QEA Module 3: Mount Doom

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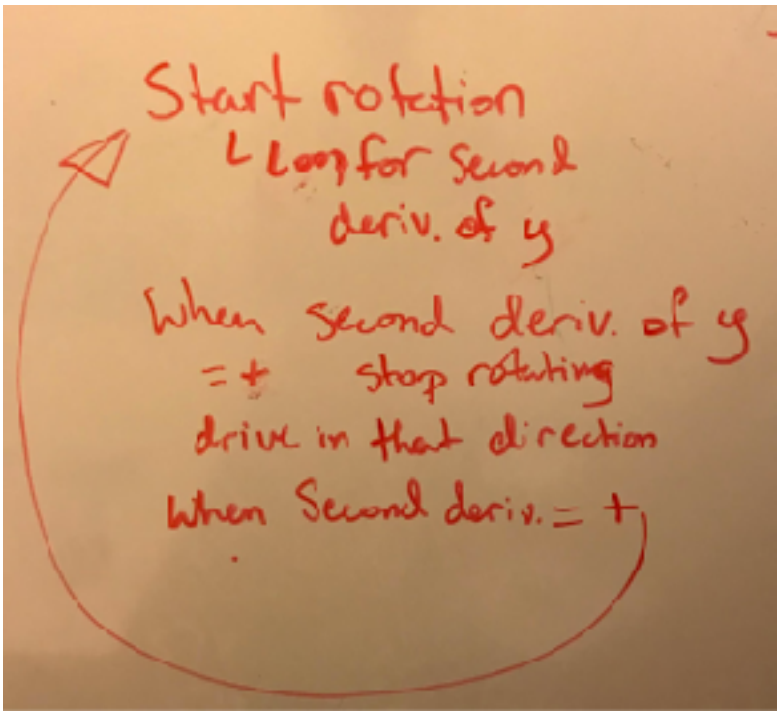
Warm-Up

1. Pseudocode



2. See GitHub

Description

Our first attempt use the first and second derivatives with respect to time of our accelerometer data. We concluded that the 3 axes of the accelerometer data, x, y, z represent the orientation of the robot with respect to the direction of steepest ascent of the curve. The y axis represented the pitch of the robot (sideways inclination) which was an angle we minimized because having a pitch meant the robot was not parallel to the direction of steepest ascent. The z axis represented the steepness of the robot's current heading, which was a parameter we maximized to orient the heading up the slope. While this solution partially worked – it successfully oriented itself on a

piece of plywood in the warmup exercise – there was too much noise in the derivative data to successfully navigate up Mount Doom™.

Upon this realization we removed differentiation with respect to time. We calculated roll, pitch and yaw rotation matrices from static accelerometer vectors. We applied the matrix to the heading of the robot in order to calculate the x, y, and z directions of steepest ascent. We found the angle between the x and y directions of steepest ascent and the current heading, and rotated the robot until the angle fell below a threshold of 5º. We then drove the robot forward, stopping every 0.45 seconds to reorient the heading. The z component of the direction of steepest ascent represented the magnitude of the slope. We set a threshold value of 0.168 to represent the flattest the jacked robot would get on the mountain. Once the Neato reached that point it would stop.

Moving forward we want to write and implement another algorithm to drive the robot from the highest point to the lowest using gradient descent. Furthermore we plan on adapting our current gradient ascent algorithm to have to robot drive continuously up Mount Doom™.

Video
https://youtu.be/pD7ezw6btVQ

Code
https://github.com/Bogidon/qea-robotsn4