Comparing the Garmin Forerunner 220 Watch and the Sparkfun GPS shield: Goliath vs. David

Overview:

I recently happened upon a Garmin Forerunner 220 (that costed 320) at Best Buy. I had a chance to use it yesterday with a heart rate monitor and thought the display was pretty nice. However, I wanted to test the accuracy of the watch and decided to go on a run with a Sparkfun GPS shield to pit the devices against each other.

Setup:

I wore the Garmin on my right wrist but did not strap on the chest monitor. Separately, I attached my GPS device (hooked up to an SD shield which was in turn hooked up to an Arduino Uno) to a portable USB battery and stuck the combined apparatus in a drawstring bag which I wore around my shoulders. The issue with the latter setup is that there are lots of cables and wires, so it might fail to record—-which is exactly what happened. Another issue could also be that the battery could not supply enough power to the device.

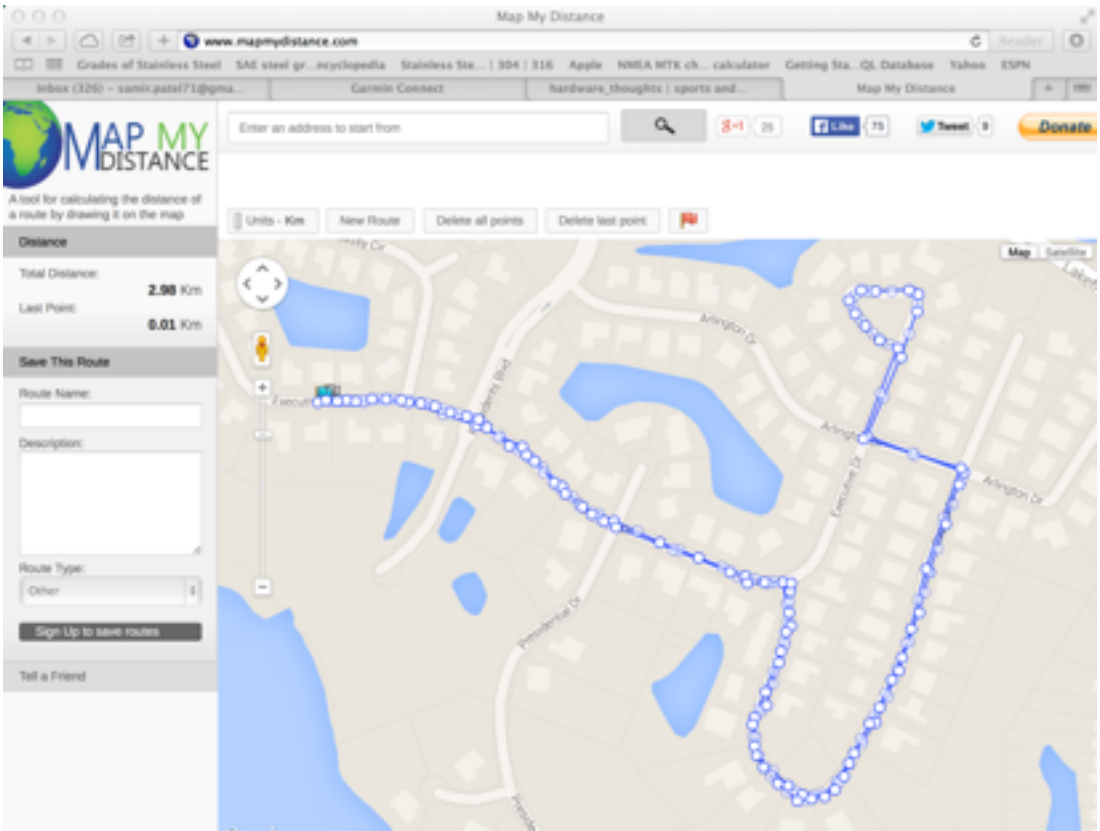
Path:

The idea was to run around my neighborhood and intersperse some long-distance running, short-distance sprints, and stationary points. I wanted to track the devices' ability to overlap on sprinting occasions and how accurately they could gauge speed and distance (and measure up to each other!).

Results:

Distance

Here is a route of my run that I created on MapMyDistance.com:



Altogether, the route that I took was just 2.98 kM when I plotted it on MapMyDistance. It took me just about 13 minutes and 25 seconds to complete it. The times seemed to match up pretty accurately—-the devices recorded the similar GPS times around the point at which the shield stopped logging data.

