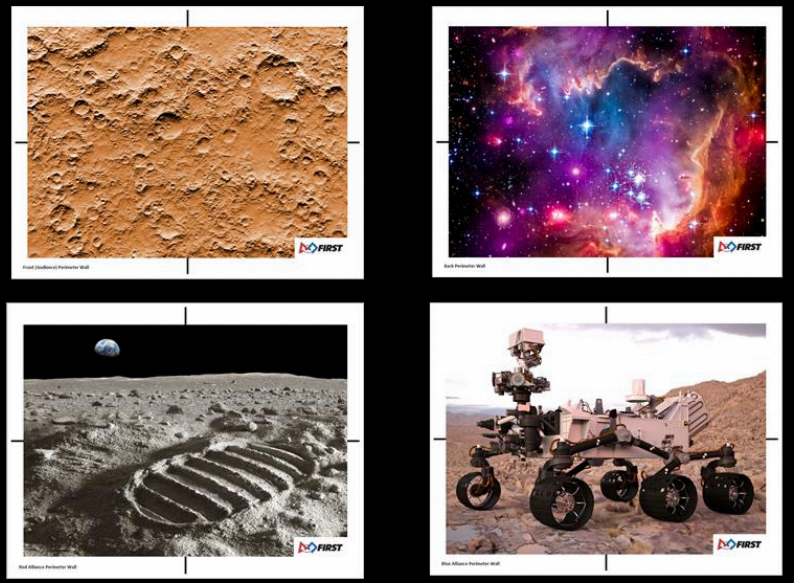
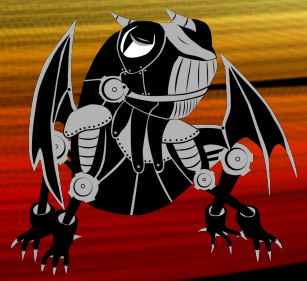
WHAT IS VUFORIA?

- Vuforia is the most widely used augmented reality software, but is also a very powerful computer vision tool.
- In the past few years, FTC teams have been able to use Vuforia for decoding pictures, detecting position, and navigating around the field



