Introduction

In this project, the objective was to create a program that detected a connection with a Wiimote and, following this detection, move the Wiimote in various “everyday” motions while recording the acceleration of the Wiimote in the X, Y and Z direction. There were three separate motions, each one performed three times: a bowling swing, and drawing “ND” in the air. Once the data was collected, it was graphed using Excel and annotated in Word.

Procedure

For the initial test run, the Wiimote was positioned on each of the six sides of the device to show the effects of gravity on the accelerometer in the device. It was held for roughly one second on each face. For the baseball pitch, a standard overhand pitch was performed. For the bowling swing, a swing with no movement in the X-direction was attempted, although human imperfection did cause some change in the X-direction. Finally, for the drawing of the ND, each section of each letter was completed in a swift manner with a short pause between sections to make the data easier to interpret when graphed.

Analysis

The test run proved useful in determining the impact of gravity on the readings from the Wiimote’s accelerometer as well as in making it clear how the device’s physical axes correspond to the axes defined by the Wiimote library. It was determined that right and left directions
correspond to the X-axis, forward and backward directions to the Y-axis, and upward and downward directions to the Z-axis. This was determined by comparing the orientation of the Wiimote to the data and determining how gravity was affecting each measurement. For example, when the Wiimote was laid flat on its face (buttons down), there was negative acceleration in the Z-direction which means that moving the device toward the ground with the battery cover facing the ground would produce a negative acceleration while moving it upward would produce the opposite effect.

For the baseball throw, the graph of the data showed smaller acceleration values for the wind-up in comparison to the actual pitch because the action of pitching the ball is obviously involves a much faster change in velocity than that of a wind-up. The same thing applies for the bowling swing as the forward part of the swing has far greater acceleration than the backward part of the swing. For the ND, the acceleration during each portion of the letters could be seen much more clearly since the motions were a lot less complicated than the first two movements. For example, for the upward part of the N, one could see a very well-defined positive acceleration as the section of the letter was started, then a leveling off because velocity became steady and then a negative acceleration as the movement was halted.

Conclusion

In the end, the project helped to gain an understanding of how the device works and how physical directions correspond to machine-defined directions. The tools developed will be useful in analyzing gestures to be used in future applications where gesture recognition is required.
Graph 1

Baseball Throw (X-Direction)

Graph 2

Baseball Throw (Y-Direction)
Graph 5: Bowling (Y-Direction)

Graph 6: Bowling (Z-Direction)
Besides human deviation in the Y direction, there are no variations for Y when drawing an ND. (Exception: An additional “air stab” was added at the end for data comparison purposes.)
Graph 9

Graph 10

Test Run

Drawing ND (Z-Direction)

Diagonal section of N
Curved section of D
First upward movement of N
Second upward movement of N
Downward movement for D

Samples

Z Acceleration

Run 1
Run 2
Run 3

Wiimote flat on table
IR sensor pointed at ceiling
Wiimote laying on left side with IR sensor facing away

Wiimote flat on button face
IR sensor pointed into table (on end)
Wiimote laying on right side with IR sensor facing away

Samples

Acceleration

X
Y
Z