Distance-wise, MapMyDistance and Garmin told me I ran 1.85 miles and 1.81 miles in total. The

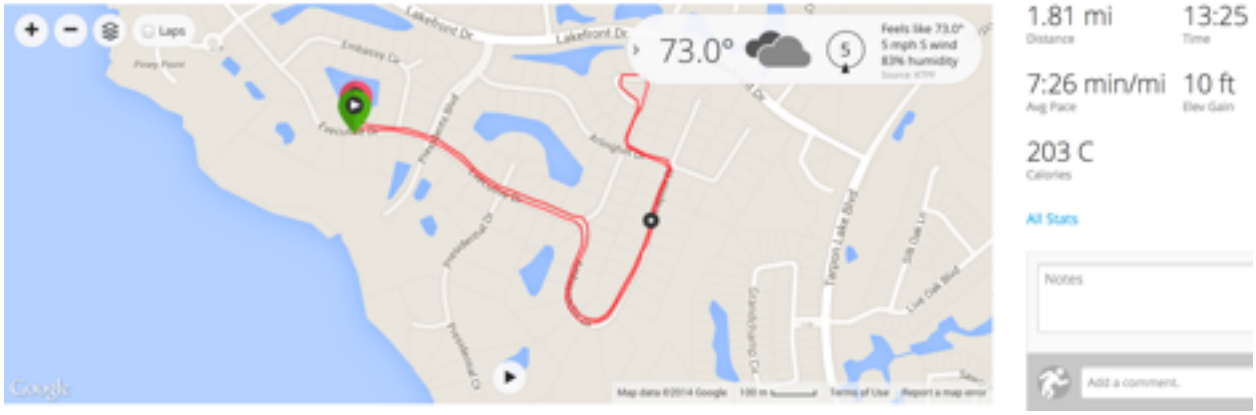
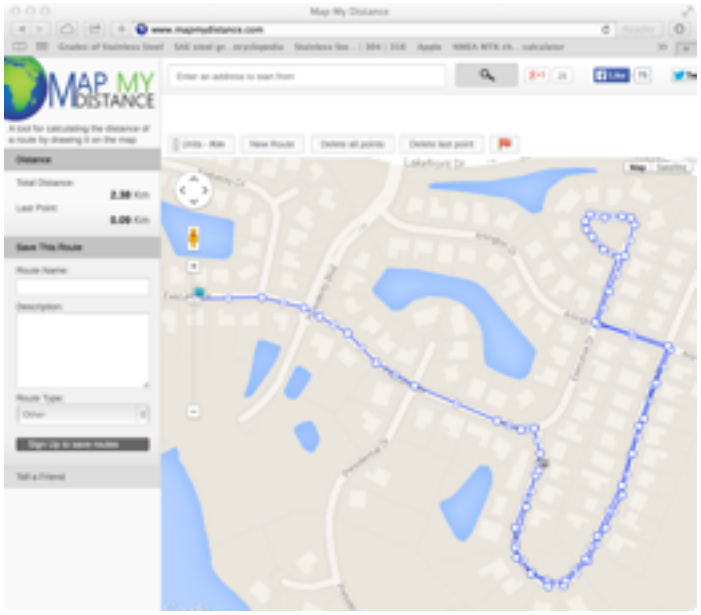


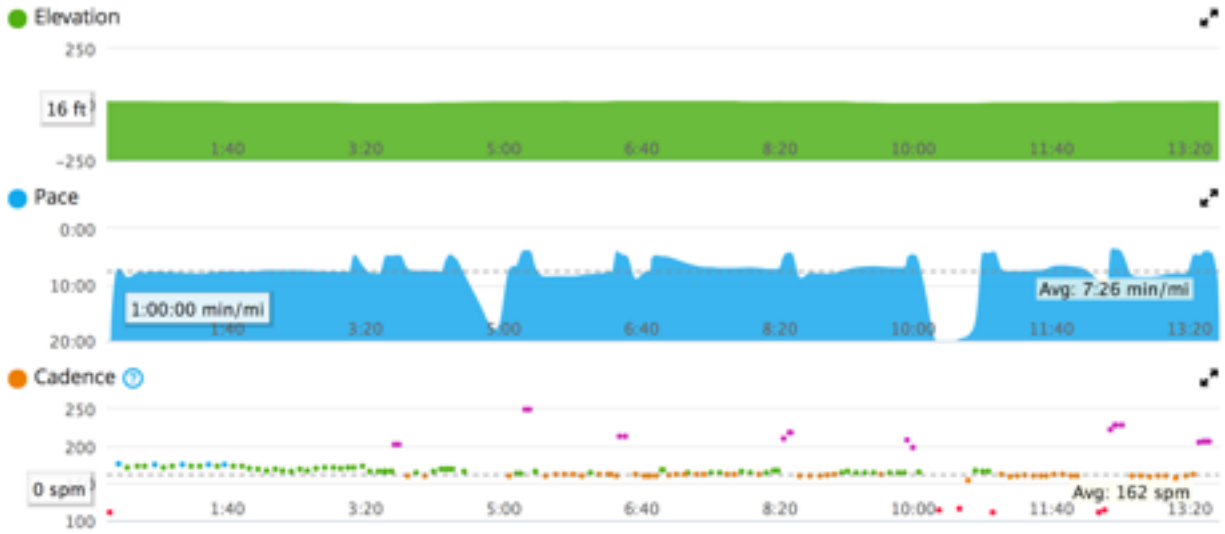
image above shows the route that the Garmin GPS logged, which would appear fairly accurate with what I plotted on MapMyDistance. The image below and on the right is the MapMyDistance plot of the path I ran up until my GPS shield failed. The image below and on the left is the actual data recorded by the GPS shield.



