**Accelerometer Writing Tool**

**Taking Data**

To write letters using the Accelerometer Writing Tool (titled Alphabet in our files), one must first write out those letters using an accelerometer as their “pen” or writing device. While doing this, it is crucial that the accelerometer is not rotated about its own axis. This means that the positive x direction should stay pointing to the right, and the positive y direction should stay pointing forward during the **entire** motion. This ensures that the calculated position data does not include unwanted motion.

**Counteracting Drift**

When taking data, the hardest obstacle to overcome is drift. This is a natural occurrence, and causes acceleration to continue in certain directions while it may not be occurring in reality. So, we have some minor techniques to counteract as much drift as possible for improved data.

1. When closing a loop, or drawing the corner of a feature in a letter, make it sharp and abrupt.
   1. This ensures that the deceleration outweighs the drift acceleration that may decrease the accuracy of the position data.
2. Find out which direction your device drifts naturally to overcome it.
   1. For example, one of our test devices is a Huawei P20 Android phone. It drifts naturally to the left, so we ensured that the acceleration to the right was more intense than acceleration to the left for more accurate results.

**Naming Conventions**

After obtaining the acceleration data in a **.csv** file format, one must rename the file according to our Naming Conventions text file. It is in the same folder as this document.

**Understanding Calculations**

To convert the obtained acceleration data into position data, it is necessary to use discrete integration, or double integration. This can be done using the following equations:

To convert acceleration into velocity:

And for velocity into position (signified by ):

*Note: are (0, 0, 0) at .*

**Plotting Data**

Once this has been done, it is time to plot the acceleration graphs and compare them to the 2D position graph. This allows one to see the acceleration in x, y, (and z), as compared to time, alongside the position in y compared to the position in x to get an idea of what path the tracker traced.

To do this, locate the file **AlphabetPlotter.py** from the **src** folder in the GitHub folder. Simply run this file, and select the desired acceleration data through the dialog box. The program will then convert the acceleration data into position data, and plot what was discussed earlier. In its conversion process, the program will check if an acceleration data value is under a certain error margin (which depends on the device), and if so, the acceleration in that direction will be turned into a zero value. If the obtained position plot does not look like the written letter, see the above section “Counteracting Drift” to improve your data.