Myo The Force Be With You

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Abstract

Our goal is to develop a VR demo of the "Force" (telekinesis) using the Myo armband and Unity. The user can pick up, move, and throw an object from a distance by pointing at them with the arm and using arm movements and gestures (fingers spread, fist, etc.). In addition, we may use an FPGA to accelerate the demo.

Key Components

1. Myo Armband

Myo Gesture Control armband. This provides the 9-axis IMU (inertial measurement unit) data as well as gestural data to our FPGA.

Spatial data

- Orientation data: roll, pitch, and yaw.
- Acceleration vector data
- Angular velocity data provided by the gyroscope, provided in vector format

Gestural data

The Myo SDK provides gestural data in the form of one of several pre-set poses, which represent a particular configuration of the user's hand.

This data is provided by the proprietary EMG muscle activity sensors. We can potentially classify more gestures using the raw EMG data Myo provides.

[Reference] Classify Gesture using Raw EMG data from Myo

2. FPGA

We will first process the Myo Armband data with Kalman filter on PC first to get it working. Later on, we will implement and run the Kalman filter and other calibration techniques on FPGA to accelerate it.

The spatial and gestural data will be sent to the Altera DE2-115 FPGA board over Bluetooth and the FPGA hardware will implement the accelerated Kalman filter.

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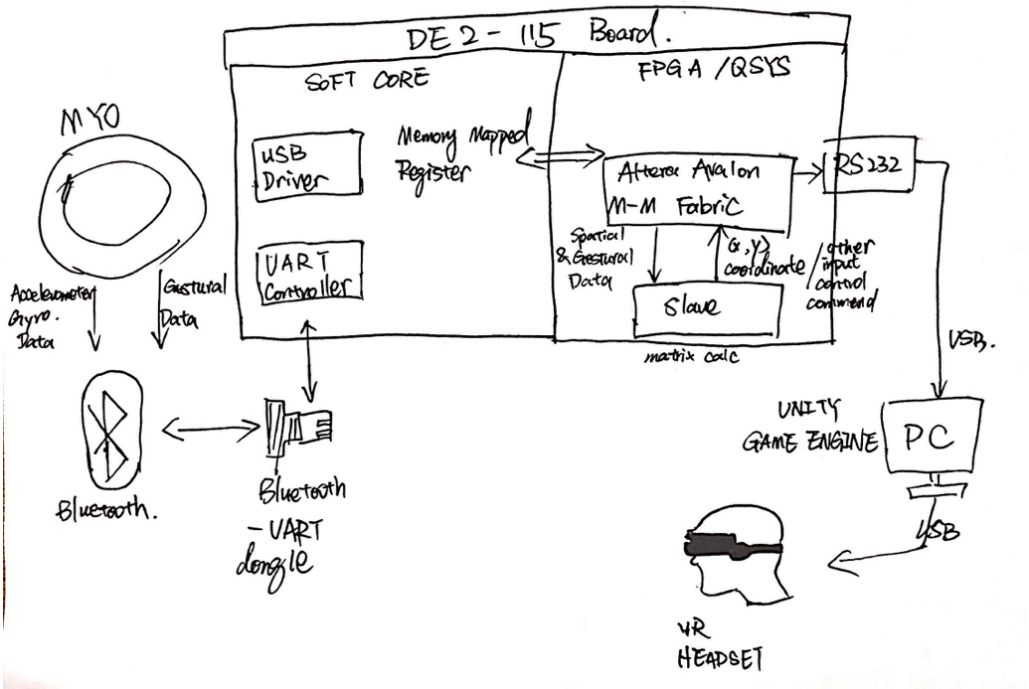

[Reference]

[An FPGA implementation of Kalman Filter on Altera DE2]

[Real-time Arm Movement Recognition using FPGA]

3. UNITY

ARM CONTROL SPECIFICATION

Point at an object using the arm: The Myo gives us the orientation, and we can assume the Myo armband is at a fixed distance from the headset, so we can compute the vector of the arm in world space. We can check if an object is selected by computing the vector from the arm to the object, and comparing this vector with the arm vector. We could add a visual marker (like a laser pointer) to help the user out.

The Myo can recognize an open/closed hand, so we can use that to grab/release an object. We can move the arm inwards to increase the velocity of the object coming toward us, and move the arm outwards to increase the velocity of the object moving away from us. Also, we can move the object left, right, up, and down by moving the arm correspondingly.

[Reference]

Gesture spotting with body-worn inertial sensors to detect user activities