

Abstract

Smartphones have revolutionized the way users interact with the world and have helped pave the way for hundreds of new and exciting mobile applications. A complex array of sensors exists within smartphones, including GPS, barometer, accelerometer and other positional sensors that are leveraged by these mobile applications. These sensors are capable of providing location, speed, gradient, altitude, and acceleration data that are foundational for providing a new generation of mobile fitness applications. One such example is the development of cycling power meter applications within the sport of road biking that provides new insights into the real time power expenditure and overall cycling efficiency. This research focuses on the potential of using a smartphone and opposing force power meter (OFPM) as a replacement for traditional and expensive direct force power meters (DFPM) that have been the “de facto” standard over the last ten years. Field collected power meter cycling data, combined with spatial analysis, is used to compare various dimensions of power meter accuracy, GPS road network accuracy, elevation agreement, and cost. The overall results of this field study showed that using a smartphone power meter application performed within +/- 10% on average when compared to a traditional DFPM meter, but only when the application had access to high quality location and speed data from the smartphone’s GPS sensors. The results also showed that on average, the OFPM system performed within +/- 2% on average when compared to the DFPM reference power meter but was challenged with data latency on quick changing terrain and accelerations. Concluding the research, a summary analysis is provided as a way for cyclist to quickly understand how well each power meter performed and to determine if a specific power meter system is better suited for a rider’s individual needs.