USING VUFORIA IN FTC

Sanjith Udupa - Black Frog Robotics 6134



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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

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()

- 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"

1 6134-RC	-	FIRST controller console	
Active Configuration: Network: active, discon- Robot Status: stopped, Op Mode: Stop Robot	Settings Restart Robot Configure Robot	Robot Controller Connection InfoThe connected robot controller resides on the wireless network named: DIRECT-TR-6134-RCDIRECT-TR-6134-RCThe passphrase for this network is: U0LiAtDvTo remotely connect to the controller, connect leptor's wireless advected to this network using	e t your
	Program & Manage Self Inspect	http://192.168.49.1:8080	enter
	Exit	Active connections: RobotController #1 connection.html	5:59

- 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



Create New O	p Mode			
Op Mode Name:				
Sample BasicPOVDrive BasicTankDrive ConceptDeviceInt ConceptSmoothS ConceptTensorFlo ConceptTensorFlo ConceptTensorFlo ConceptVuMarkD ConceptVuforiaNa RevBlinkinLed	teraction Servo DwObjectDetection DwObjectDetectionWebca eech etection avRoverRuckus	m		
S FIRST. robot controllet console	r Blocks OnBotJa	va Manage		
Create New Op	Mode Upload Op Mode	Download Offlir	ne Blocks Editor	
Rename Select	ed Op Mode Copy Selec	ted Op Mode D	elete Selected Op Modes	Download Se
My Op Modes				

• 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

BLOCKS EXAMPLE

FIRST. robot controller console	Blocks	OnBotJava	Manage	
Save Op Mode Ex	port to Java	Download C	Dp Mode Do	wnload Image of Blocks
o Mode Name: Nav	igation	TeleOp	🗘 Grou	p: ♥Enabled
 LinearOpMode Gamepad Actuators Sensors Other Devices Android Utilities Logic Logic 	O I I I I I I I I I I I I I I I I I		Press start to continue.	<pre></pre>
Loops Math Text Lists Variables Functions Miscellaneous	en it Turnergin en it and the second de la Carter Ar en target en target de la Carter Ar en target de la Carter de la Cart		skaladnine Sukaladniani BosPerinster - Sukaladniani PosPerinster - Sukaladniani PosPerinster - Sukaladniani BosPerinster - Na Targeta Detected Targeta an no k celus	ad [cannot) (ctob) ad [cannot) (ctob) ad [cannot) (ctob) ad (cannot) (ctob) ad (cannot) (ctob) ad (cannot) (ctob) ad (cannot) (ctob) ad (cannot) (ctob) ad (c
		Istementy could be Driver Statemin Tomotry could be a statemin be been as a statemin be year with seconds (6) (4)(4)(4)(4)(4)(4)(4)(4)(4)(4)(4)(4)(4)(<pre></pre>

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.

- 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



onceptVuforiaNavRoverRuckus onceptVuMarkIdentification	New	
onceptVuMarkIdentificationWeb ardwarePushbot	Link C++ Project with Gradle	
ushbotAutoDriveByEncoder_Line	℅ Cut	жх
ushbotAutoDriveByGyro_Linear	🖻 Сору	жс

ConceptVuforiaNavRoverRuckus

- 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



a是leOp(nam	e="Concept:	<u>Vuforia</u>	Rover	Nav",	group	="Concept")	
<pre>@Disabled</pre>							
public clas	<mark>s <u>ConceptVu</u></mark>	foriaNav	RoverRu	<u>ickus</u> (extends	LinearOpMode	e

• In a web browser, go to <u>https://developer.vuforia.com/license-manager</u>.

••• <

- Click the "Register" Button
- Follow the registration steps

	6		🗎 developer.vuforia.com		Ċ	0 â 7
V	uforia [,] engine [,] developer portal	Home Pricing	Downloads Librar	y Develop Suppo	Drt Log In R	tegister
	License Manager					
	Create a license key for your applica	tion.				
	Name	Туре		Status 🗸	Date Modified	_
		Log In	to manage licen:	se keys		

- 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"

Please copy the license key below into your app

AcqsjT3/////AAABmSG/FtfdMkqxp8eIvMDet9wdnf00ei8VoDvyTTpwkRZt2jScbPvjY6TwodoxcGcmRkorkkyMhx9dhFoqODrtMIdPtG

private static final String <u>VUFORIA_KEY</u> = "AcqsjT3////AAABmSG/FtfdMkqxp8eIvMDet9wdnf00ei8VoDvyTpwkRZt2

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

- 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:

```
VuforiaTrackables targetsRoverRuckus = this.vuforia.loadTrackablesFromAsset( assetName: "Rove Ruckus");
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");
```

 In the whileOpModelsActive() method, comment out the if(targetVisible) statement

	<pre>// Provide feedback as to where the robot is located (if we know).</pre>
/	if (targetVisible) {
	<pre>// express position (translation) of robot in inches.</pre>
	<pre>VectorF translation = lastLocation.getTranslation();</pre>
	telemetry.addData("Pos (in)", "{X, Y, Z} = %.1f, %.1f, %.1f",
	<pre>translation.get(0) / mmPerInch, translation.get(1) / mmPerInch, translation.get(2) /</pre>
	// 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", rotati <mark>on.firstA</mark> ng
	else {
/	<pre>telemetry.addData("Visible Target", "none");</pre>
	<pre>telemetry.update();</pre>

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

}

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

- 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"



• 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!