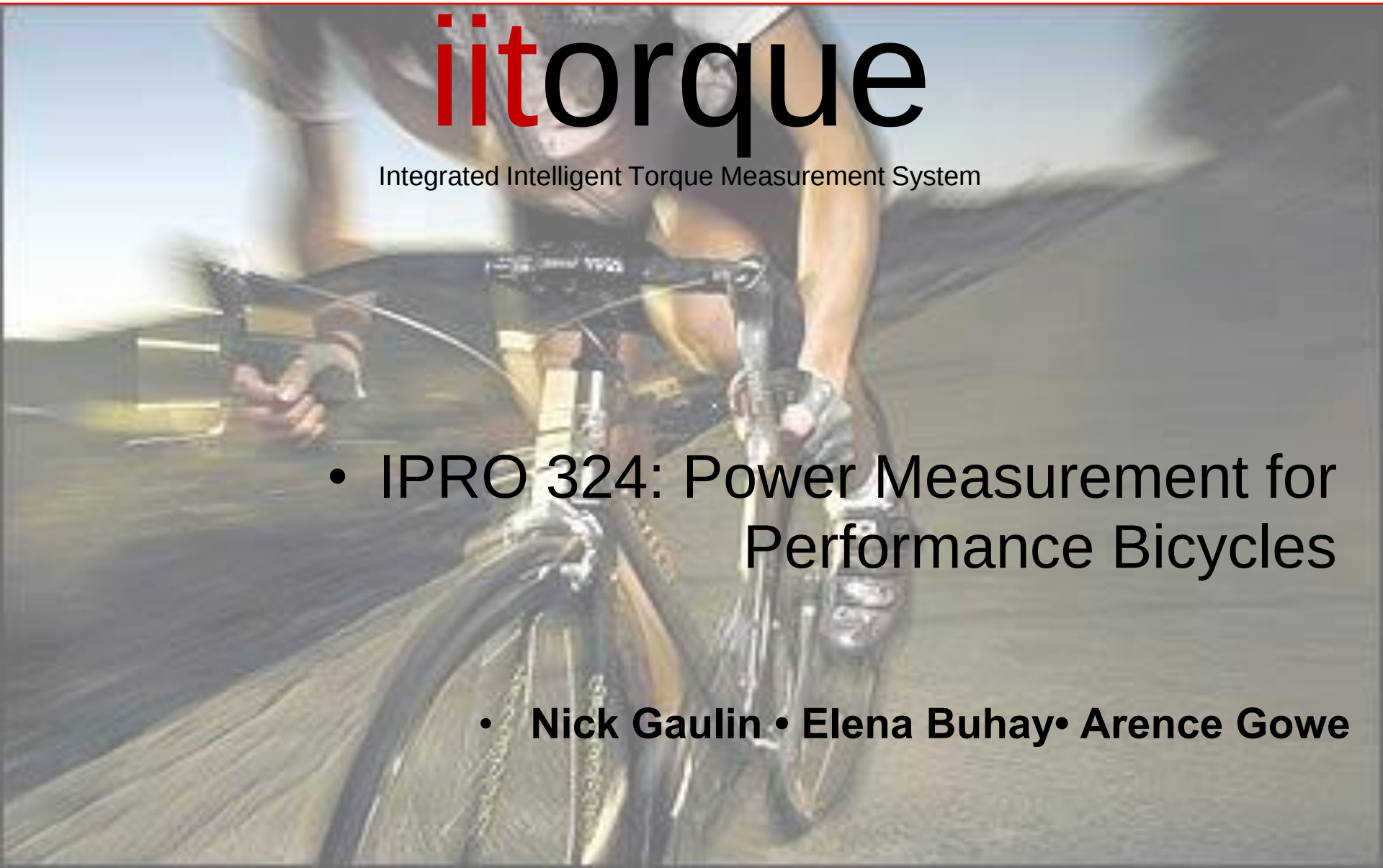
IPRO It takes a team!
INTERPROFESSIONAL PROJECTS PROGRAM

ILLINOIS INSTITUTE OF TECHNOLOGY



iitorque

Integrated Intelligent Torque Measurement System

- IPRO 324: Power Measurement for Performance Bicycles

- **Nick Gaulin • Elena Buhay• Arence Gowe**

Introduction

- Mission statement:

"Develop a system that measures the applied torque at the crankset of a bicycle. In contrast to existing solutions, we want to be able to retrofit our system to existing cranksets, obviating the need to abandon parts that the bicyclist already owns. "

