

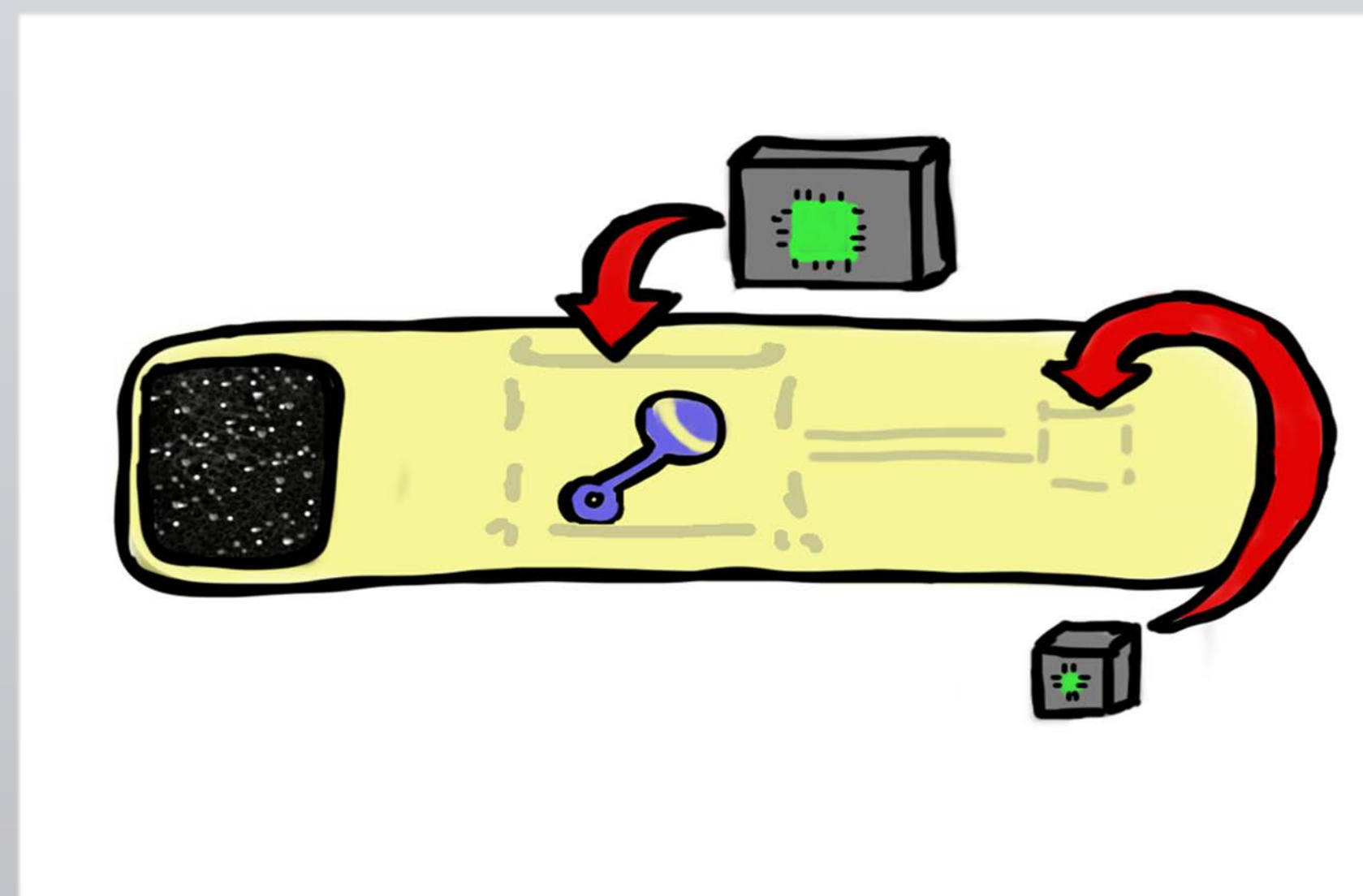
Abstract

The Baby Band is a biometric metering device for children. It has four different sensors which measure temperature, heart rate, breath rate, and sleeping habits. All of the hardware would ideally be contained on a harness that is strapped around the child. All of the readings are output to an application for parental viewing.

Requirements

- Accuracy: $\pm 10\%$ of medical standard.
- Power Consumption: <10 V.
- Size: Fits in a 5" x 5" x 5" enclosure.
- Battery Life: At least 8 hours.
- Physically Secure, Encrypted Data, and Environmental Proof.
- Compatibility: Will work with a website and mobile application.
- Safe, Easy to Use, High Quality, and low-cost.