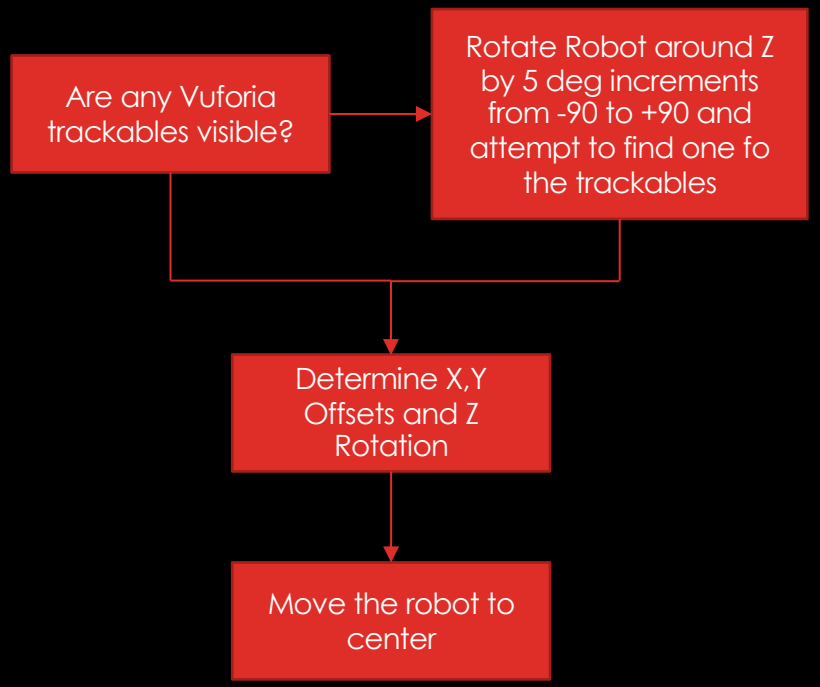


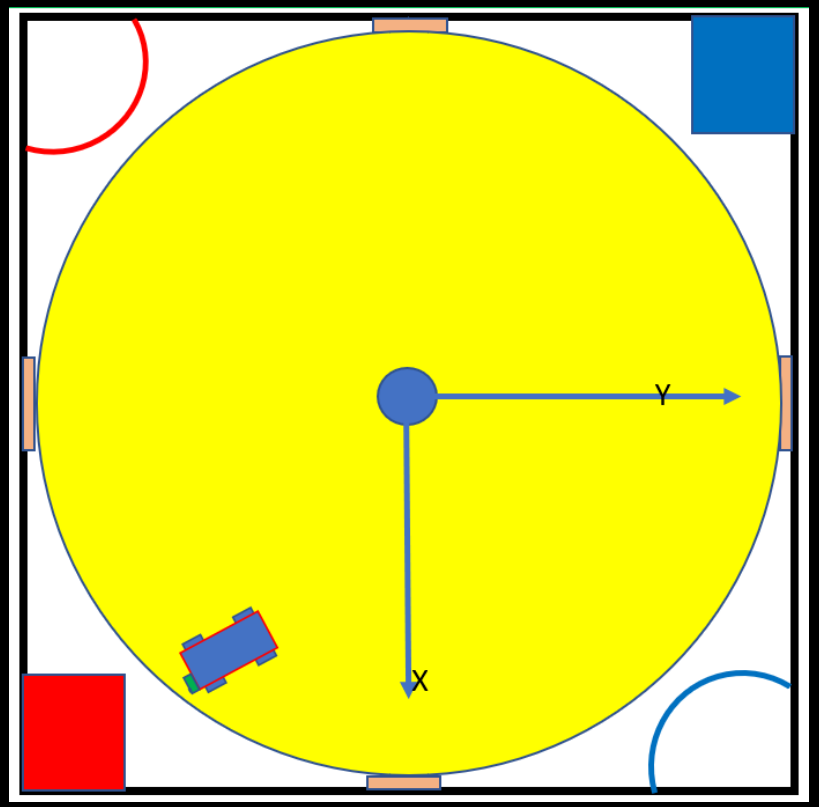
ADVANTAGES OF VUFORIA

- Vuforia can help teams in cases where:
  - They need to figure out proper distances to travel
  - The robot position is messed up during autonomous
  - Their drive code is not very accurate
