Bluetooth Temperature and Barometric Pressure Sensor

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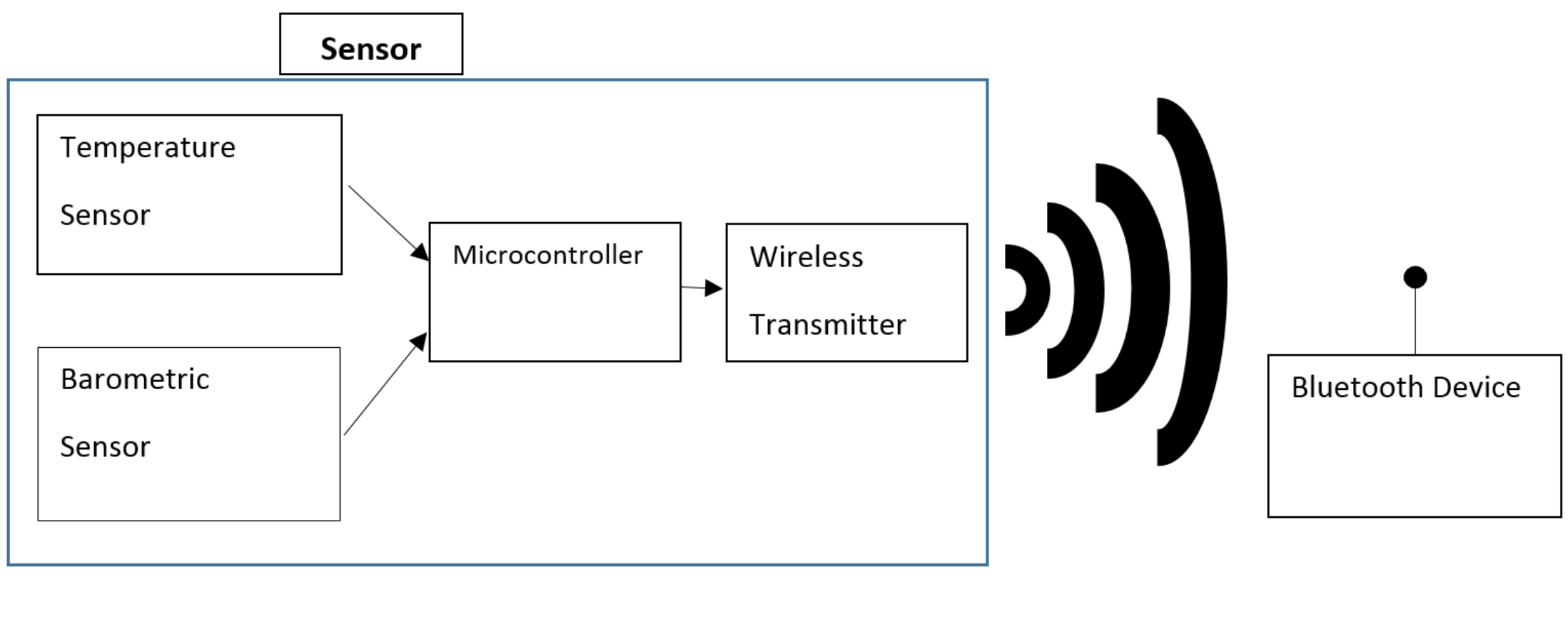
Initial Ideas and Goals

- The project started because of an interest in Bluetooth technology.
- Initial project designs:
  - Wireless, via Bluetooth communication
  - Sensor would be portable and battery powered
  - Temperature readings accurate to 0.5 degrees Celsius.
  - Pressure readings accurate to 0.02 millibars (1 bar = 750.06 mmHg)

Initial Design



Main Components

The three main components I used where:

- Bluetooth Mate Silver
- Barometric Pressure Sensor – BMP180
- MSP430 Launchpad

Part	Cost
Bluetooth Mate Silver	$24.95
Barometric Pressure Sensor – BMP180	$9.95
MSP430 Launchpad	$9.99

