**Aim of the project:** Estimate the impact of available battery power in smart devices on variability of timestamps of data captured from device’s sensors.

**Research design:** Sensors are always or periodically active. They produce data at certain acquisition frequency in real time that are digitized and put it in a memory buffer for reading. However, by the time we can read it the system time will be different, so the data timestamp will have a delay. That delay comprised of mainly acquisition frequency and wait in a queue for the buffer read, is not constant but a variable that depends on many parameters. In this study we are concentrating on how device’s power management affects the wait in a queue. We do not have an access to the time when sensor updates the buffer, however, it is much faster (100Hz) than we will read the sensor data (5Hz), hence, should not introduce significant differences in the timestamps by itself.

Timestamp variability will be used to estimate reliability of the sensors data timestamps. It can be assessed by evaluating the time interval between captured sensor data. We will use in-house designed mobile app to listen for specific sensor(s) at a given polling rate. App will be kept in the background during recordings. Since, the time when data are read from the sensor buffer are not going to be exactly equal to preset polling rate but dependent on OS queuing it, that ultimately will introduce a variability between the readings.

The sensors that we chose to monitor are linear accelerometer and gyroscope, which are most commonly used for health research.

**Methods:**

***Single sensor study.***

*Our control* experiment for sensor data collection will be comprised of the collecting data timestamps on each sensor separately on 100% charged plugged in device. This is best case scenario that we should expect. So, variability in the timestamps from the sensors data is expected to be at its minimum.

*The first condition* is 100% charged not plugged in device, this condition will provide preferable real world conditions in the course of relatively consistent data collection. This should reveal timestamp variability that one should expect during a daily use of their device that maybe slightly greater than in control.

*The second condition* is 10% battery charge remaining not plugged in to imitate data recording under the various power conserving mechanisms utilized by the device’s hardware and OS. This must produce the greatest variabilities in the readings that will provide insight into power management control of and access to the sensor’s data.

*The third condition*, 100% charged device under the heavy nearly 100% load to reveal how device’s power management systems enforce task threads depending on their power consumptions. In this experiment our app tasks power consumption should be negligible to the load we artificially introduce. The results will show what kind of competition profile there is implemented and how users activity may impact accuracy of the data coming from sensors.

**Data analyses:** Data on variability as means and standard deviations can be compiled from these experiments and statistically analyzed for significant differences.

***Multisensor study***

*In the next set of experiments*, we will simultaneously record data from both sensors using the same recording paradigm. The variability of timestamps between the two sensors will be assessed. This data will elucidate the impact on reliability of reading from multiple sensors in various conditions. In addition to the between sensors variability we can assess their cross-correlation (lag). If in fact it is pronounced and increased or decreased that would indicate that there is a relationship that power management introduces to multi-sensor data readings.

***Multidevice study***

The same set of experiments will be conducted using two devices from two main different manufactures, i.e. Google and Samsung, but comparable in overall specifications. That will show the impact of different hardware on the same Android platform on reliability of the sensor data.