Quad Rat Monitor

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Overview

- PET Imaging of Rats
- Device Requirements
- Existing Devices
- Motivation
- Timeline
- Hardware
- Interface
- Housing
- Future Work

PET Imaging of Rats

- Positron emission tomography (PET) scans monitor location of radiotracers in rat's brains
- Client scans four anesthetized rats at a time
- Monitoring the vitals in real time is necessary to maintain health

PET scanner at Harlow Primate Lab

Device Requirements

- Non-invasive probes and user-friendly interface
- 4 rats simultaneously
- SpO_2 levels: ±2% accuracy
- Heart rates up to 500 BPM
- Respiratory rates of 20-30 BPM
- Rectal temperatures of 93-100°F

Existing Devices

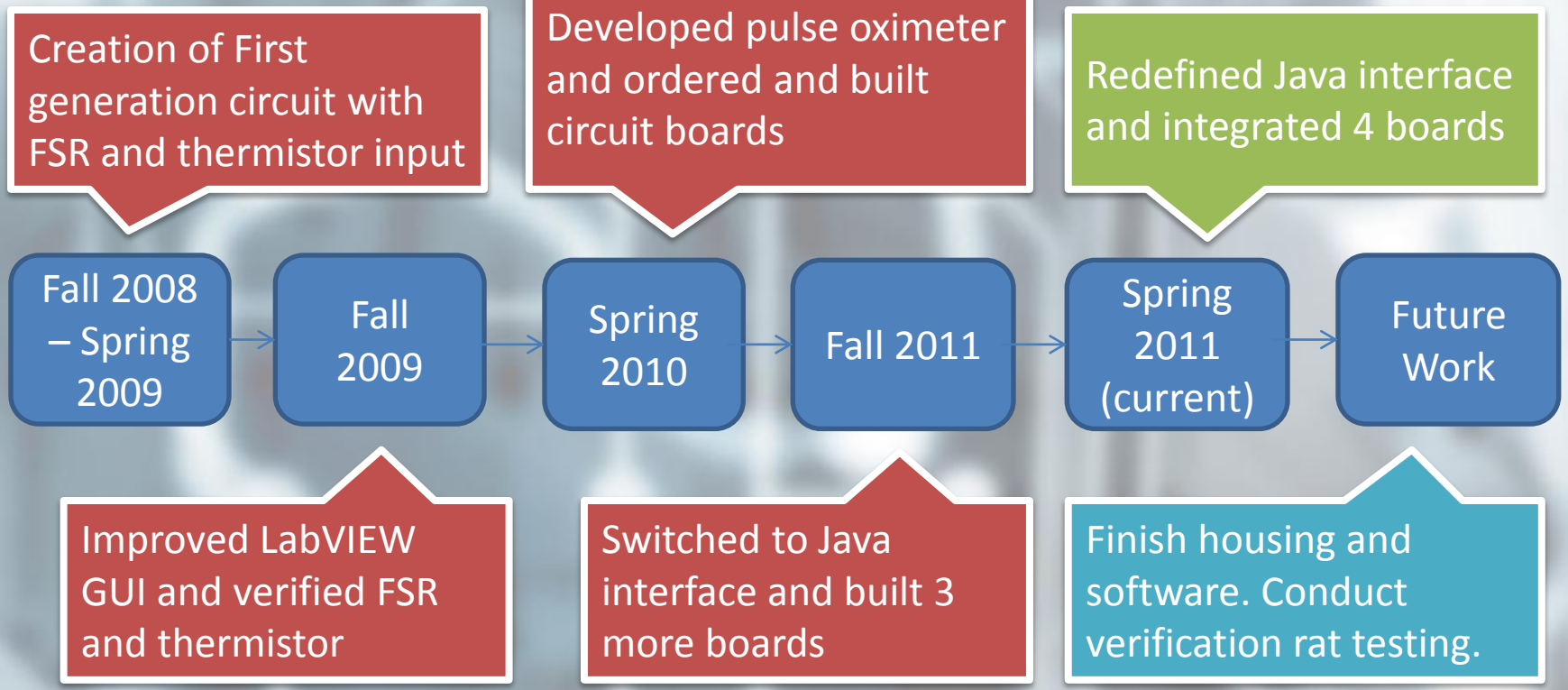
- Client currently uses rudimentary devices to monitor vitals
- Available: MouseOx
  - Pulse oximeter for mice and rats
  - Over $7000
  - Measures only one rat at a time