- Vuforia can solve these problems by:
  - Giving readings from a certain point, and then
  - Adjusting distances from a certain point

ADVANTAGES OF VUFORIA

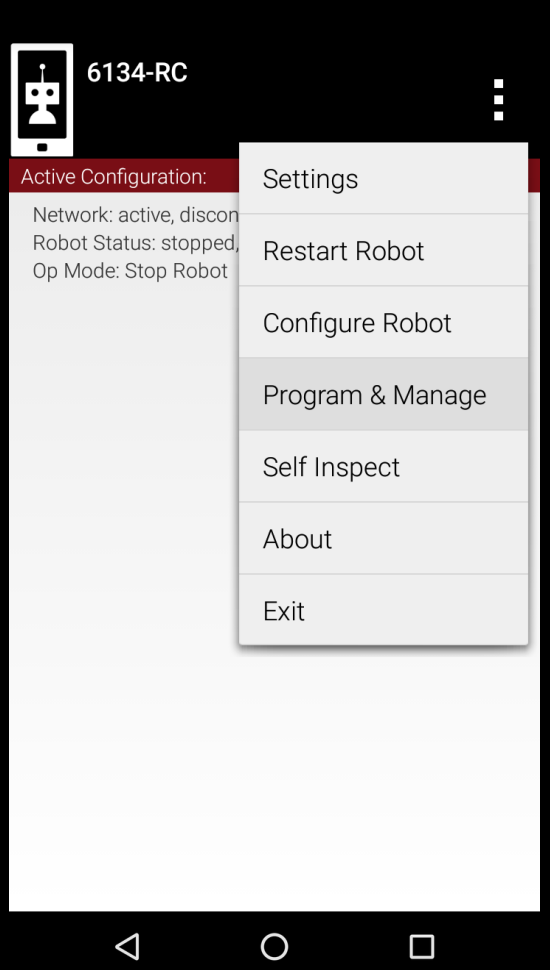
- One example of a workflow with Vuforia is driving to the center of the field from anywhere

