Multi-Protocol Bus Monitoring System: MultiMon

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Background:

A wide variety of serial bus protocols exist for communication between microcontrollers or FPGAs and other devices such as sensors, other processors, memory, and wireless communications devices. By far the three most common protocols used today are I^2C (inter-integrated circuit), SPI (serial peripheral interface), and CAN (control area network).

These serial protocols may provide data transfer between two integrated circuits next to each other on a single printed circuit board, or they may link multiple independent electronic devices. Common data rates may be up to tens of mega-bits per second.

Debugging such networks can be troublesome, in that it can be difficult to convert all the ones and zeros from an oscilloscope or logic analyzer into meaningful data. An electronic “sniffer” device with a well-written computer software interface would greatly simplify the debugging process.

Project Details:

This Capstone project attempts to use an off-the shelf Texas Instruments microcontroller development board to capture data passed on three different bus protocols: I^2C, SPI, and CAN. The data will be queued locally then transmitted over USB to a computer where it will be organized and displayed. Two additional development boards will be used as a surrogate system to generate and pass the data that gets sniffed.

This project will require one electrical and one computer engineer. The electrical engineer will be responsible for understanding the bus protocols and developing the hardware/software components of the surrogate data generation system. The computer engineer will be responsible for the computer interface. Both team members will work together to develop the software in the monitoring device as well as the data transmission scheme for communicating with the computer

Development Stages:

- Conduct background research and examine common implementations (MEMS devices, DACs,
  ADCs, etc.)

- Develop hardware and software for test system to pass I^2C, SPI, CAN (verify using oscilloscope)
- Determine scheme for displaying meaningful data and build PC graphical user interface
- Develop microcontroller sniffer software and scheme for communicating over USB to PC
- Demonstrate operation with surrogate data system
- Demonstrate operation with a system supplied by NUWC technical directors