Bluetooth Mate Silver
Roving Networks

MSP430 Launchpad
Texas Instruments

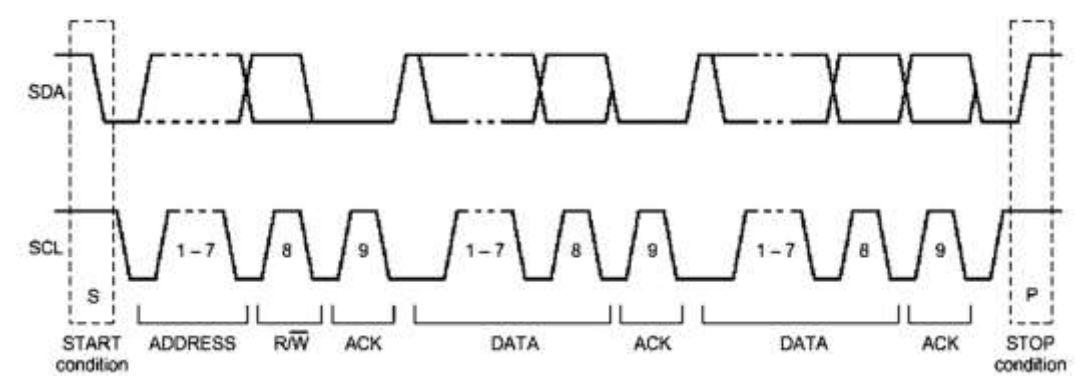
Barometric Pressure Sensor – BMP180
Bosch Sensortech

Steps Toward the Finished Project

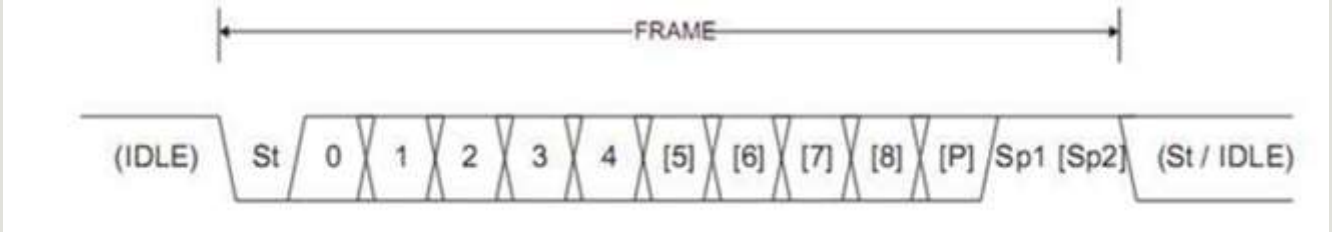
1. Determine what forms of communication to use between the sensor, microcontroller, and Bluetooth module.
2. Create code for microcontroller to grab data from the sensor and ship that data out to the Bluetooth Module.
3. Setup Bluetooth Module to be a pipeline that receives data, and immediately transmits that data.
4. Design printed circuit board, solder parts to board, and test.