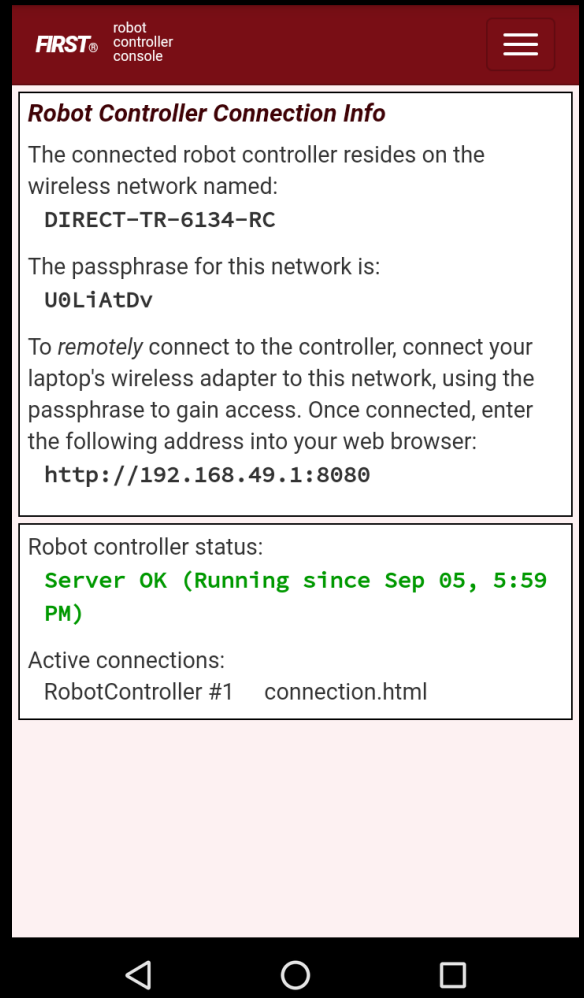




BLOCKS EXAMPLE

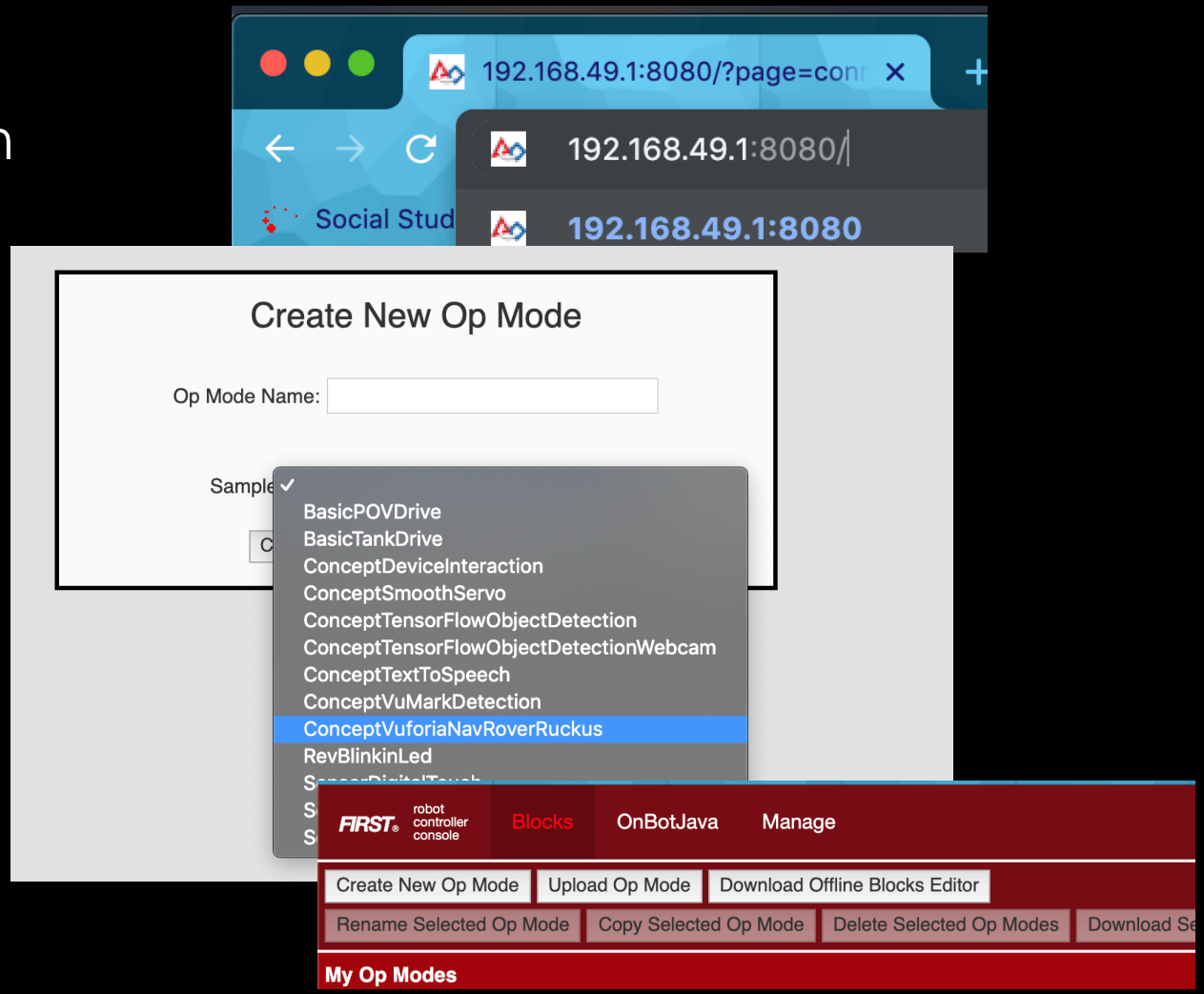
- Now we will go over some examples on how to get Vuforia readings in blocks
- First, open programming mode on the robot controller.
- Then, on your computer, connect to the Direct Network from your phone(should be called something like “DIRECT-someLetters-TEAM#-RC”





