Integrating LabVIEW, TinyOS and Expansion Modules to the PHOTONS Sensor Platform

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The advantages of making a sensor small and inexpensive range from having them affordable for home use as breath analyzers to enabling scientists to utilize hundreds of sensors to collect wide area data for air pollution studies. One issue is how to implement different types of sensors for research purposes without requiring full reimplementation of the sensor software and electronics. In this work we are developing expansion modules and software for the PHOTONS platform being developed at Rice.

We have developed basic sensor networking software which provides an interface for TinyOS based sensor networking motes to LabVIEW. Since TinyOS is typically used in wireless sensor networking research groups, and LabVIEW in photonic sensing research groups, this bridge between the software environments is important. These motes utilize wireless 2.4 GHz IEEE 802.15.4 RF transceivers to create a network that sends live data to a base station sensor plugged in via USB, but also sends commands to individual sensors in the field collecting data. The transmission of multi-node data over the radio is controlled using Time Division Multiplexing (TDM) programmed in NesC for TinyOS. A LabVIEW VI collects the data from the sensor motes, determines which mote is transmitting the data, and graphs the data and location of the sensors depicted in Fig. 1.

In this work we have also developed an expansion card (Fig. 2). The main function of this card is to manage the charging and usage of a Li-Ion battery powerful enough to drive high efficiency QCLs through small solar panels. The expansion card also allows the sensor to store large amounts of long term data and/or high temporal resolution measurements by storing data onto a built in 'microSD' card interface over SPI bus. The power expansion card has an option to attach a GPS module to transmit positioning data into LabVIEW for use in unmanned vehicular sensing and mapping. Since the GPS module is also capable of altitude measurements and the sensor can write data to a microSD card, a complete sensor is small and light enough to where it can be attached to unmanned aerial vehicles (UAV).

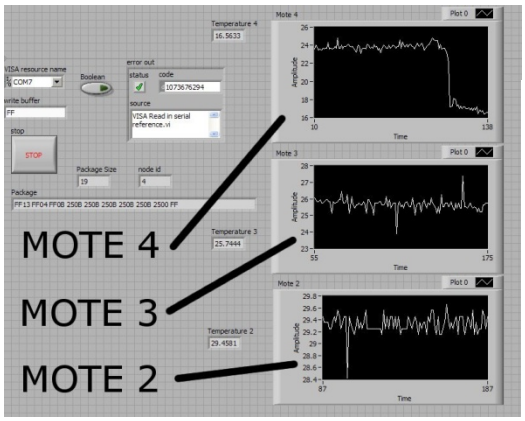

Figure 1

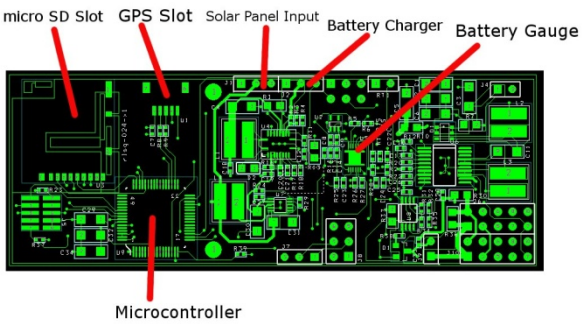

Figure 2

Figure 1: LabVIEW VI displaying and graphing heat measurements from each mote.
Figure 2: PCB of power expansion card.