Communication

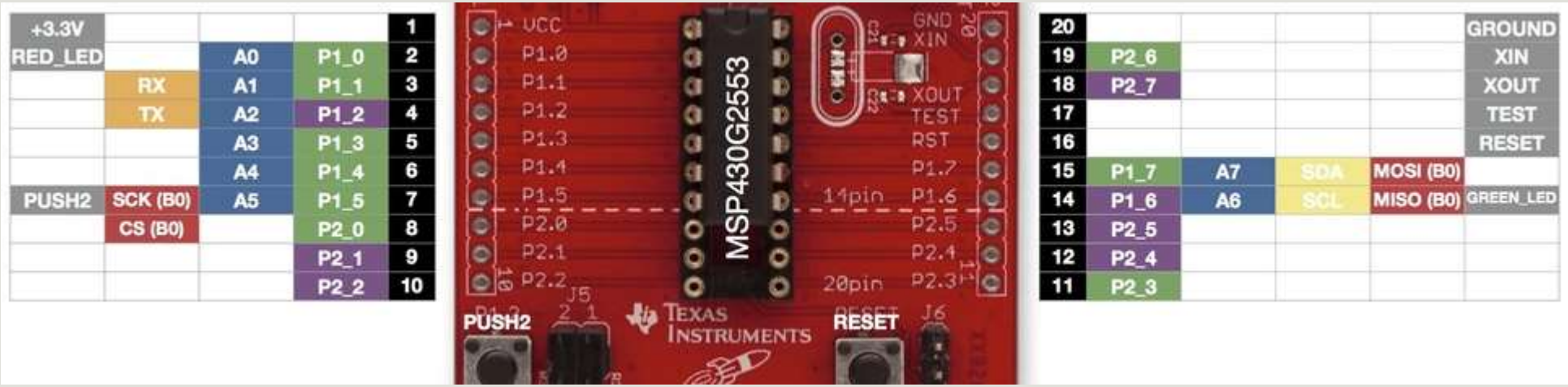
I²C Protocol



UART Serial Communication



MSP430 Pin Connections



Code

```
// Start a temperature measurement:
// If request is successful, the number of ms to wait is returned.
// If request is unsuccessful, 0 is returned.

status = pressure.startTemperature();
if (status != 0)
{
  // Wait for the measurement to complete:
  delay(status);

  // Retrieve the completed temperature measurement:
  // Note that the measurement is stored in the variable T.
  // Function returns 1 if successful, 0 if failure.

  status = pressure.getTemperature(T);
  if (status != 0)
  {
    // Print out the measurement:
    Serial.print("temperature: ");
    Serial.print(T,2);
    Serial.print(" deg C, ");
    Serial.print((9.0/5.0)*T+32.0,2);
    Serial.println(" deg F");
```

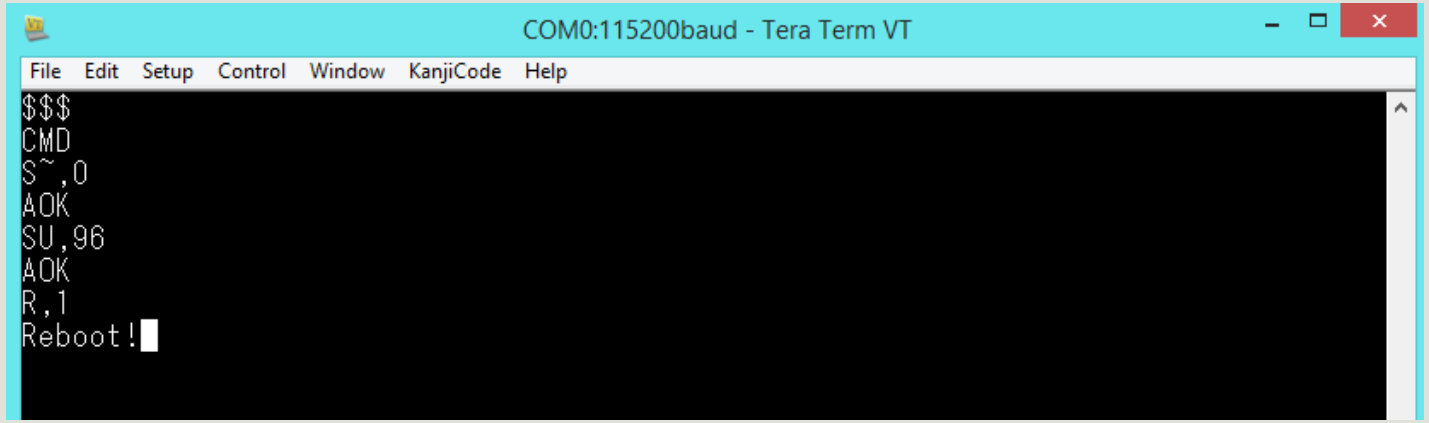
```
// Start a pressure measurement:
// The parameter is the oversampling setting, from 0 to 3 (highest res, longest wait).
// If request is successful, the number of ms to wait is returned.
// If request is unsuccessful, 0 is returned.

status = pressure.startPressure(3);
if (status != 0)
{
  // Wait for the measurement to complete:
  delay(status);

  // Retrieve the completed pressure measurement:
  // Note that the measurement is stored in the variable P.
  // Note also that the function requires the previous temperature measurement (T).
  // (If temperature is stable, you can do one temperature measurement for a number of pressure measurements.)
  // Function returns 1 if successful, 0 if failure.

  status = pressure.getPressure(P,T);
  if (status != 0)
  {
    // Print out the measurement:
    Serial.print("absolute pressure: ");
    Serial.print(P,2);
    Serial.print(" mb, ");
    Serial.print(P*0.0295333727,2);
    Serial.println(" inHg");
    Serial.println("\n");
  }
```