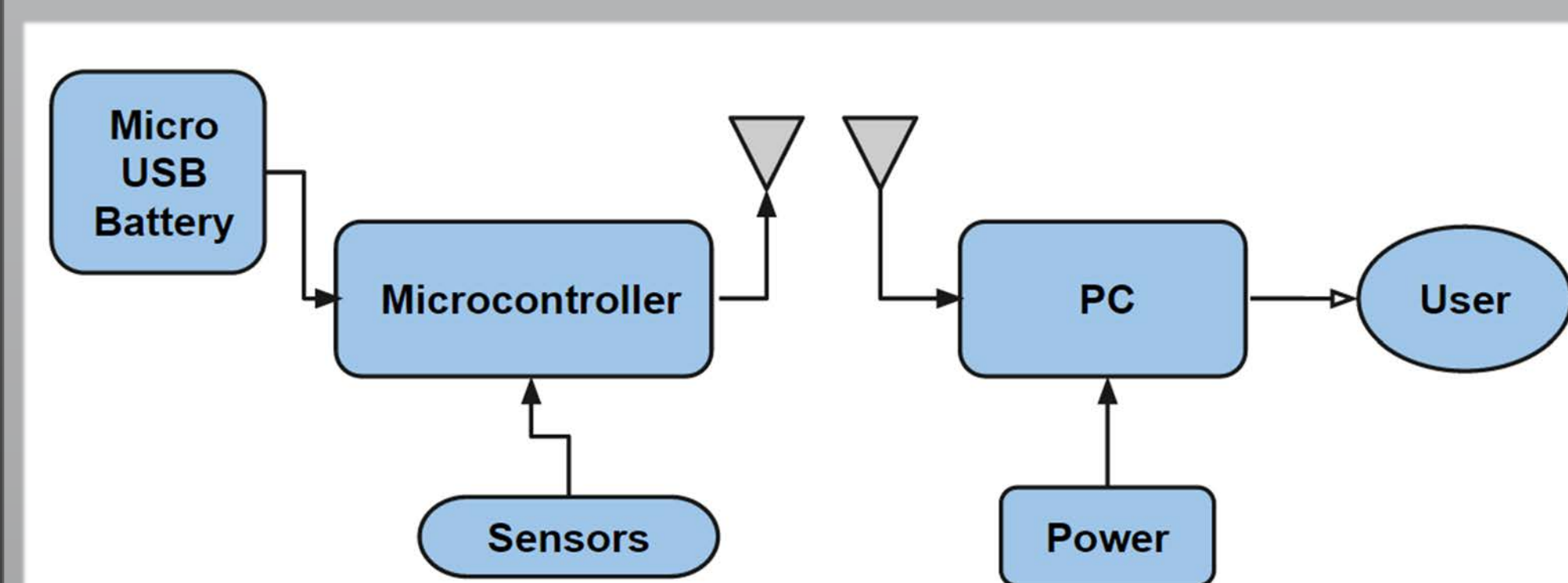
Concept Design



This is a mockup displaying what the band would look like:

- The sensors are located on the harness.
- There are strips of Velcro to secure the harness. The fabric is a interlocking 100% cotton weave.
- A battery would be located on the harness.

Functional Decomposition



- The sensors will gather vital readings for processing on the microcontroller.
- The microcontroller and sensors are powered by a micro-USB battery.
- The data is then sent wirelessly to a PC.
- From the PC, parents can monitor the readings using a Windows application.