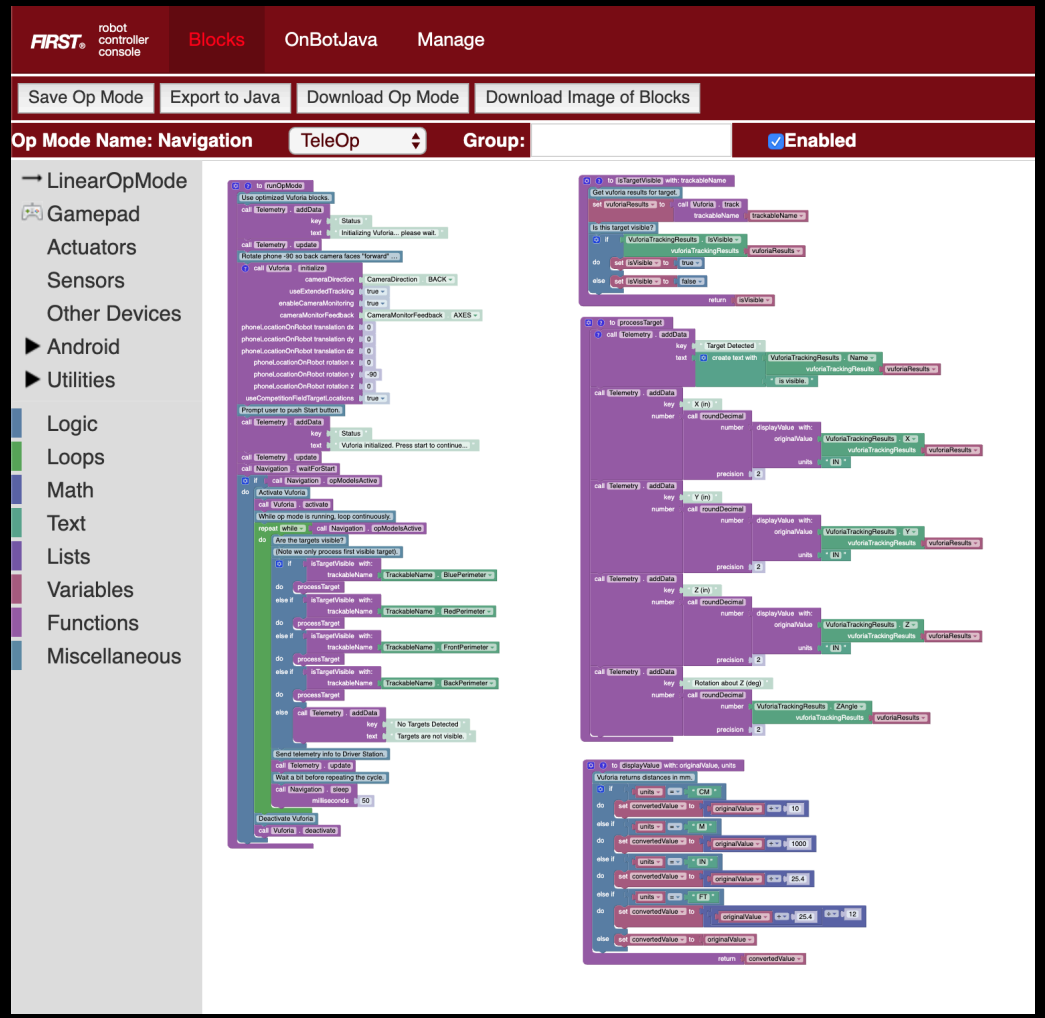
BLOCKS EXAMPLE

- Then, go to http://192.168.49.1:8080 in a browser like Chrome.
- Click “Blocks”
- Click “Create New OpMode”
- In the dialogue box, choose “ConceptVuforiaNavRoverRuckus”
- Name the OpMode whatever you want



BLOCKS EXAMPLE

- Double click the name in the list if it doesn't automatically open
- Read through the program and see how this is identical to the Java code
- Press Save OpMode and check your phone

