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CMSC 491

Sensor Streams into 3-D Orientation

Per the assignment, we were tasked with using the accelerometer, gyroscope, and magnetometer to calculate the 3-D orientation of an android device. I began by calculating 300 instances for the x, y, and z axis for the three sensors. To note, the accelerometer gathered instances at 3 times the rate of the other sensors. To account for this, I only took every third instance. I stored them into an array list, and divided each of them by 300 to obtain the 9 mean values. These values are crucial in obtaining the pitch (X), roll (Z), and yaw (Y) values we are looking for. I calculated these values twice, once with the accelerometer, and once with the gyroscope. To obtain the pitch from the accelerometer, I used the formula atan2(-avg\_acclx, sqrt((avg\_accly\*\*2) + (avg\_acclz\*\*2)). To obtain the roll, I used atan2(avg\_accly, avg\_acclz). Lastly, to obtain the yaw, I used a formula that contained both data from the accelerometer and magnetometer. The formula was atan2(-avg\_magx \* cos(accl\_roll) + avg\_magy \* sin(accl\_roll), avg\_magz \* cos(accl\_pitch) + avg\_magx \* sin(accl\_pitch) \* sin(accl\_roll) + avg\_magy \* sin(accl\_pitch) \* cos(accl\_roll). Next, I used my data from the gyroscope to calculate the pitch, roll, and yaw. The roll can be gathered from gyro\_roll += gyro\_x \* dt, where dt represents the time (in seconds) between instances. In this case, dt is always 1/5. The pitch can be obtained from the same formula, but with gyro\_y instead. The same values could have also been calculated by using the formula 300 \* avg\_gyrox (or avg\_gyroy) \* 60. The same yaw formula also applies here, but with the newly obtained pitch and roll.