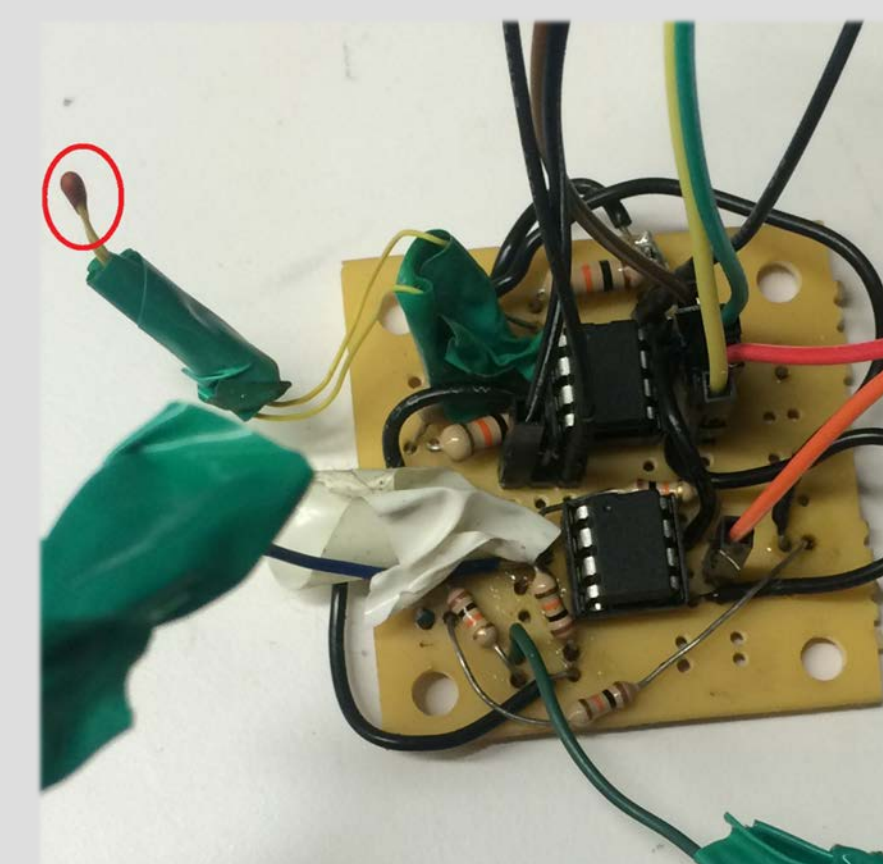
Sensors

Temperature



NTC Thermistor

- Small
- Low-Cost
- Accurate

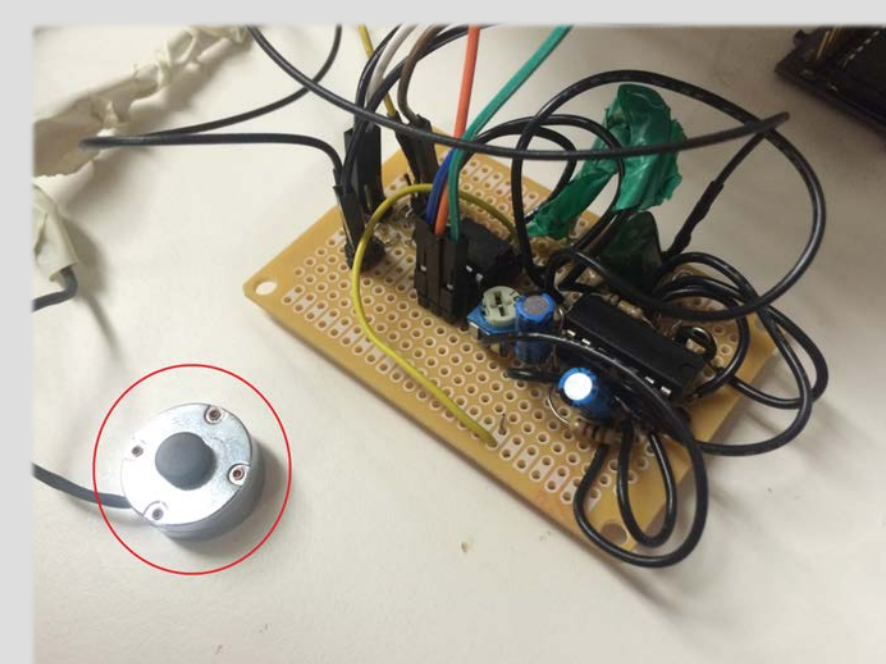


Heart Rate



CM-01B: Contact Microphone

- Small
- Low-Cost
- Sensitive

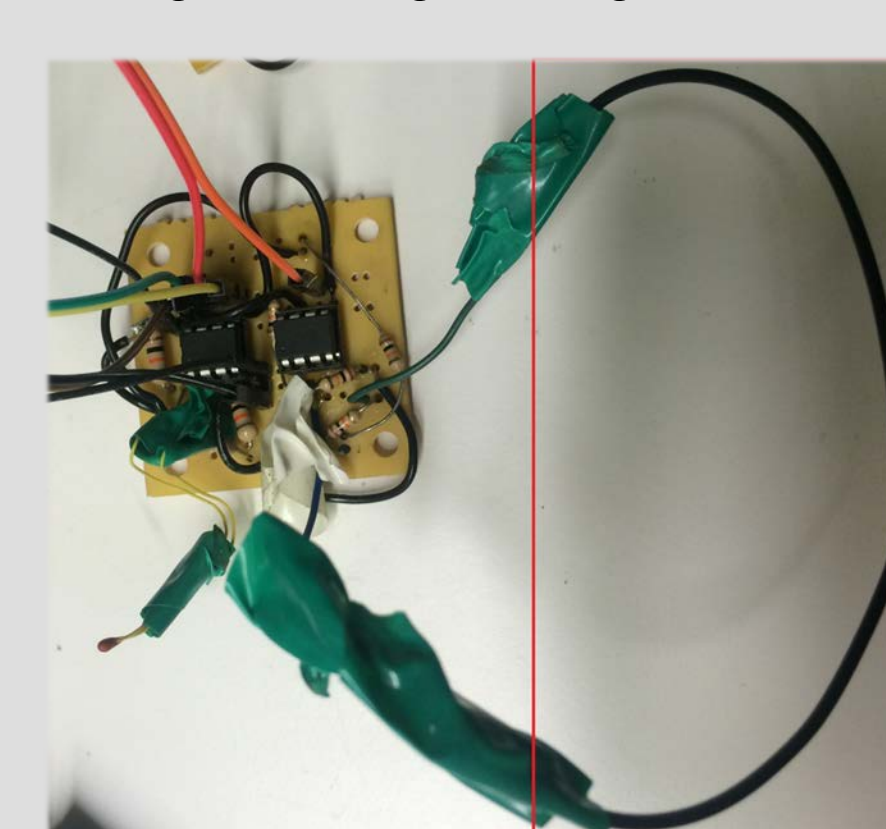


Breath Rate