Source: http://www.starrlifesciences.com/

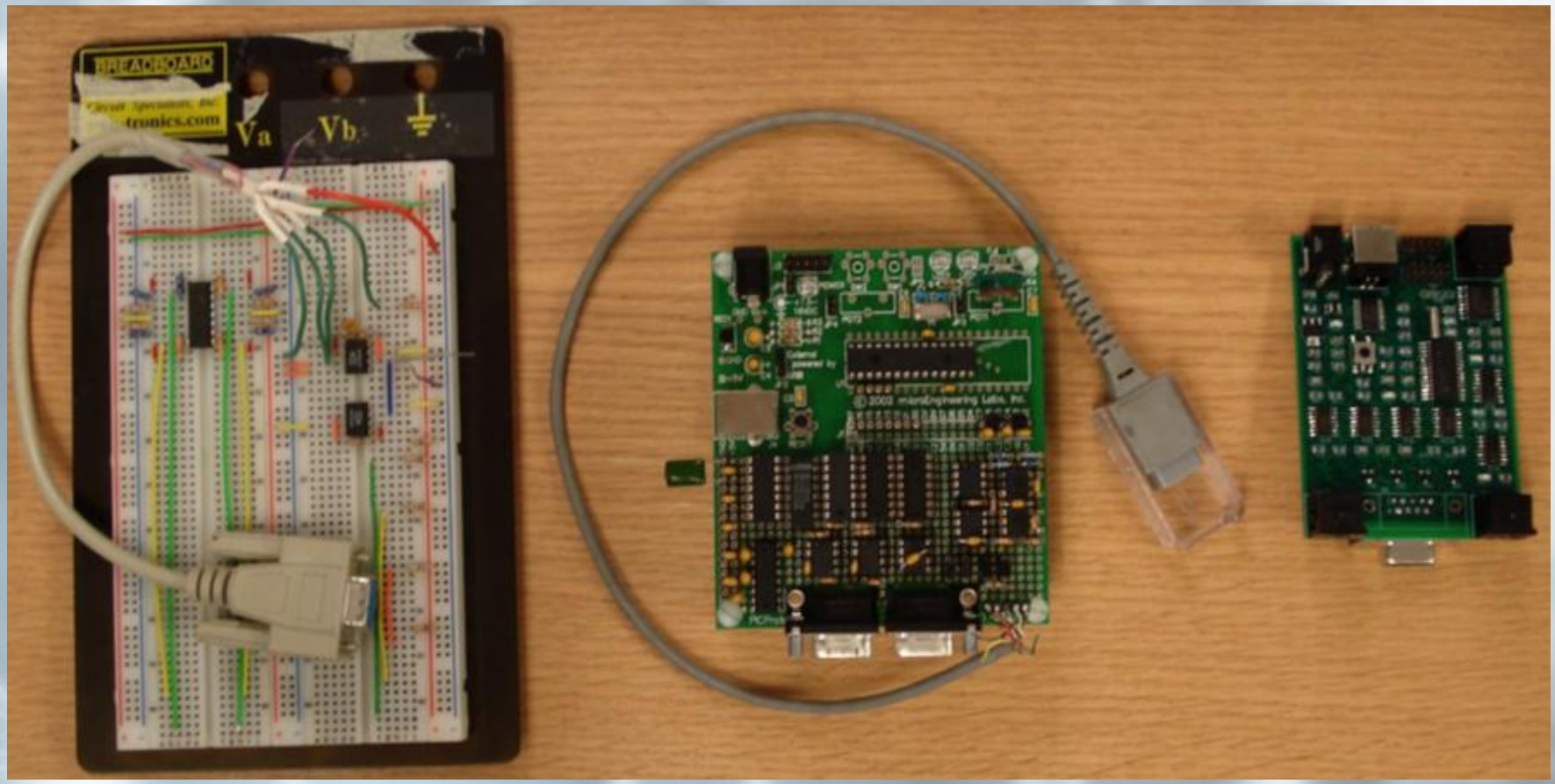
Motivation

Each rat is under anesthesia during testing, which requires manual adjustments by the laboratory assistants. The development of a system that displays the current values of each vital sign along with the histories would be beneficial in maintaining the rat's health throughout the testing.

Timeline


Creation of First generation circuit with FSR and thermistor input
Developed pulse oximeter and ordered and built circuit boards
Redefined Java interface and integrated 4 boards
Fall 2008 – Spring 2009
Fall 2009
Spring 2010
Fall 2011
Spring 2011 (current)
Future Work
Improved LabVIEW GUI and verified FSR and thermistor
Switched to Java interface and built 3 more boards
Finish housing and software. Conduct verification rat testing.

