Gesture Controlled Driving

Ollie Peng, Manish Raghavan, Victor Sutardja

Overview

Using the Kobuki platform from lab, we built a system by which the Kobuki drives in a path drawn by the user. Specifically, the user draws a path in the air using a brightly colored object. The Kobuki takes a series of images of this path using a webcam mounted on its frame. These images are streamed to a laptop which performs the image-processing needed to detect the object used for drawing. The points from the images are interpolated into a smooth path. Using feedback from the OptiTrack camera system, the Kobuki is instructed to drive along this path, correcting for any errors in real time.

Setup

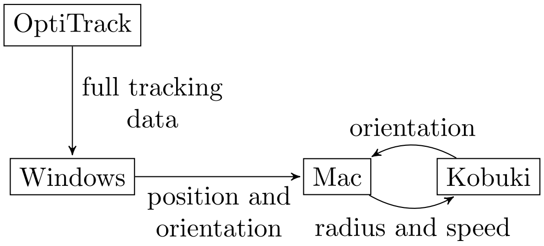

Figure 1: Flow of information

Figure 1 shows the flow of information between various devices. There are two key design decisions we made in order to overcome challenges we faced. First, we streamed the OptiTrack data to a separate Windows machine instead of the Mac that was communicating with the data because the frame rate from the traking system was too high and would be constantly modifying shared variables. Since we were only sending updated commands to the Kobuki once every second, we did not need such frequent information, and therefore used the Windows machine to sample the data at a lower rate before passing it on the Mac. Second, we chose to take orientation data from both the OptiTrack and Kobuki. We did so because the orientation from OptiTrack was given in terms of quaternions in a rotated axis space, meaning that the standard equations for converting to yaw, pitch, and roll no longer applied. Instead, we needed to know which quadrant the yaw was in to correct them. As a result, we used the orientation from the Kobuki to determine which quadrant it was facing, allowing us to use the correct equations to get the true orientation.

Image Processing

B-spline Interpolation

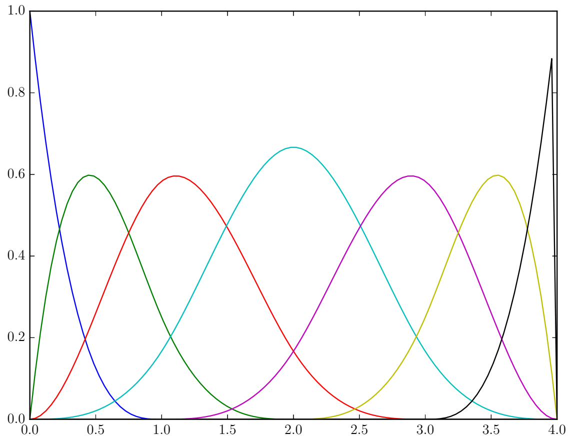

Figure 2: Cubic spline basis curves

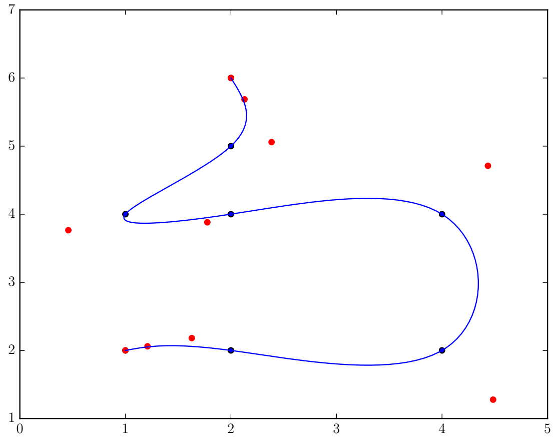

Figure 3: Sample spline interpolation

Timing

Threading

Modeling movement

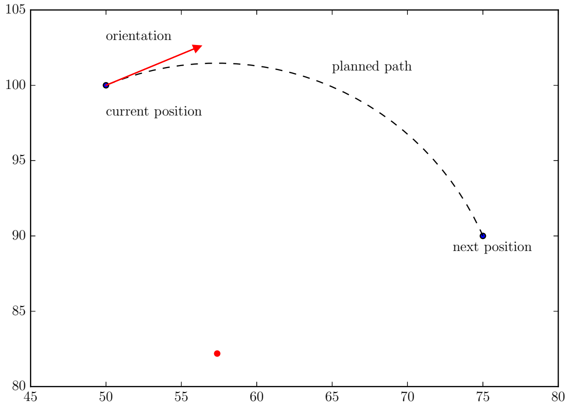

Figure 4: Movement planning

Results