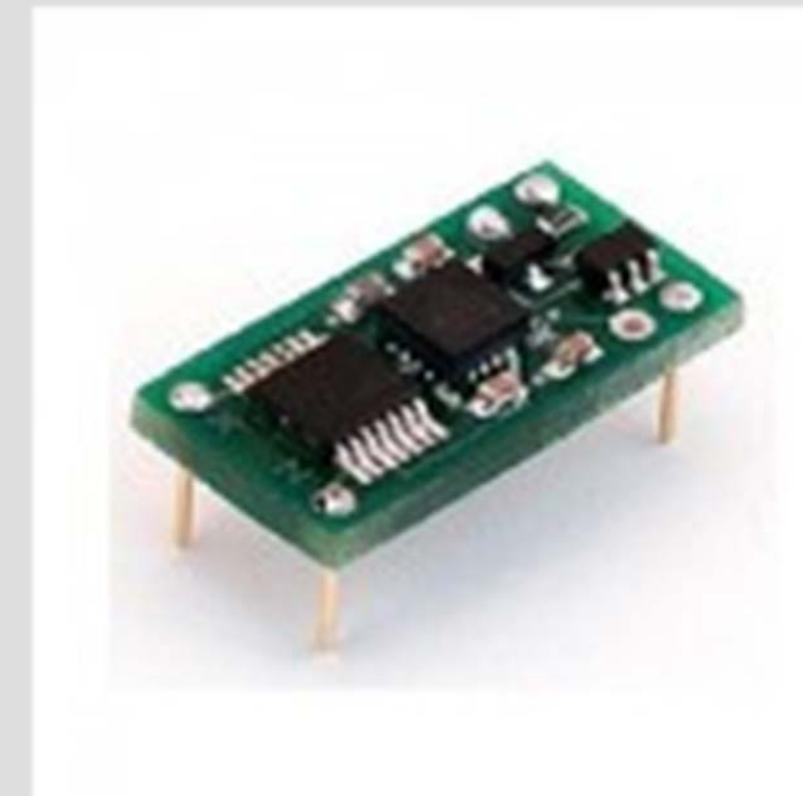


STRX-06: Stretch Sensor

- Small
- Low-Cost
- Large Voltage Range

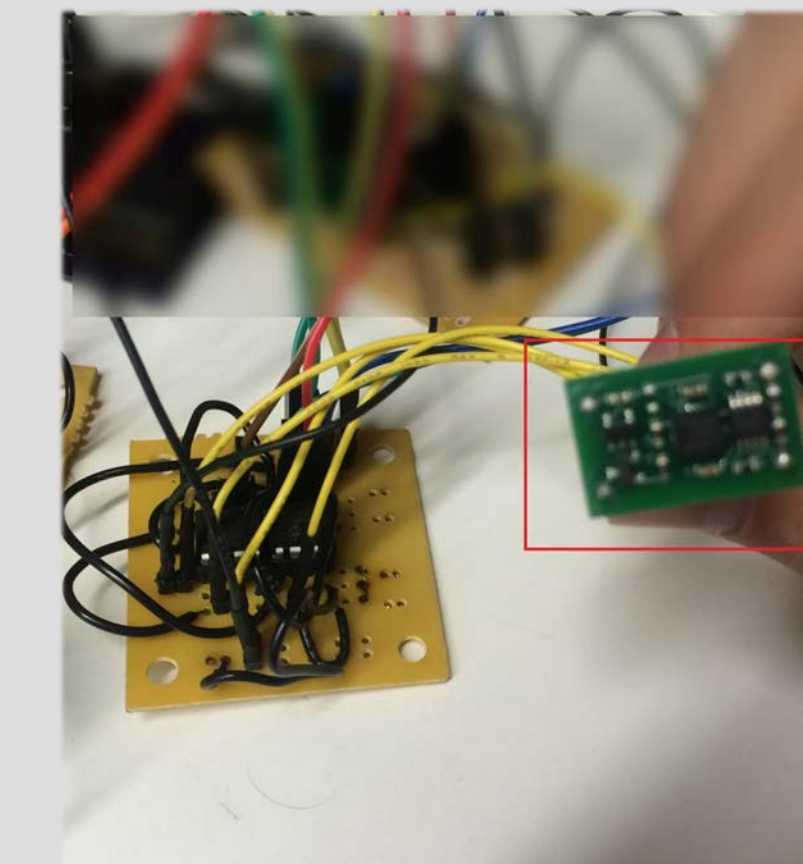


Sleeping Habits

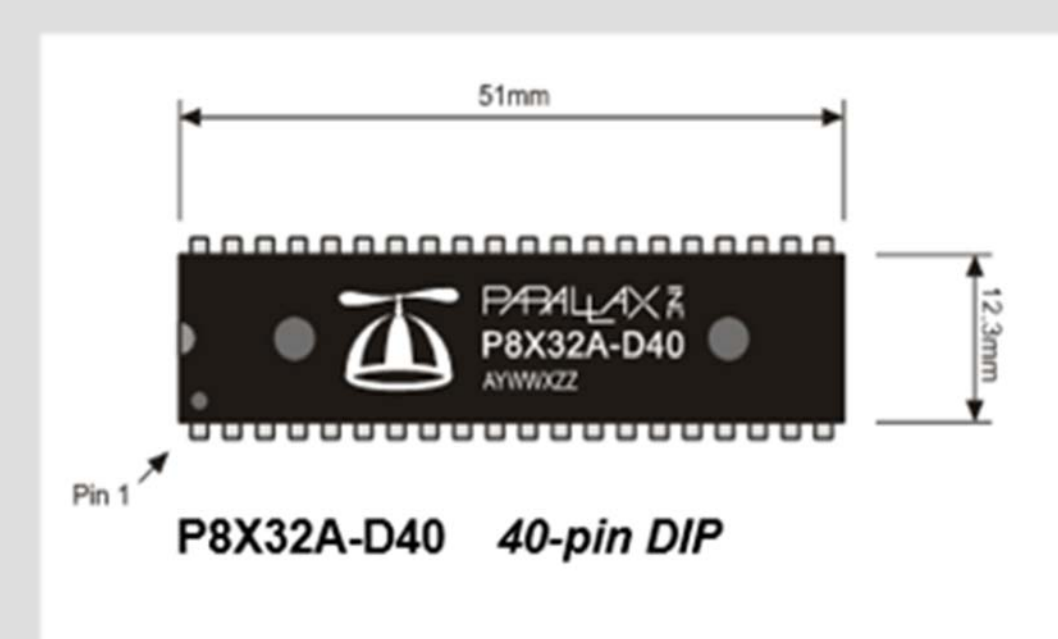


LIS244ALH: Accelerometer

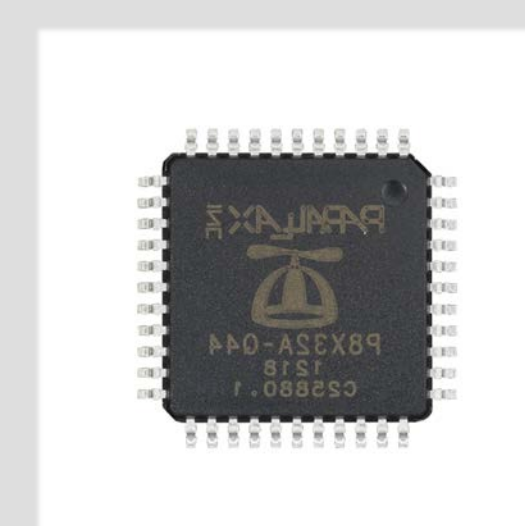
- Small
- Low-Cost
- 2-axis



Processing Module