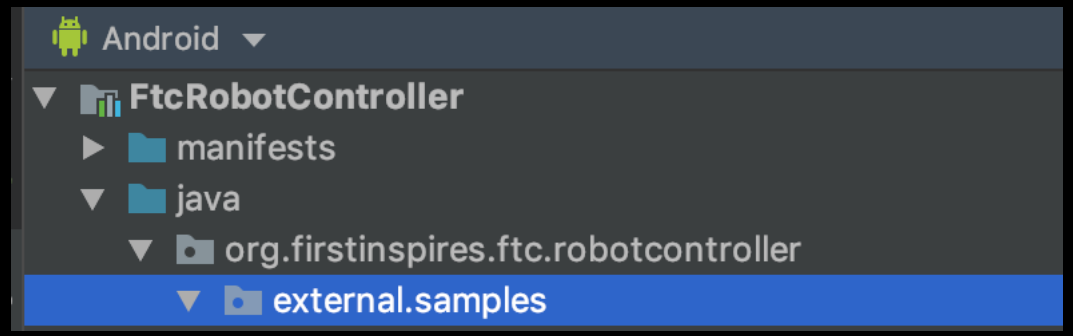


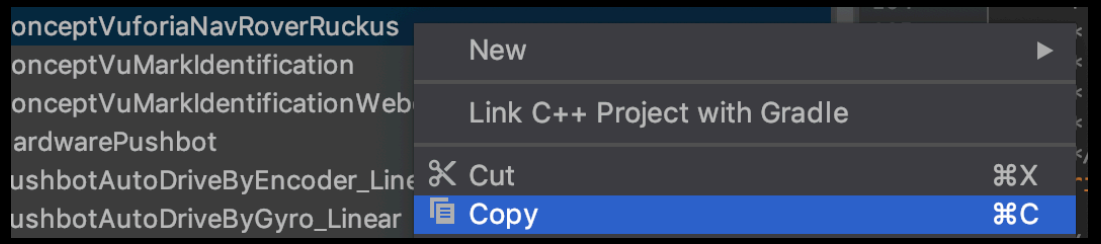
RUNNING THE EXAMPLE PROGRAM

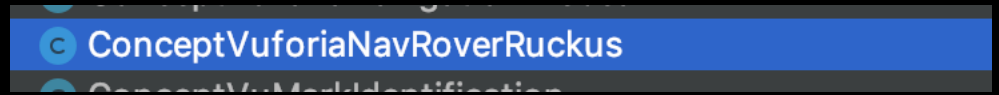
- Select the TeleOp Dropdown on the driver station and click on the name that you assigned the program to
- Click the Init button.
- Wait until the program is ready and then run it.
- Put the robot controller phone in front of the Navigation target.
- Watch as how the output changes when you move the phone around.

JAVA EXAMPLE

- Now we will go over some examples on how to get Vuforia readings in Java
- First, navigate to the “External Samples” folder in the FTCRobotController Folder
- Find “ConceptVuforiaNavRoverRuckus”
- Right Click it and press copy

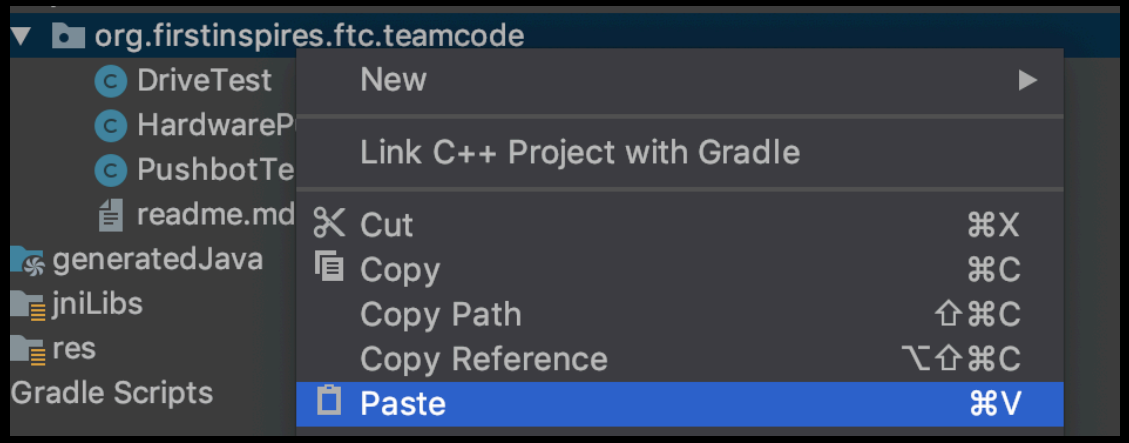




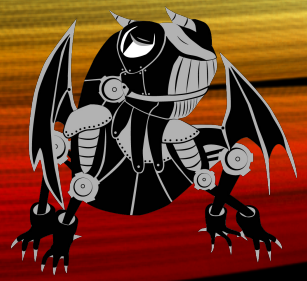


JAVA EXAMPLE

- Find your desired package in the TeamCode Folder and paste the class in, following through the steps to paste it.
- Find the line that says @Disabled, and delete it

