Introduction to Vuforia
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- What is Vuforia?
- Programming Vuforia
- Using Vuforia in Rover Ruckus
- Vuforia Resources
What is Vuforia?

Vuforia is an augmented reality software development kit (SDK) for mobile devices that enables the creation of augmented reality applications. It uses computer vision technology to recognize and track Image Targets in real time.

This image registration capability enables developers to position and orient virtual objects, such as 3D models and other media, in relation to real world images when they are viewed through the camera of a mobile device.
Vuforia screen samples

- Camera view with overlay

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Blocks Programming Vuforia
OnBotJava Programming Vuforia

```java
92  * is explained below.
93  */
94  @Autonomous(name="OnBotJava Vuforia NRR", group ="Demo")
95  
96  public class OnBotJavaVuforiaNRR extends LinearOpMode {
97  
98  /* IMPORTANT: You need to obtain your own license key
99  * 'parameters.vuforiaLicenseKey' is initialized is
100  * A Vuforia 'Development' license key, can be
101  * web site at https://developer.vuforia.com/license
102  */
```

Build started at Fri Oct 12 2018 17:42:43 GMT-0700 (Pacific Daylight Time)
Build finished in 5.9 seconds
Rover Ruckus Field Coordinates
Rover Ruckus – Vuforia Notes
References

Programming Resources
https://www.firstinspires.org/resource-library/ftc/technology-information-and-resources

Using Vuforia Vumarks:

FTC Field Coordinate System:
Q&A

• Questions?
Demonstrations
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The right hand screen image shows Vuforia adding x,y,z axis to the camera view on the robot controller.

Using Telemetry the program can display the robot location at the bottom of the driver station display.
If you use Blocks, if you want to use Vuforia, you should view the Java sample program called Concept Vuforia Nav Rover Ruckus. It has many comments that explain how to use Vuforia. Somethings like a Vuforia developers key and positioning of the image targets have been done for you by Blocks.

Show Concept VuMark Detection sample, as modified to work with Rover Ruckus.
For most things Blocks and Java have the same functionality. However, I think there are more sample programs in Java. Both Blocks and OnBotJava have tutorials in the FTC programming resources page at the FIRST website. Show my OnBotJavaVuforiaNRR program which is based on the Vuforia Rover Ruckus sample. Show my OnBotJavaVuforiaTest1 program which drives the robot towards the back wall target.
The FTC SDK makes use of something they call the Field Coordinate System, (see PDF in GitHub ftc_app releases).

**Origin:** The 0,0,0 origin of the FTC coordinate system is the point in the center of the field, equidistant from all 4 perimeter walls (where the four center tiles meet). The origin point rests on the top surface of the floor mat.

**X Axis:** Looking at the origin from the RED WALL, the X axis extends through the origin point and runs to the right and left, parallel with the RED WALL. The X axis values increase to the right.

**Y Axis:** Looking at the origin from the RED WALL, the Y axis extends through the origin point and runs out and in, perpendicular to the RED WALL. Increasing Y values run out (away) from the RED WALL.

**Z Axis:** Looking at the origin from the RED WALL, the Z axis extends through the origin point and runs up and down in a vertical line. Increasing Z values extend upwards.
So Vuforia can be used to locate your position on the field.

Pros
- you get a x,y position on the field in mm or ln. Plus your orientation (rotation).
- you can drive based on the position or rotation depending on your needs.
- Ideally Vuforia is combined with other navigation techniques and used to aid or correct your driving.

Cons
- depending on your phone camera or web cam, the image targets typically have a range limit beyond which Vuforia can't find the target. The perimeter also reduces range.
- If the camera view doesn't include the target you don't get any information, you might need to add a web cam or two, or perhaps one that is on a servo so you can rotate it to face the target as you drive by.
- Using position to navigate might involve complex calculations.
References

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Demonstrate the various programs

- start with OnBotJavaVuforiaNRR to demonstrate the x,y positions
- Show range limit, try range with panel
- use OnBotJavaVuforiaTest1 to demonstrate autonomous driving