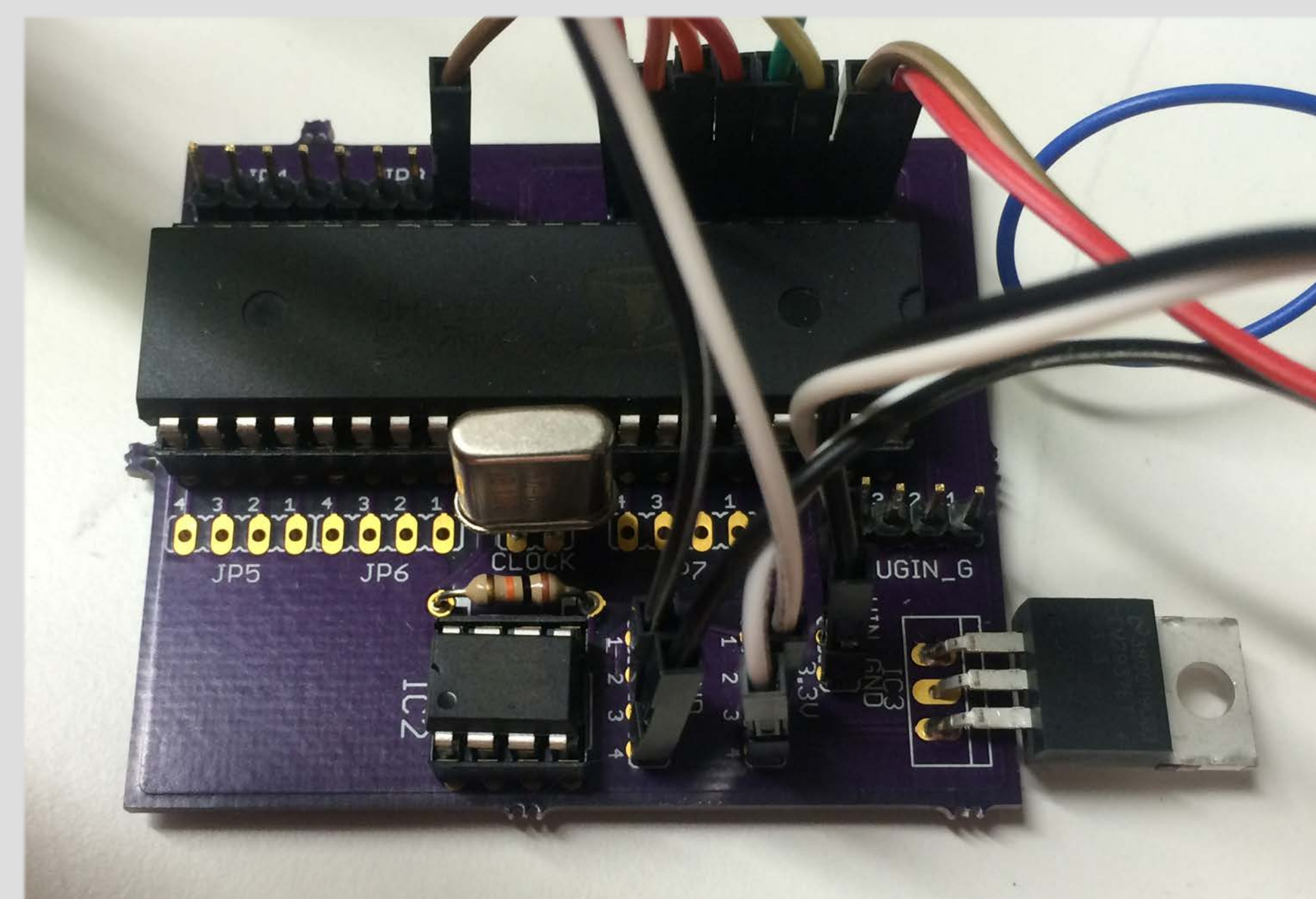


DIP Package (used)



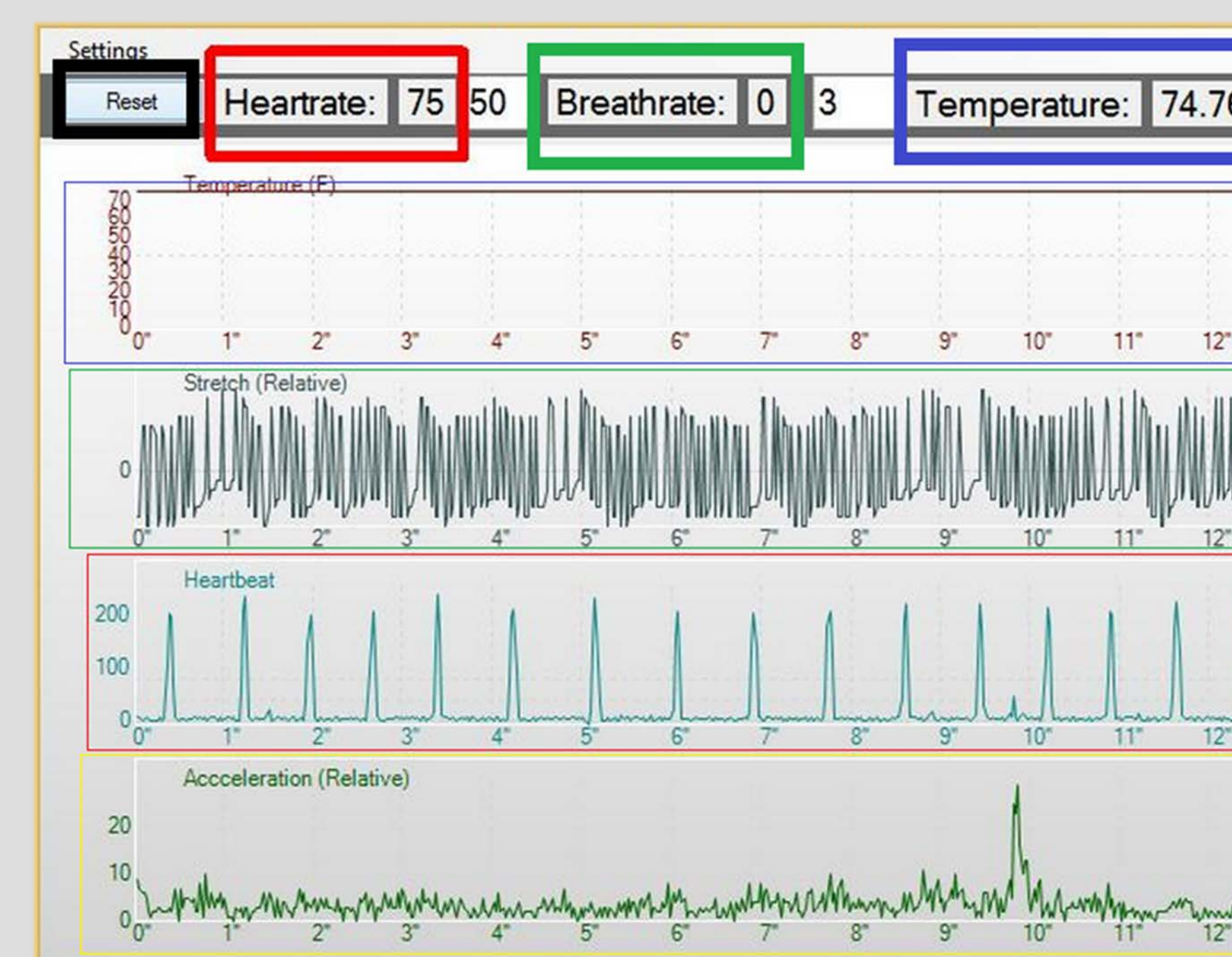
Surface Mount Package

The Parallax Propeller is a 8-processor microcontroller which runs at 80 MHz. We chose this processor to meet the parallel and high-speed requirements of our project.



