**Embedded Data Acquisition Class Design**

**Fall 2020 Master’s Project Abstract**

Illya Kovarik

University curriculum emphasizes the theoretical aspects of a subject with homework drills to reinforce the lessons. The theory must be learned to earn the degree but the problem is that often graduates are lacking practical experience at a complete system level to make something work.

The objective of this project is the material basis for an embedded data acquisition class which could be taught at UNHM. This project strives to close the gap between theory and practice by integrating high-level Linux software and low-level electronics while students are challenged to face and resolve real world engineering situations.

The project will approach the problem by using an embedded Linux pocket computer, the BeagleBone, as a data acquisition engine. Several cases will be studied which highlight specific aspects of the topic. Scripts will be written to perform various tests and the results of these tests, the data, will be analyzed. For example, a Jupyter Notebook can be used to collect measurement data from a temperature sensor and the variation can be plotted over time. Another example script can control standard bench instruments, such as power supplies and meters, to measure the characteristics of some electronic component. Typically Python libraries Numpy and Pandas will be used to process the data and visualizations created using Matplotlib or other libraries. The comments or markup descriptions in the scripts will introduce the data acquisition concepts, the test background and methodology but it also becomes the executable test itself and the final report, all integrated into one. Thus, it will be intuitive to follow the flow and learn the basics of data acquisition, but also clear to see the possibilities the embedded Linux framework offers at a low cost and easily accessible.

The results will include a collection of case studies in the form of scripts covering a reasonable spread of data collection scenarios aimed at learning but also at demonstrating that the embedded platform is a powerful tool. The choice of embedded processor platform will be reviewed. The possible optimization of the embedded Linux distribution for running Jupyter will need to be studied. Since lab gear access or availability can be a bottleneck, we will make our own data acquisition daughter-card to mount on the BeagleBone, i.e., a “cape”, which will include various sensors making it easy to get started.