

Embedded Systems Project Proposal

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February 15, 2011

1 Project Abstract

The project is to build a remote weather station which reports weather conditions periodically from a remote sensing platform to a central controller. Both remote sensor and central controller will be implemented using Zilog Z16 microcontrollers. Communication will be over the 802.15.4 (Zigbee) protocol, using an XBee XB24-AWI-001. The remote sensor will collect temperature, humidity, barometric pressure, light intensity, and soil moisture. Wind conditions would be interesting, but sensors are expensive. Rain rate would also be interesting, but I haven't been able to find something that interfaces with a microcontroller. Integrating a simple CMOS camera to take periodic images of current sky conditions would also be an interesting extension. The remote Zilog will gather weather conditions, and periodically (five minutes to fifteen minutes) report collected data back to the central controller over 802.15.4. The central controller will do something interesting with the data. At the very least it will scroll current conditions and daily min/max across the LED array (responding to buttons). It can easily report data to a larger computer over the serial port, or the project could be expanded to have the central controller log data records to external flash memory. The central controller could also be extended to interface with a small LCD display and show larger summary of conditions, perhaps will nifty sun and cloud graphics.

2 Strategy

- Platform: Zilog Z16
- Capabilities: Analog inputs, SPI, I2C, Zigbee
- External: Temperature, Pressure, Humidity, Light sensors. XBee radios. Flash memory log? LCD display? Camera sensor?
- Evaluations: Comparing sensors based on data sheets.
- Software: Communication drivers for radios, sensor communication (I2C, SPI), sensor data interpretation (math).

3 Unknowns

Relative difficulty and complexity of communicating over Zigbee is an unknown. RF communication links may prove to be finicky.

4 Implementation Plan

- Step 1: Research and purchase sensors.
 - The Temperature sensor I plan to use is the Analog Devices TMP36, since there's a good tutorial on adafruit. Other sensors I've looked at include Vishay's TEMT6000 or National Semiconductor's LM34CZ, and the Analog Devices AD22100 mentioned in Catsoulis ch 13.
 - Humidity sensors I'm considering include the Parallax HS 1100/1101, HH10D (sparkfun), DHT22 (from sparkfun), Parallax SHT15, SHT11, or Honeywell HIH 4000.
 - Light sensors of interest are the TAOS TSL250R mentioned in the book, the Advanced Photonix Inc (API) PDV-P8001, or the Sensor Solutions B 9060.
 - Pressure sensors I'm considering are the Freescale MPXA6115A mentioned in Catsoulis ch 13, or the Freescale MPL115A1 (Freescale sells an evaluation board with SPI or I2C).
- Step2: Get the two Zilogs to communicate data over the XBee radios. I already own a pair of XBee chips with adapter kits from adafruit.
- Step 3: Implement each sensor one at a time, working through the analog communication issues and the calibration / data interpretation.
- Step 4: Work on the controller display and other potential end-user outputs.