Final Project Report

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Introduction:

In this project ,we aimed to design a distance recording program, with board STM32F429I with Gyroscope I3G4250D. Our report will include the methodology of calibration and distance calculation.

Methodology abstract:

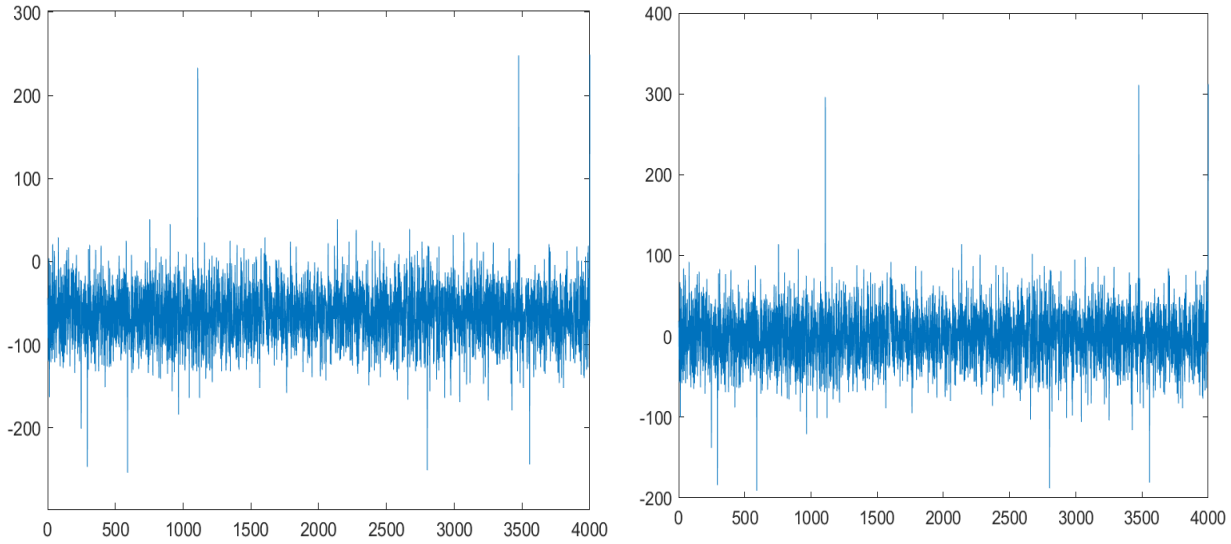
—Basic Measurement—

1.We decided to use the Z axis as better measurement output.The reasons will be mentioned in Distance Calculation Method 1

2.We measure the length of tiles in videos using ruler and Apple's distance measure App.

—Calibration—

1. We notice that even when the gyroscope is still, there are still readings from the board. We collected 4000 reads in 40 seconds and found the average reading was -63.(left)This could be



The above pictures show the data before(left) and after(right) offset removement

because the temperature between my room and the temperature that data sheets suggest(25 Celsius Degree) is different. We will be including this offset during Further Calculations.

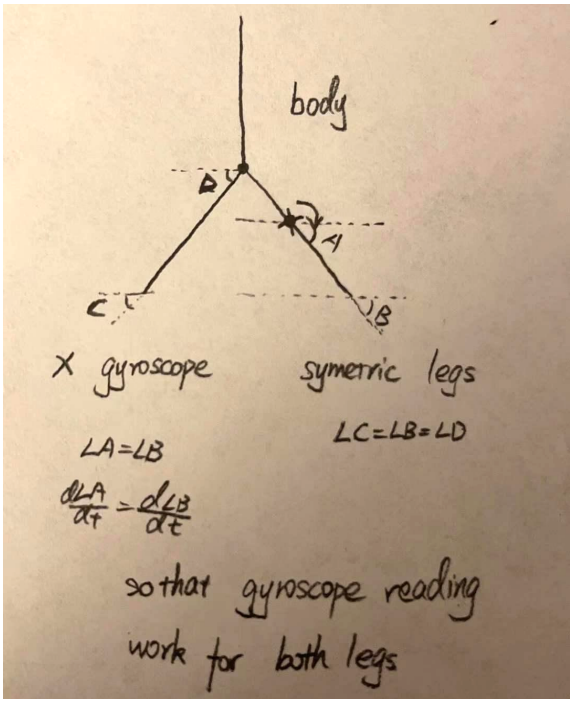
2. Though we found that the readings in gyroscopes means 245dps, we tested this ourselves to check it. We Design a 4000 sample reads in 40 seconds during which the gyroscope is spined 10 whole rotations around the Z axis of the board(3600 degrees) and test the total amount of readings. We got around 38,000,000 in summation over 40 secs. knowing this should mean 3600 degrees per 40 seconds. we get 262 DPS which is close to the data sheet.

```
sum(calibration2)
abs(sum(calibration2)/3600/40)
```

```
ans = -37774218
ans = 262.3210
```

—Distance Calculation—

Method 1:



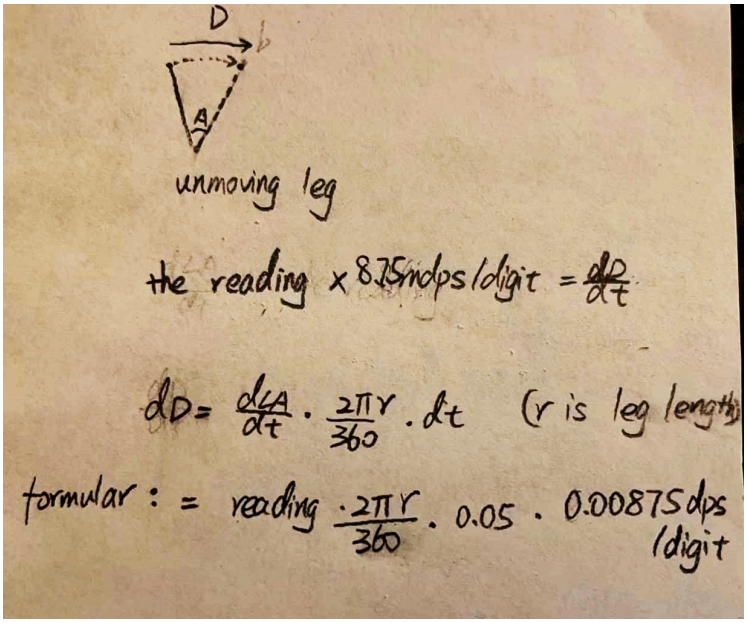
The method utilized leg length and angular velocity to approximate the distance moved. This includes an assumption that when one walks both legs are symmetric to each other. Hence, we choose to use data from the Z axis so that when we are testing on the side of the leg. Additionally, we put the board higher than knee to avoid difficult data processing.

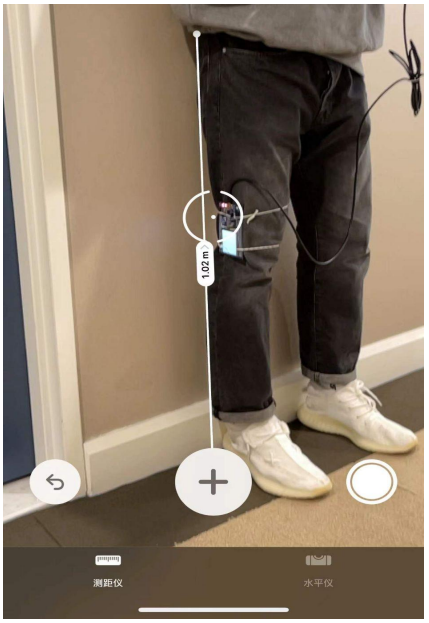
The mode of Calculation is as left:

Since we know that reading works for both legs but just in different signs, we can do the following analysis.

In the draft below, we know that when one walks, there is always one foot that is not moving at the time, then we have the formula:

change in Distance=reading(offset removed)*2πr*0.05(sampling frequency)*0.00875





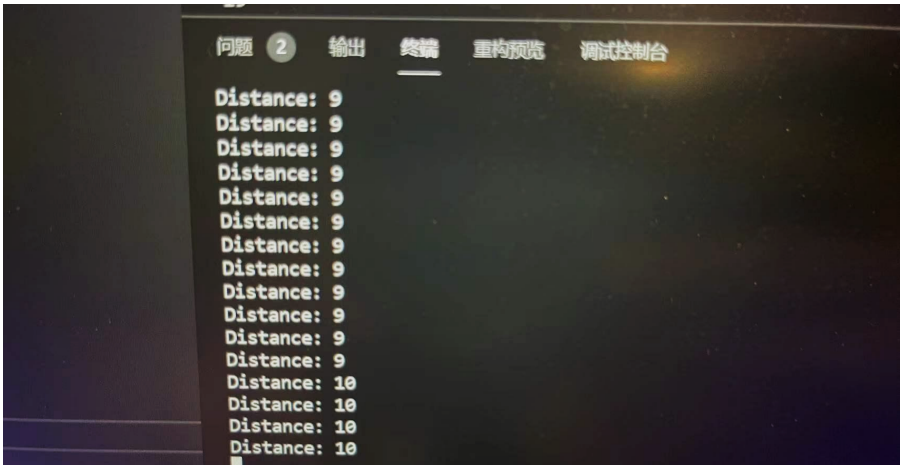
note:0.00875 comes from I3G4250D user manual page 10 as typical value of sensitivity and r is measured from leg using apple distance measure App and rule(the picture of Apple distance measure is shown for clearer effect).

Method 2:

In This method we used the fact that every step that one person takes is a period and we only need to find the transition of positive to negative angle velocities in order to determine steps. Then we tested the average length of our steps and gained 0.7 meters for each.

Method 3:(Adopted)

This method is Improved from Method one so that it can print out the distance every time a value is read for which we have determined to be beneficial to our video recording.



(a sample showing terminal output of method 3)