Circuit Progression

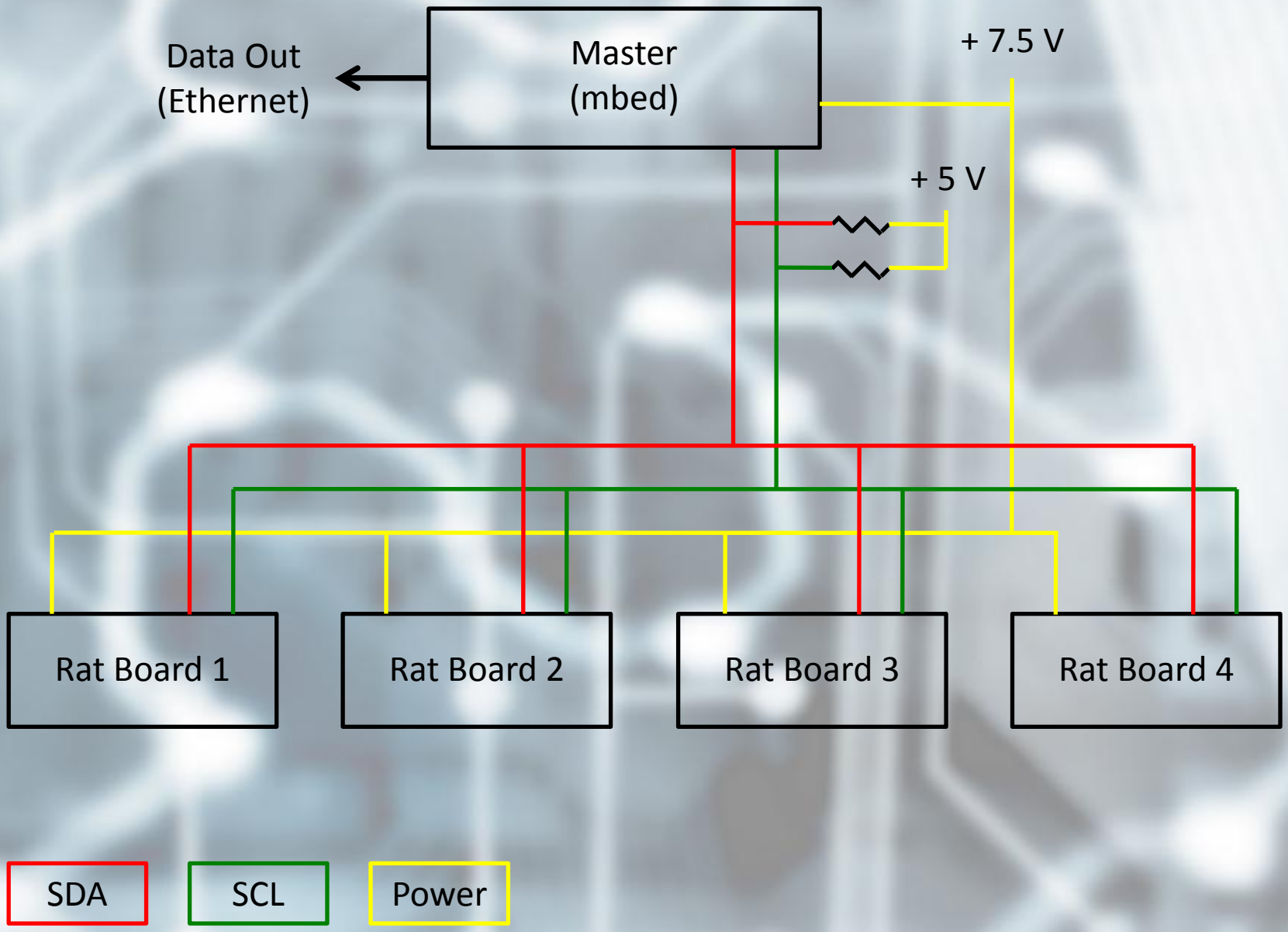


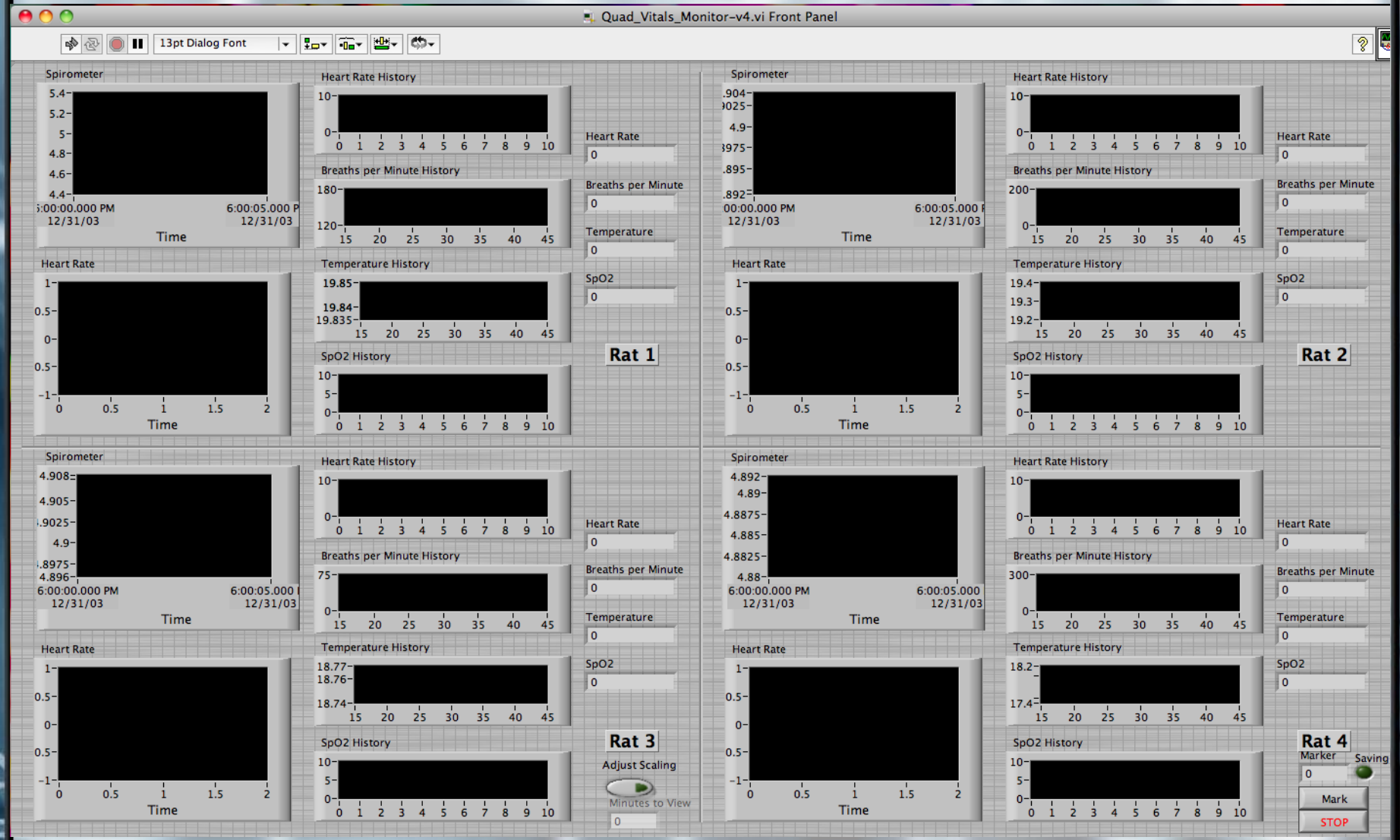
Hardware

- Built and debugged 4 identical circuit boards
- Firmware mostly complete
  - Autogain and I^2C remain
- Potentially need to improve data output format

