Using the Raspberry Pi for Data Collection, Dissemination and Display

INTRODUCTION

The collection of data plays a significant role in the products and services provided at CIMH. As Technical Officer (I) at the Institute and a member of the research and development team, I am always looking for innovative ways to make data collection and its management, for the end user, simpler but also looking at making it cost-effective.

In 2011, I started interacting with the Raspberry Pi which is a credit card sized, low-power, high performance computer created by the Raspberry Pi Foundation. Running Raspbian Wheezy, which is based on the Debian distro, I was then able to have the flexibility of a full Linux machine while not only significantly reducing power consumption but also the the price. My intentions were to develop a system that will be accessible from the network, initial tests were done on the Raspberry Pi version 1 model B.

COLLECTION

In 2013, I began research in replacing Windows based computer which was being used to collect and display data which was received through a serial connection. Initially the data collection was done using ASCII text files. Using Python 2.7 to accept the information from the datalogger through the serial connection, I was then able to store the data in folders based on variable names and ultimately in ASCII text files. However, as the datasets grew larger, data retrieval became time consuming as persons requesting datasets spanned over larger time periods.

DISSEMINATION

In 2015, some research was done in looking for a database system that would not only meet the needs of the system but work within the limited resources of the Raspberry Pi architecture. The SQLite software library was chosen to be the database engine, SQLite is a serverless, self-contained software library that fits perfectly with the Raspberry Pi. With a Python 2.7 library already available, implementation into the existing script was seamless. Once the historical data was ingested into the database, the complete dataset was then available from the database. Coupled with a simple web page, shown above in figure 1, also served on the Raspberry Pi, data can now be downloaded locally from any computer on the same network as the Raspberry Pi.

DISPLAY

Addressing all of the features of the collection was relatively straight forward, however the display of this data was a bit more challenging. Initially the data was displayed in tabular form using HTML tables. As the data was received, the web page information was updated to reflect the changes. This was then further supplemented through the graphing of the data. Using Gnuplot, which is a command line open-source graphing utility, the data was then graphed over a 24 hour and 7 day periods. This was done to show both short and long term trends. The table and the images were implemented as separate web pages, but were then combined. Each image is now a thumbnail representation of the full sized graph shown in figure 3.

Additional Features:

With the Raspberry Pi showing that it was more than capable of replacing the full sized computer system, it is not particularly office friendly, with its small size and protruding wires. To harden the design, the Raspberry Pi inside an electrical adapter box. Coupled with a switch, a standard 110 V AC plug and the standard male adapter from a computer supply, the system can be powered. The mains power was then connected to a 2A mobile phone wall charger, which accepts a USB to micro cable used to connect to the Raspberry Pi to power.

A USB to serial cable is connected to one of the USB ports of the Raspberry Pi. The serial communication between the Raspberry Pi and the datalogger does not use hand shaking, a simple three wire adapter (TX, RX and GND) was made to attach the serial cable from the RF radio to the outside of the electrical box. Finally, an Ethernet surface mounted adapter was installed to accept the Ethernet cable externally. Once the setup is complete, all interactions with the Raspberry Pi can be done through a command line interface, therefore the HDMI visual output was not ported to the outside of the electrical box.

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Figure 4a

Figure 4b

Figure 5

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Figure 1

Figure 2

Figure 3