We chose a modular design to allow for design changes and in anticipation of localized hardware bugs or failures.

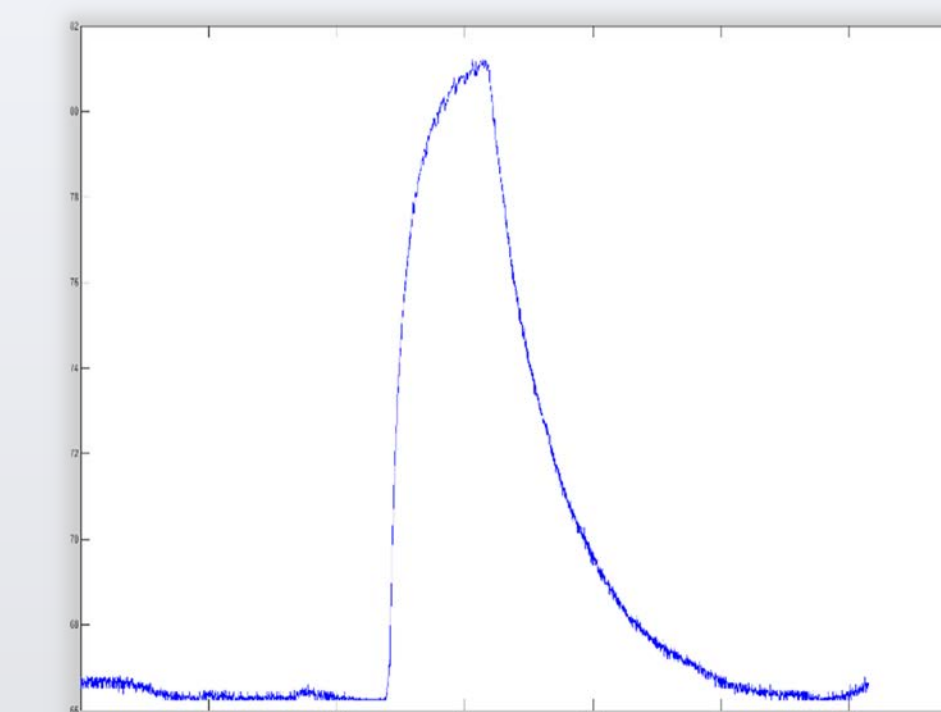
User Interface



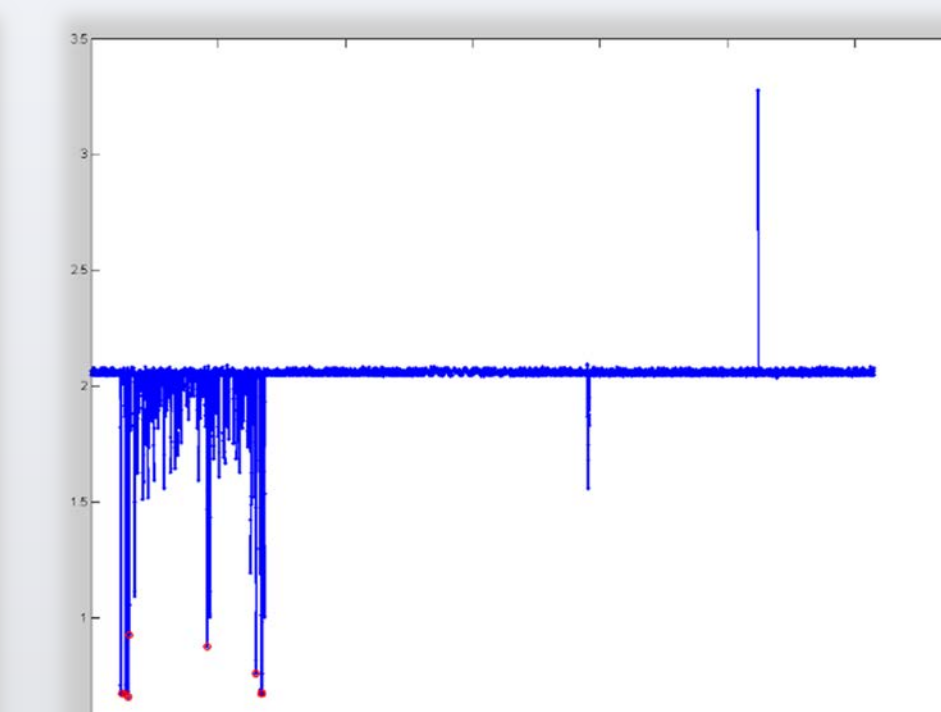
The user interface is a Windows application from which a user can see the pulse, breaths, temperature, and movement of their child. To the right of the red and green boxes are the thresholds required for an independent pulse and breath to be registered by the program, respectively.

- Black: Reset button clears all previous data
- Red: Beats per minute (top), waveform (below)
- Green: Breaths per minute (top), waveform (below) – not in use
- Blue: Instantaneous temperature (top), history (below)
- Yellow: Acceleration (bottom)