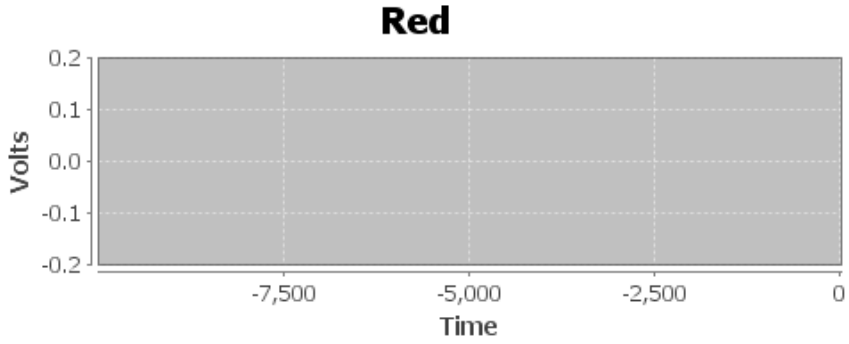
System Master

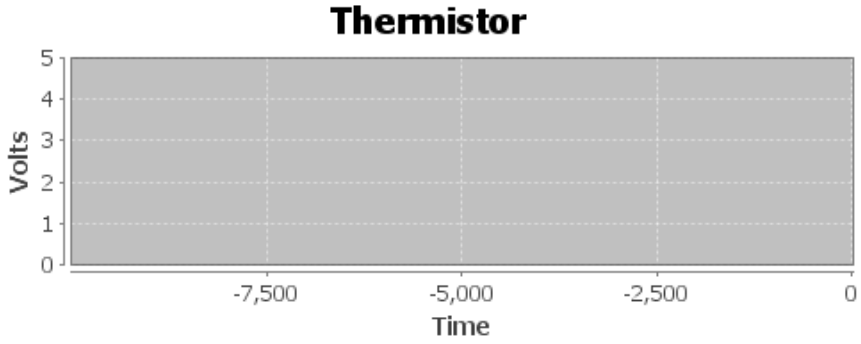
- “Master” microcontroller (eg mbed)
- Power distribution system
- Communicates with slaves via I^2C
- Will output data via USB and/or Ethernet