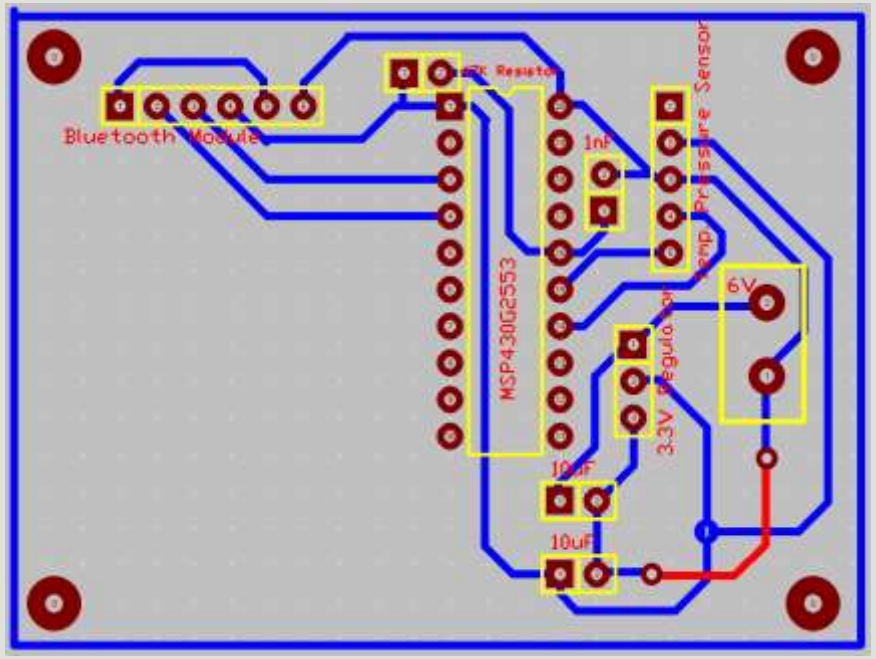
Bluetooth Module Setup

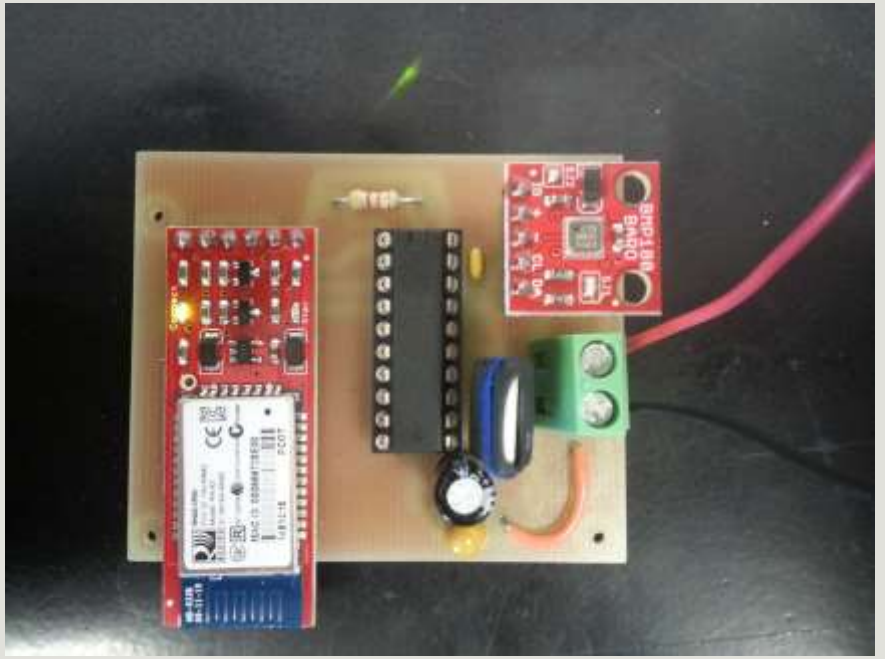


FTDI Breakout Board - 5V

- $$$ - Enters command mode to allow user to change settings.
- CMD - Bluetooth module enters command mode
- AOK - Bluetooth module responds that command was accepted.
- S~,0 - Sets Bluetooth module to the Serial Port Profile (SPP), acts as serial pipeline.
- SU,96 - Change the baud rate of the Bluetooth module.
- R,1 - Reboots the Bluetooth module.