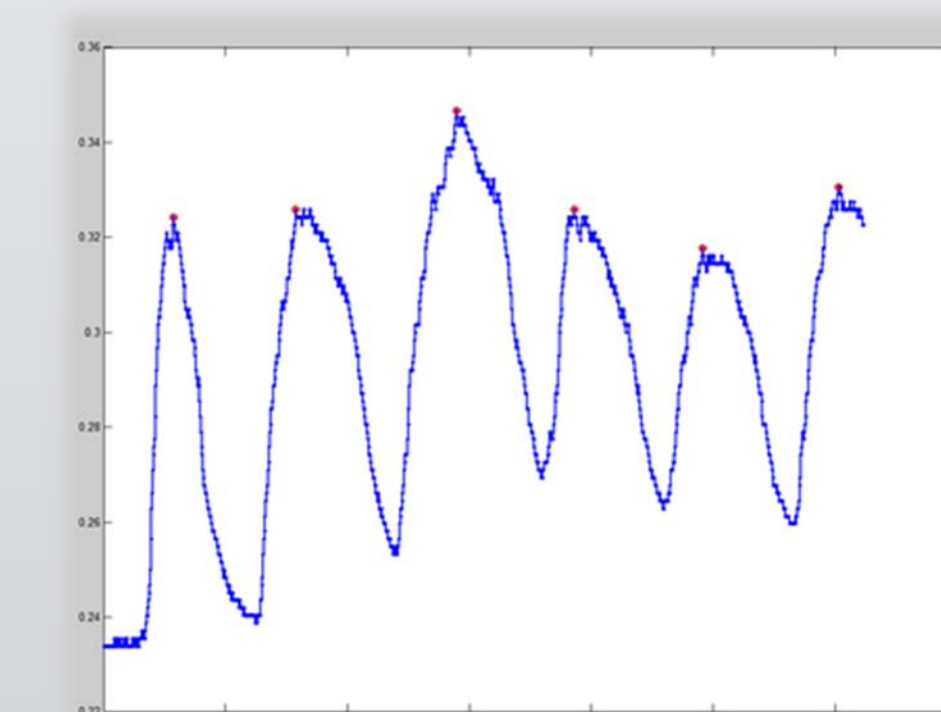
Algorithms



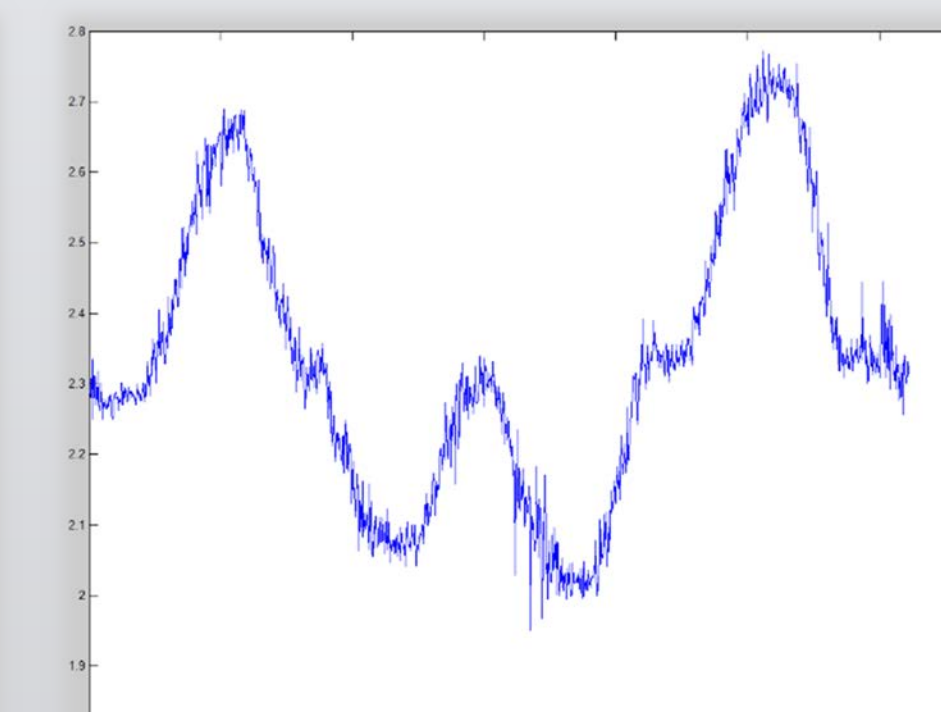
Processed Temperature Data.



Processed Heart Rate Data



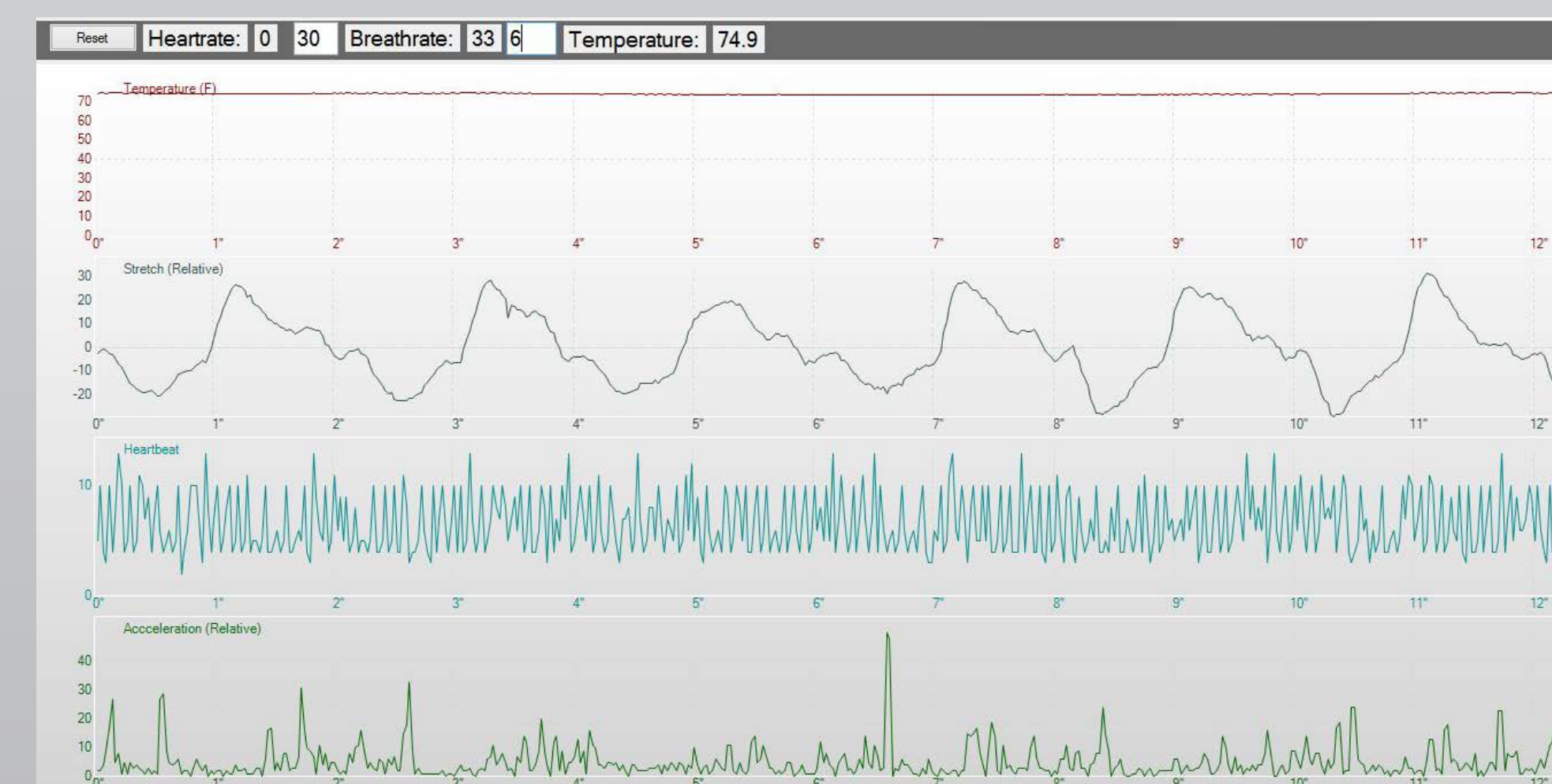
Processed Temperature Data.