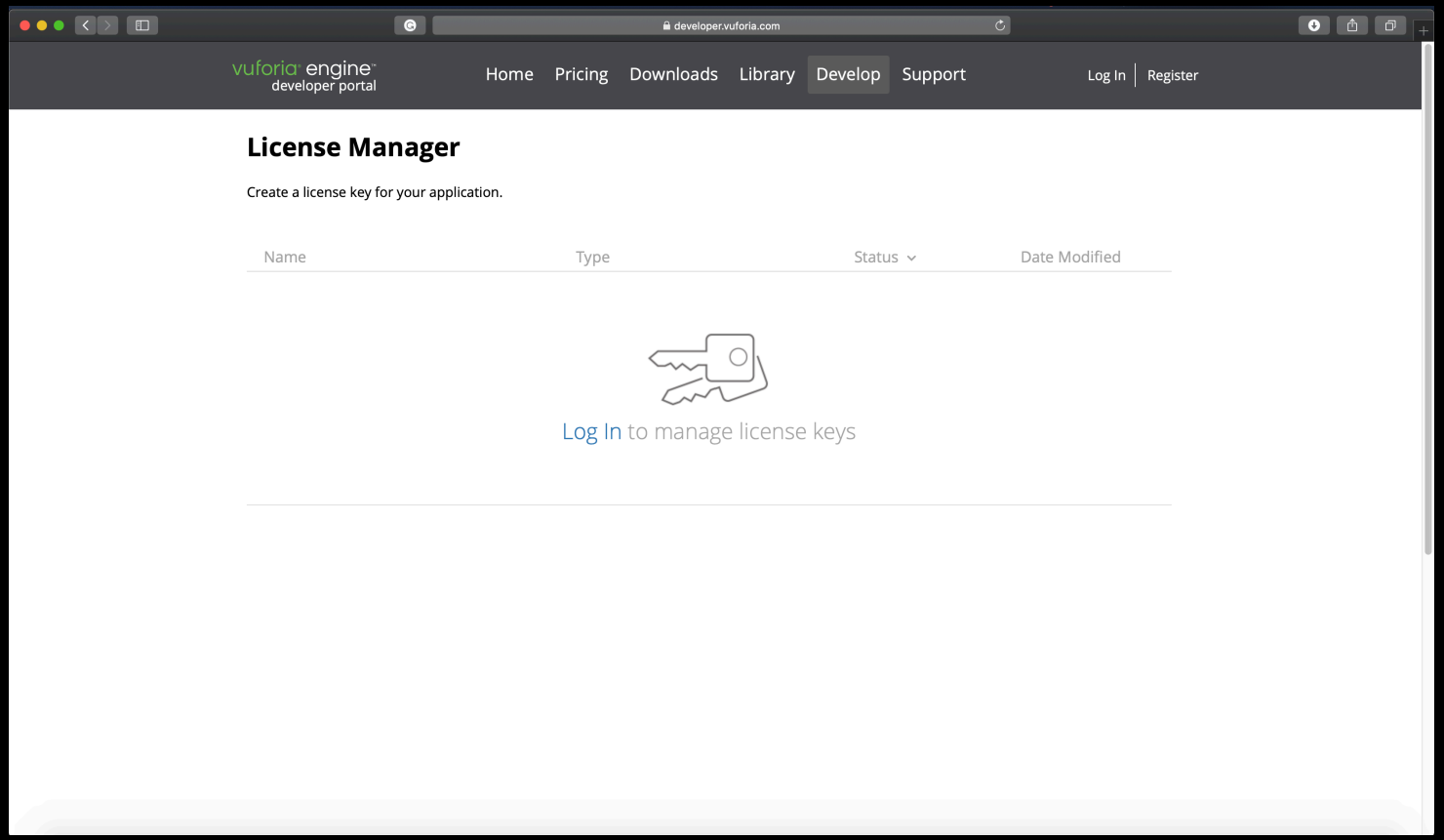



```
@TeleOp(name="Concept: Vuforia Rover Nav", group ="Concept")
@Disabled
public class ConceptVuforiaNavRoverRuckus extends LinearOpMode {
```



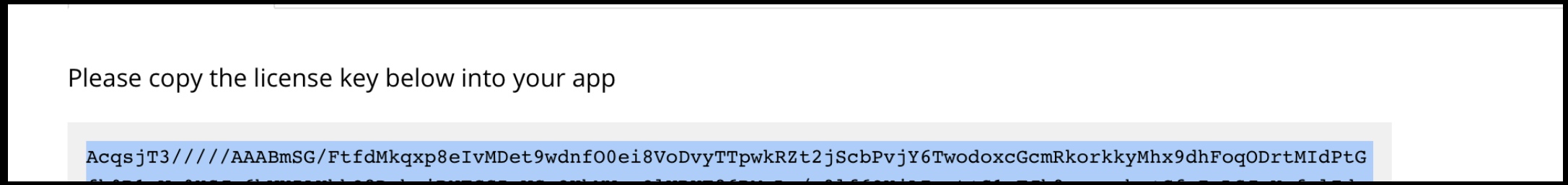
JAVA EXAMPLE

- In a web browser, go to https://developer.vuforia.com/license-manager.
- Click the "Register" Button
- Follow the registration steps