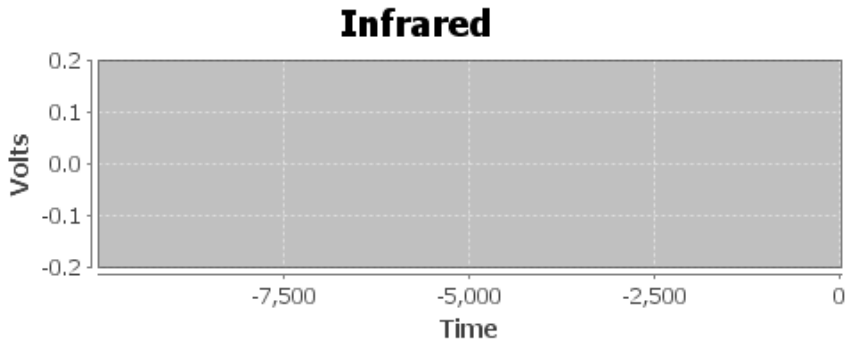

Data Out
(Ethernet)
Master
(mbed)
+ 7.5 V
+ 5 V
Rat Board 1
Rat Board 2
Rat Board 3
Rat Board 4
SDA
SCL
Power

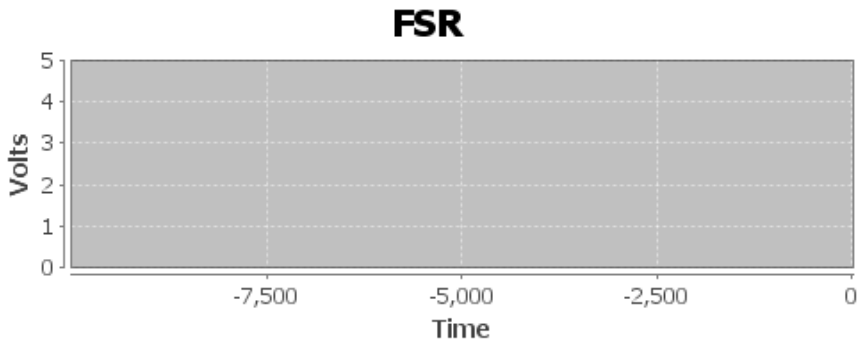

Quad_Vitals_Monitor-v4.vi Front Panel
13pt Dialog Font
Spirometer
Heart Rate History
Heart Rate
Breaths per Minute History
Breaths per Minute
Temperature
Temperature History
SpO2
SpO2 History
Time
Rat 1
Rat 2
Rat 3
Rat 4
Adjust Scaling
Minutes to View
Marker
Saving
Mark
STOP

Quad Rat Vitals Monitor - 1 Rat









Heart Rate:

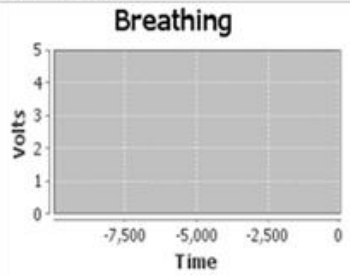
SpO2:

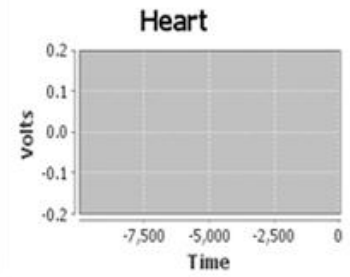
Temperature:

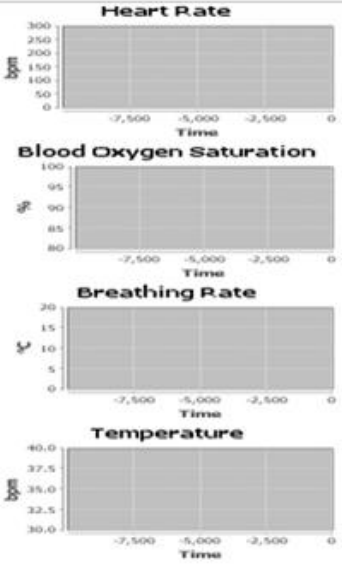
Breathing Rate:

QuadRat MenuBar

File Image







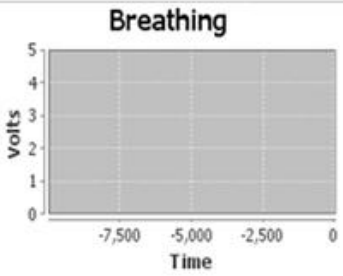
Heart Rate:

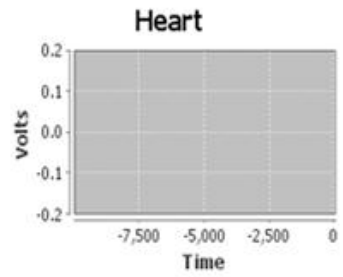
SpO2:

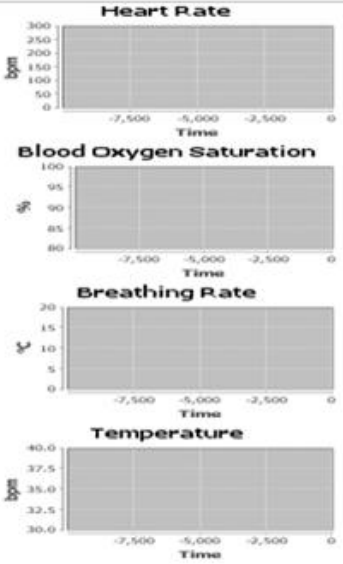
Temperature:

Breathing Rate:

Rat 1







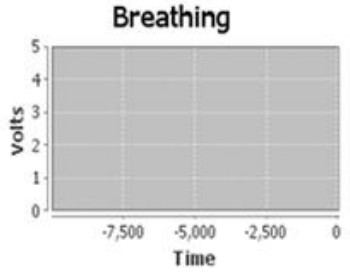
Heart Rate:

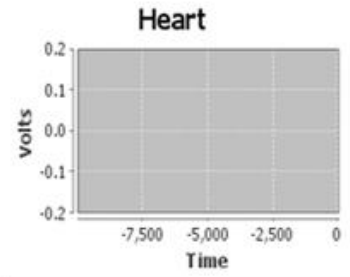
SpO2:

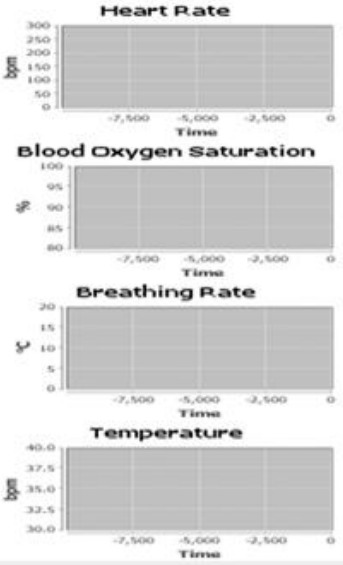
Temperature:

Breathing Rate:

Rat 2







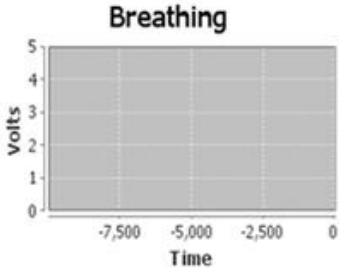
Heart Rate:

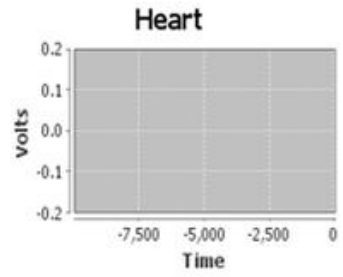
SpO2:

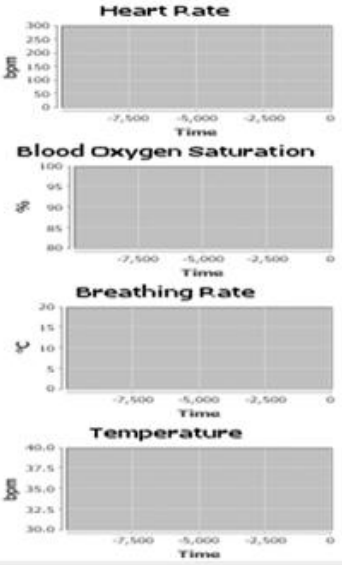
Temperature:

Breathing Rate:

Rat 3







Heart Rate:

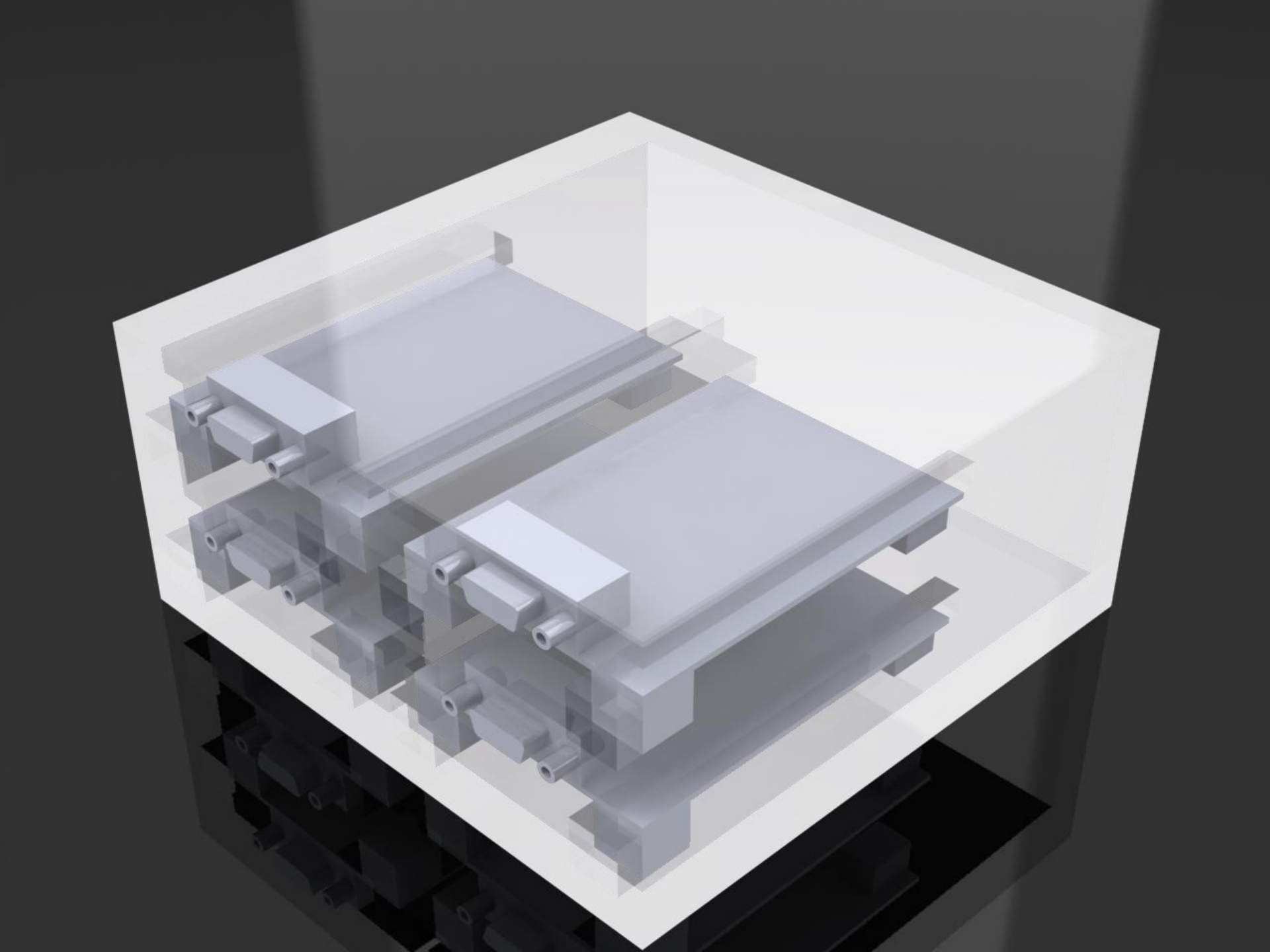
SpO2:

Temperature:

Breathing Rate:

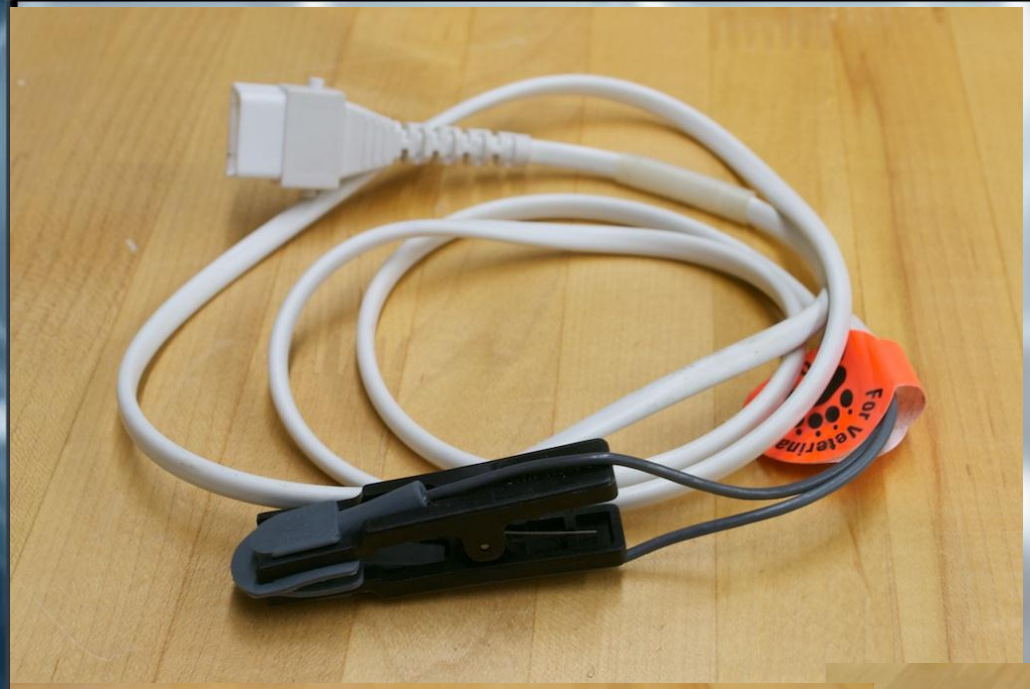
Rat 4

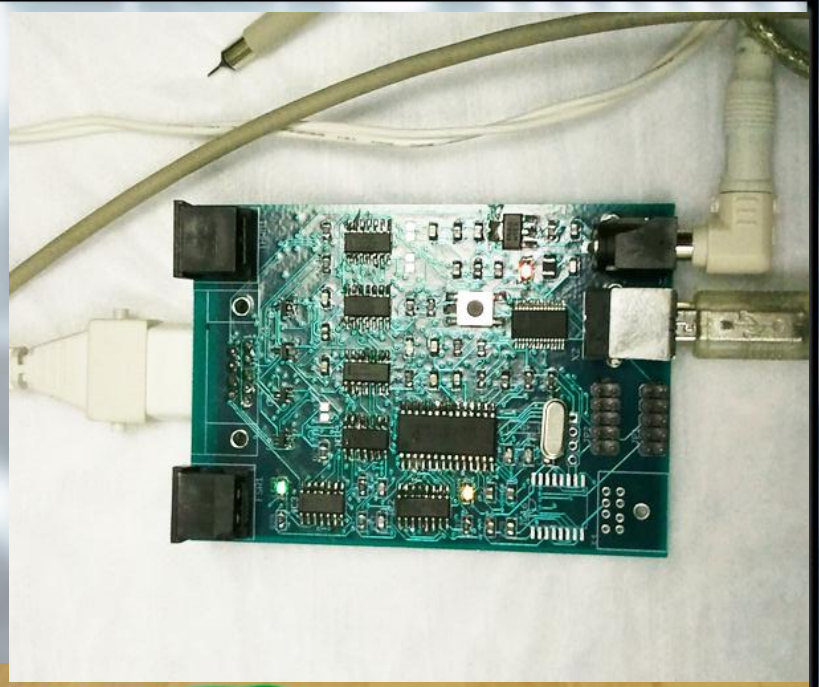
Status: Probe Disconnected!

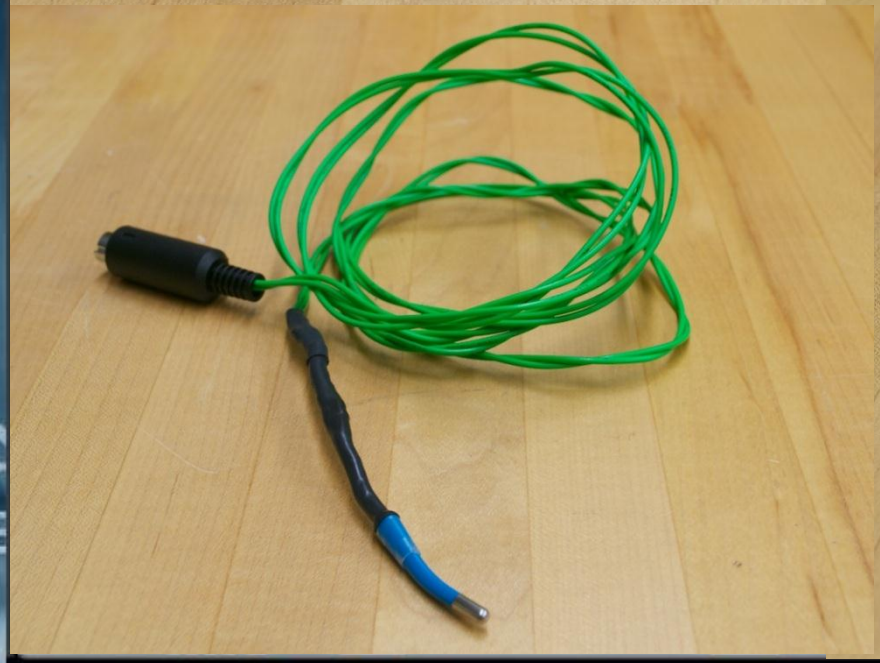


Future Work

- Program master and I^2C
- Build housing
- Finish interface
- Improve algorithms
- Verification testing
- User manual







Acknowledgements

- Amit Nimunkar
- Peter Klomberg
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- Liz Ahlers