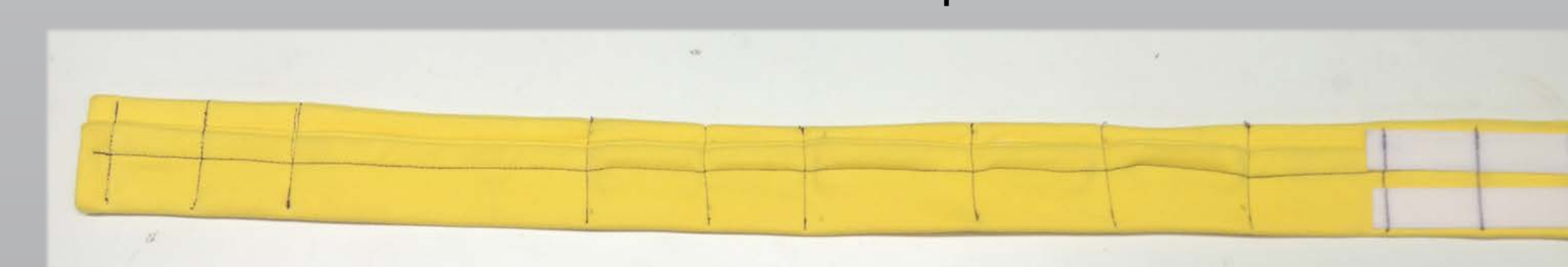
Processed Heart Rate Data

Results

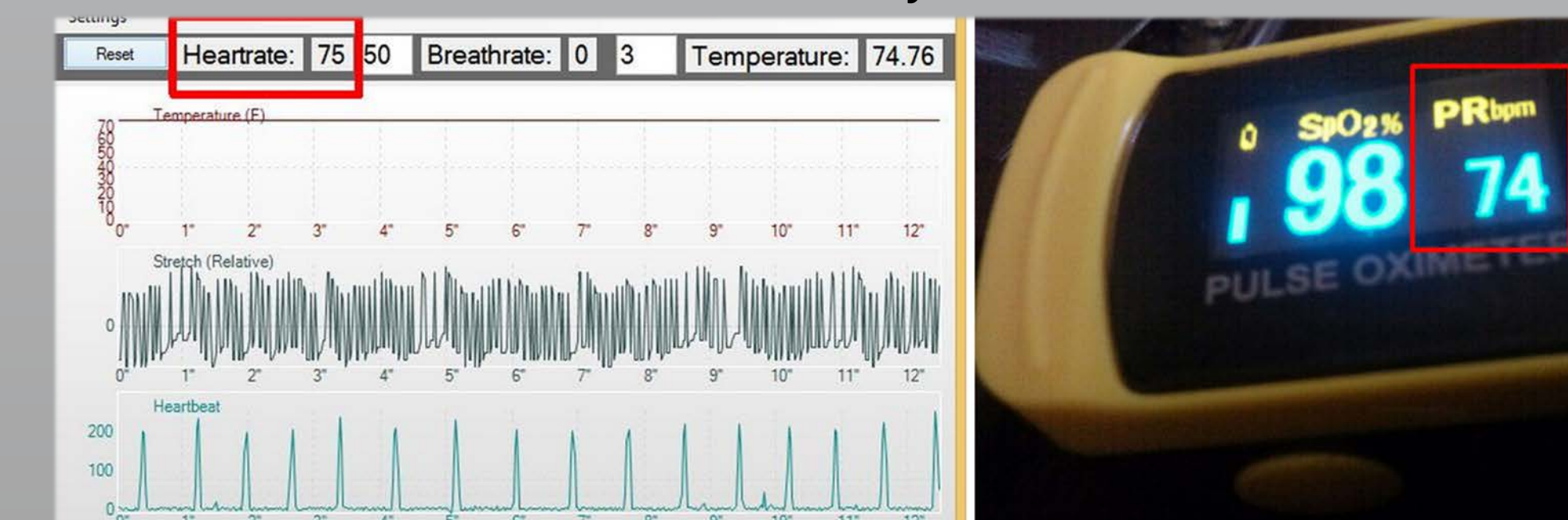
Interface



Chest Strap



Accuracy



Acknowledgements

Sponsor: Louisiana State University

Mentor: Dr. Jin-Woo Choi and Professor John Scalzo