JAVA EXAMPLE

- Once you log in, click the Get Development Key button
- Follow the steps and copy the license key
- Paste it into the String called "VUFORIA_KEY"



- You can run it the same way you ran the blocks sample

CREATING A USABLE EXAMPLE

- Now, we will change the sample program to distinguish between two targets
- First, duplicate the sample program and change the name.
- Then, scroll down and remember these Strings:

```
// sets are stored in the "assets" part of our application.
VuforiaTrackables targetsRoverRuckus = this.vuforia.loadTrackablesFromAsset( assetName: "RoverRuckus");
VuforiaTrackable blueRover = targetsRoverRuckus.get(0);
blueRover.setName("Blue-Rover");
VuforiaTrackable redFootprint = targetsRoverRuckus.get(1);
redFootprint.setName("Red-Footprint");
VuforiaTrackable frontCraters = targetsRoverRuckus.get(2);
frontCraters.setName("Front-Craters");
VuforiaTrackable backSpace = targetsRoverRuckus.get(3);
backSpace.setName("Back-Space");
```

CREATING A USABLE EXAMPLE

- In the whileOpModeIsActive() method, comment out the if(targetVisible) statement

```
            // Provide feedback as to where the robot is located (if we know).
//          if (targetVisible) {
//              // express position (translation) of robot in inches.
//              VectorF translation = lastLocation.getTranslation();
//              telemetry.addData("Pos (in)", "{X, Y, Z} = %.1f, %.1f, %.1f",
//                      translation.get(0) / mmPerInch, translation.get(1) / mmPerInch, translation.get(2) /
//
//              // express the rotation of the robot in degrees.
//              Orientation rotation = Orientation.getOrientation(lastLocation, EXTRINSIC, XYZ, DEGREES);
//              telemetry.addData("Rot (deg)", "{Roll, Pitch, Heading} = %.0f, %.0f, %.0f", rotation.firstAng
//          }
//          else {
//              telemetry.addData("Visible Target", "none");
//          }
            telemetry.update();
        }
```

CREATING A USABLE EXAMPLE

- In the if statement within the for loop, create a new if statement with the condition as (trackable.getName() == “Blue-Rover”) from before
- Then, add an else if under it with a similar condition, but with the “Red-Footprint”

```
for (VuforiaTrackable trackable : allTrackables) {
    if (((VuforiaTrackableDefaultListener)trackable.getListener()).isVisibl
        telemetry.addData( caption: "Visible Target", trackable.getName());
        targetVisible = true;


        if(trackable.getName() == "Blue-Rover"){


        }


        // getUpdatedRobotLocation() will return null if no new information
        // the last time that call was made, or if the trackable is not cur
        OpenGLMatrix robotLocationTransform = ((VuforiaTrackableDefaultList
        if (robotLocationTransform != null) {
            lastLocation = robotLocationTransform;
        }
        break;
    }
}
```

```
if(trackable.getName() == "Blue-Rover"){


}else if(trackable.getName() == "Red-Footprint"){


}
```

CREATING A USABLE EXAMPLE

- Add the telemetry statement defining what target is seen

```
if(trackable.getName() == "BluePerimeter"){
    telemetry.addData( caption: "> ",  value: "Blue Visible");

}else if(trackable.getName() == "RedPerimeter"){
    telemetry.addData( caption: "> ",  value: "Red Visible");

}
```

- Now, when we run it, it will display our own text and not tell us our position
- This kind of program has many uses, such as telling which alliance you are on, and figuring out which wall you are on.

QUESTIONS?

- If you have any questions, please ask them now. You can also contact Black Frog Robotics through our Facebook, Twitter and Instagram.

- Thank you!