

1.How to calculate the distance based on accelerometer?

Yes, but have some issue cause the error.

The acceleration is the rate of change of the velocity of an object and the velocity is the rate of change of the distance of an object. If we obtain the acceleration, we can calculate the position if a double integration is applied (with initial position). The calculation is as shown below.

$$v = \int (\vec{a}) dt \text{ and } \vec{s} = \int (\vec{v}) dt \therefore \int \left(\int (\vec{a}) dt \right) dt$$

Figure 1

This assumption is correct if the sampling time tends to be zero, but with accelerometer we should consider the sample rate. In a real situation an error is generated as shown Figure 2. The red line is the real world acceleration, the blue line is our sample acceleration. With Figure 2, if we just integrate the acceleration, the error will dominate the data. The solution of this problem is using the formula that consider the previous data (Figure 3).

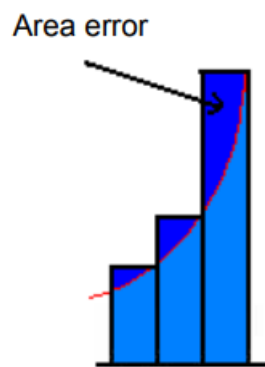


Figure 2

$$Area_n = Sample_n + \frac{|Sample_n - Sample_{n-1}|}{2} \times T$$

Figure 3

Another issue is the noise of accelerometer device, we should use the Filter filtering the accelerometer data like Kalman filter. This algorithm also consider previous data.