Final Design and Results



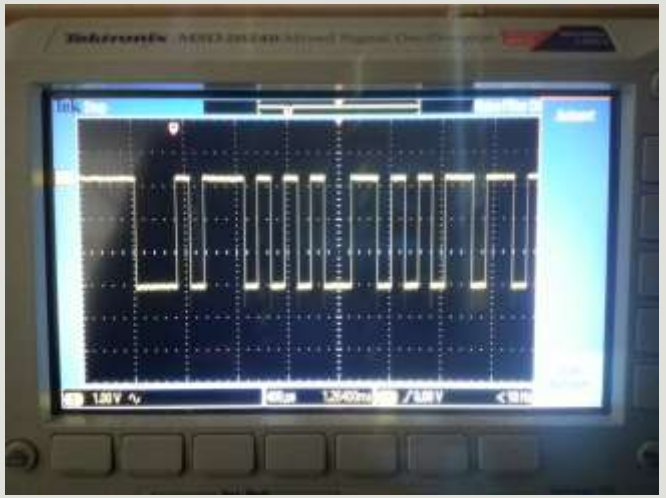


Final Design and Results (cont'd)

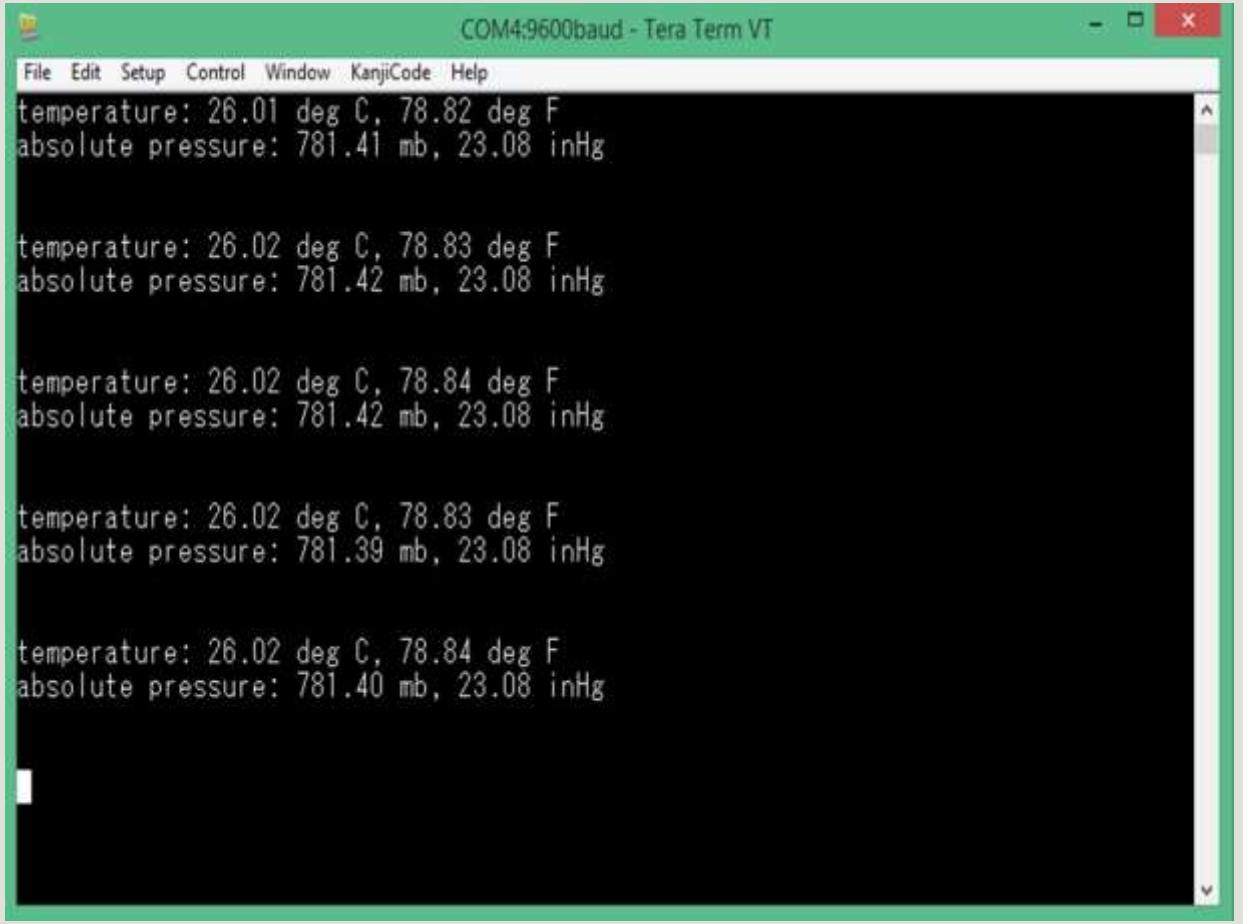
I²C Protocol
Serial Data Line

Clock Line

UART Serial Communication



Final Design and Results (cont'd)



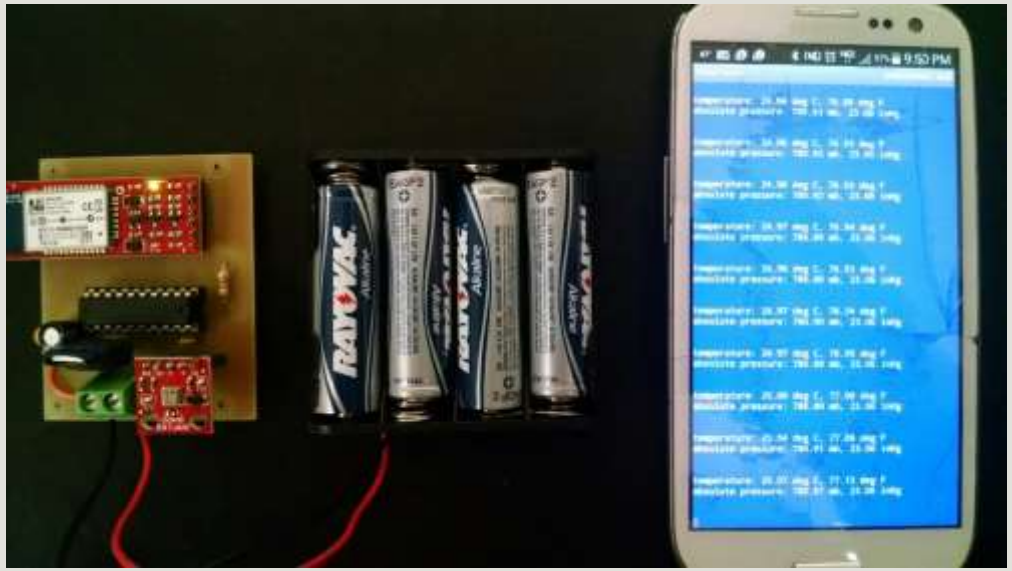
Future Considerations

- I found that, when my sensor was connected and transmitting data, the circuit pulled between 30 and 35 mA of current. I used 4 AA batteries to power my circuit, with each battery holding about 2800 mAh of electrical charge. The approximate battery life of my design is a little over 3 days, when connected and transmitting continuously. To increase my battery life, I could program my microcontroller to go into “sleep mode” and conserve energy. I could also increase the time between sensor readings.

- My circuit and battery pack are not enclosed in a box. To make my design easier to handle, I could place the circuit in a box, but that would require some calibration of the sensor.

Conclusion

- I accomplished my goal of learning more about Bluetooth communication.
- I acquired the temperature and barometric pressure accuracy goals.
- I designed a portable temperature and barometric pressure sensor.



Questions