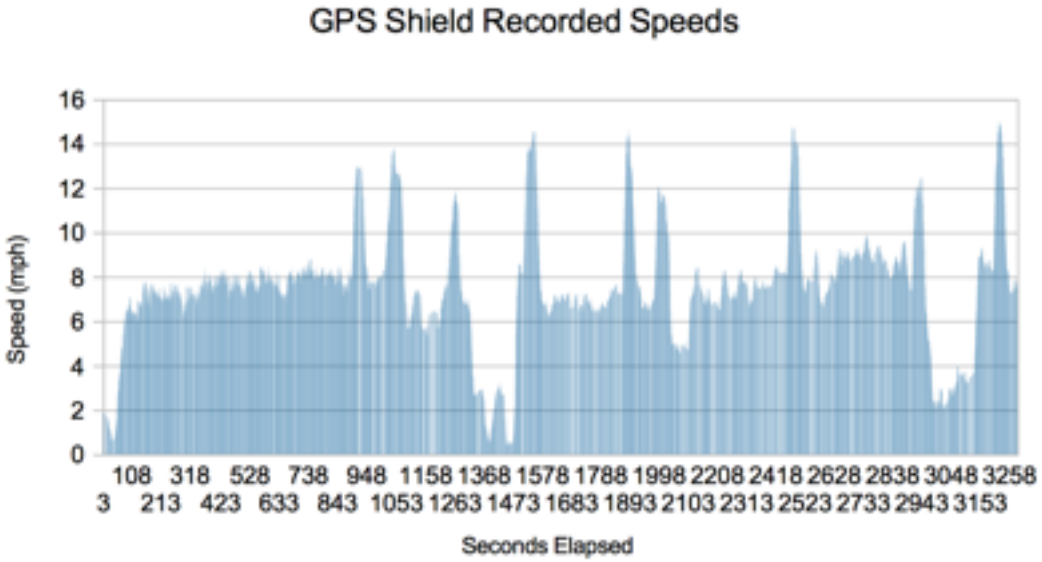
It would appear that the GPS shield was not as accurate as the Garmin GPS. There were instances where the path indicated that I was running on the sidewalk or grass, yet I did not run on the sidewalk or grass during my run. Additionally, there are some deviations from the course where bad data appeared—-this will require software implementations to weed out bad data from the GPS shield MapMyDistance told me I should have run 2.38 km up to the point where my GPS shield stopped working, while basic position/time integration from the GPS data told me that I had run 2.2 km. That's an error about 10%. Seeing as how the Garmin was off by some amount (though not 10%), this would lead me to conclude that my GPS shield might not be as accurate as the Garmin.

Speed

Digging into the actual data, I have provided snippets of the Garmin and GPS pace data below.



Garmin Data (above)



As we can see, the GPS shield and Garmin both pick up the intervals when I am running, sprinting, and resting/going really slow. The Garmin data would appear to be taken at different intervals or when there is a noticeable change in acceleration as it looks very smooth. The GPS shield data is understandably noisy as it is unfiltered and raw (given this is what I used to compute distance for the GPS shield, that seems pretty good!).

Note that I did stop running at certain times. The Garmin told me my lowest pace was around 2 minutes per mile, which is close to what my GPS shield had indicated as well. The last part of the Garmin data from 10:50 and onwards was not captured by the GPS shield as the latter stopped logging.

Were they exactly the same? No, but they were close. The Garmin told me I had an average pace of 8.1mph while the GPS shield told me I had an average pace of 7.46 mph. Granted, the GPS shield didn't get the last part of my run, which is when I had a couple of sprints and might have raced my overall pace. Additionally, the Garmin told me my max speed was 17 mph while the GPS shield told me it was 15 mph.

Conclusion:
After I muse over these findings during a long night's sleep!

Sources of error:

- A potential source of error in distance mismatching is identifying the exact route I took. It could be the case that MapMyRun is not correct and that the Garmin route is indeed the route I took. Same goes for the GPS shield.
- A potential source could be inaccurate velocity estimations. Both of the GPS devices could very well be off in their velocity estimation.
- There are probably other things out there but I'm sleepy :)