Overview

- What's out there:
  - Power meters currently in the market
  - Pros/cons
- Power measurement for cyclists
  - Accurate
  - Low cost
- Project goals
  - Working prototype
  - Durable encasement
- Target market
  - Performance cyclists
  - Casual cyclists for general fitness

Goals of the Project

- Proposed solution
  - Torque measurement using strain gauges
  - Crankset attachment
- Impact on end user/target market
  - Affordable power measurement
  - Accurate power measurement for all cyclists
- Current solutions
  - Pedal systems
  - Rear hub
  - Chain vibration

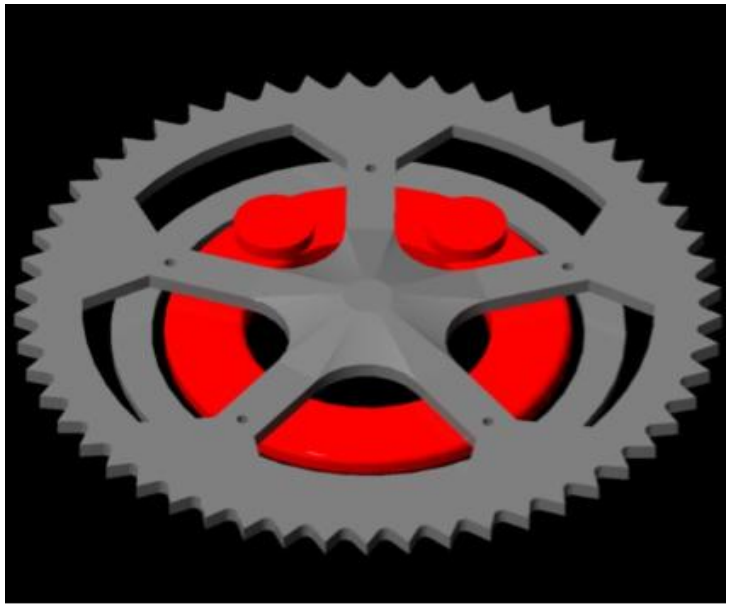
no strain, no gain

Organization of the Team (WBS)

Mechanical	Electrical/Programming	Research
• Design and build case • Dynamic lab test • Road test	• Redesign circuit • Rewrite code • Establish wireless communication	• Order parts • Analyze market • Prepare deliverables and documentation

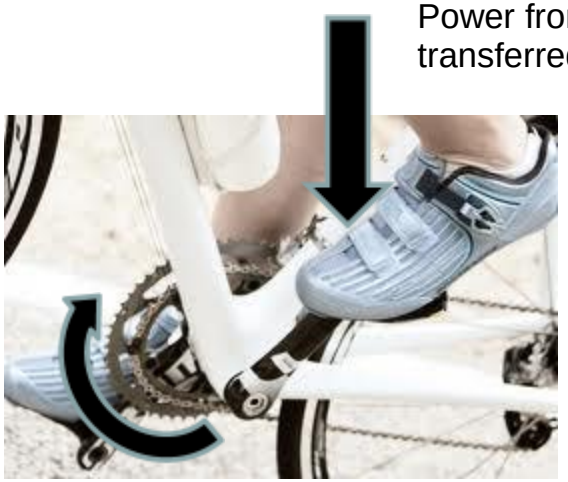
Previous IPRO

- Design of product housing
- Testing procedure
- Strain gauge use
- Static testing and calibration
- Data acquisition method



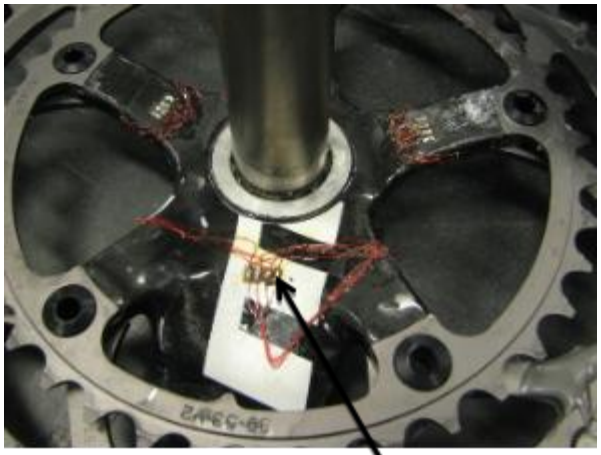
Mechanical Team:

- Mechanics
- Power transfer through crankset to chain to wheel
- Law of energy conservation tells us that crankset deformation α power input



Power measurement

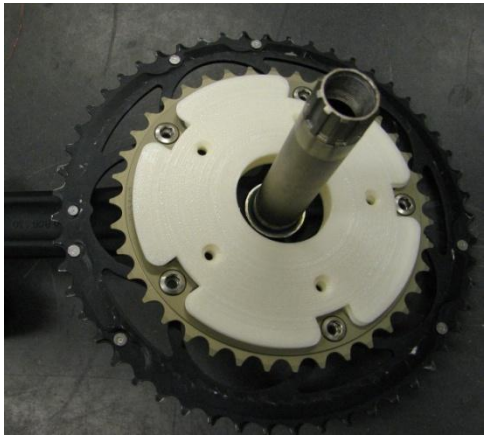
- Strain gauges measure electrical resistance
- Change in resistance α deformation α power input
- Recorded resistance values used to determine torque and hence power in lab view

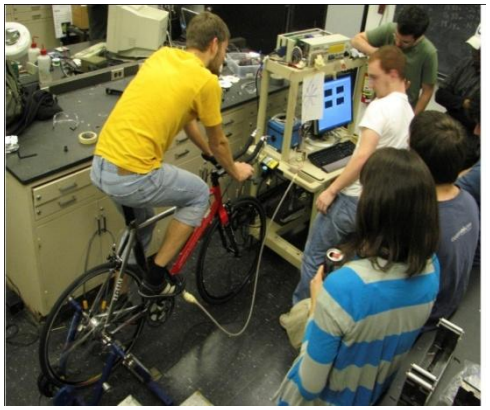


Strain gauges attached to crankset

Accomplishments

- Designed and constructed the casing.
- Performed in-lab dynamic testing.
- Collected data and analyzed it
- Compared data of iitorque with other existing power meters





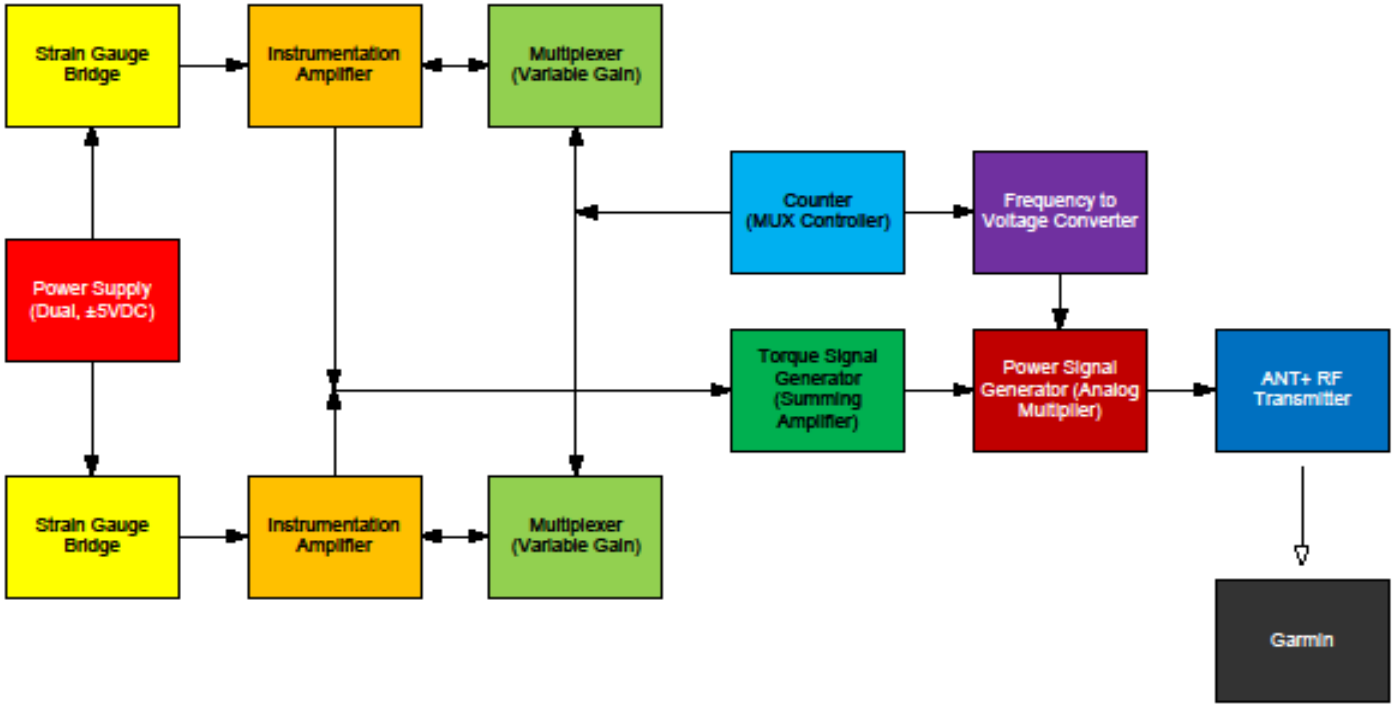
Electrical/Programming Team:

- Previous IPRO work
  - Digital circuit with microprocessor (PIC18)
  - Automatically generated ANT+ code

- ANT+ background
  - wireless sensor network protocol
  - specifically for sport and health devices
    - Bike power sensors
    - Heart monitors
    - Speed Sensors etc.

Electrical/Programming Team:

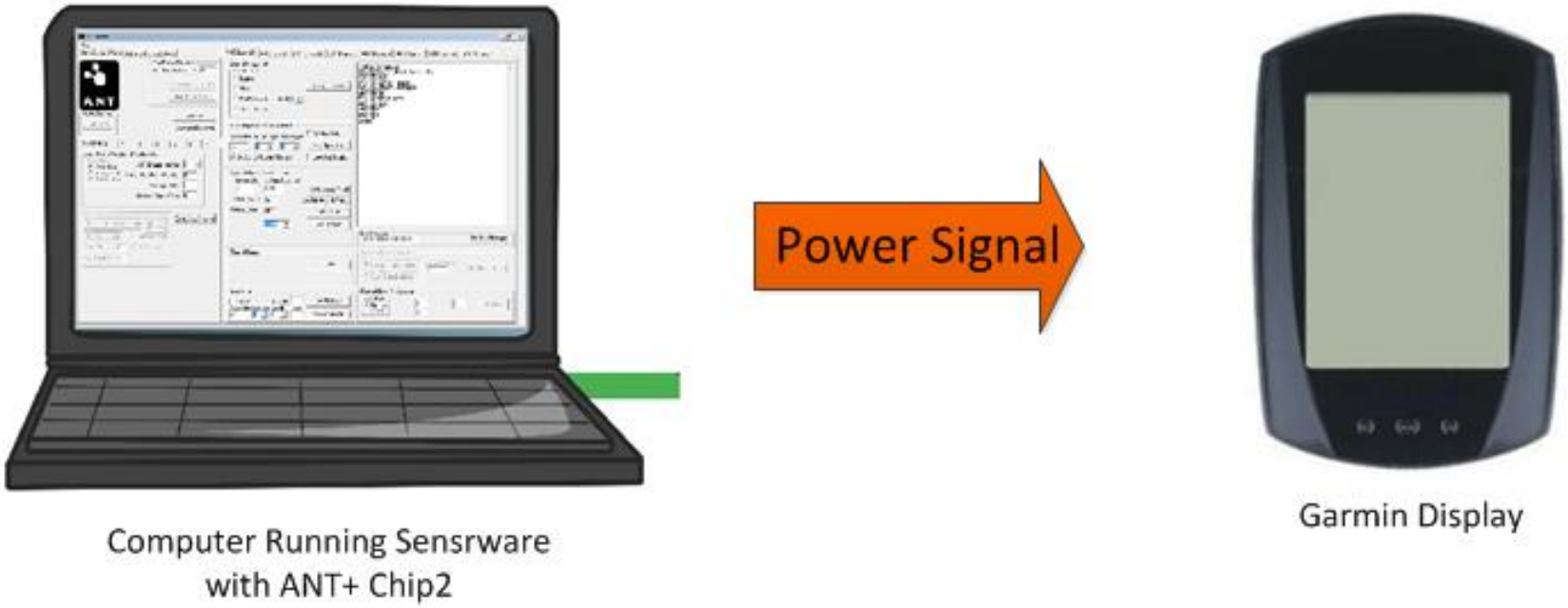
- Process:
  - Designed an analog circuit
    - Eliminates microprocessor and code



no strain, no gain

Electrical/Programming Team:

- Tested simplest mode of ANT+, Sensrcore, to transmit power signal



- Later discovered Sensrcore's purpose is testing only a few types of signals

Electrical/Programming Team:

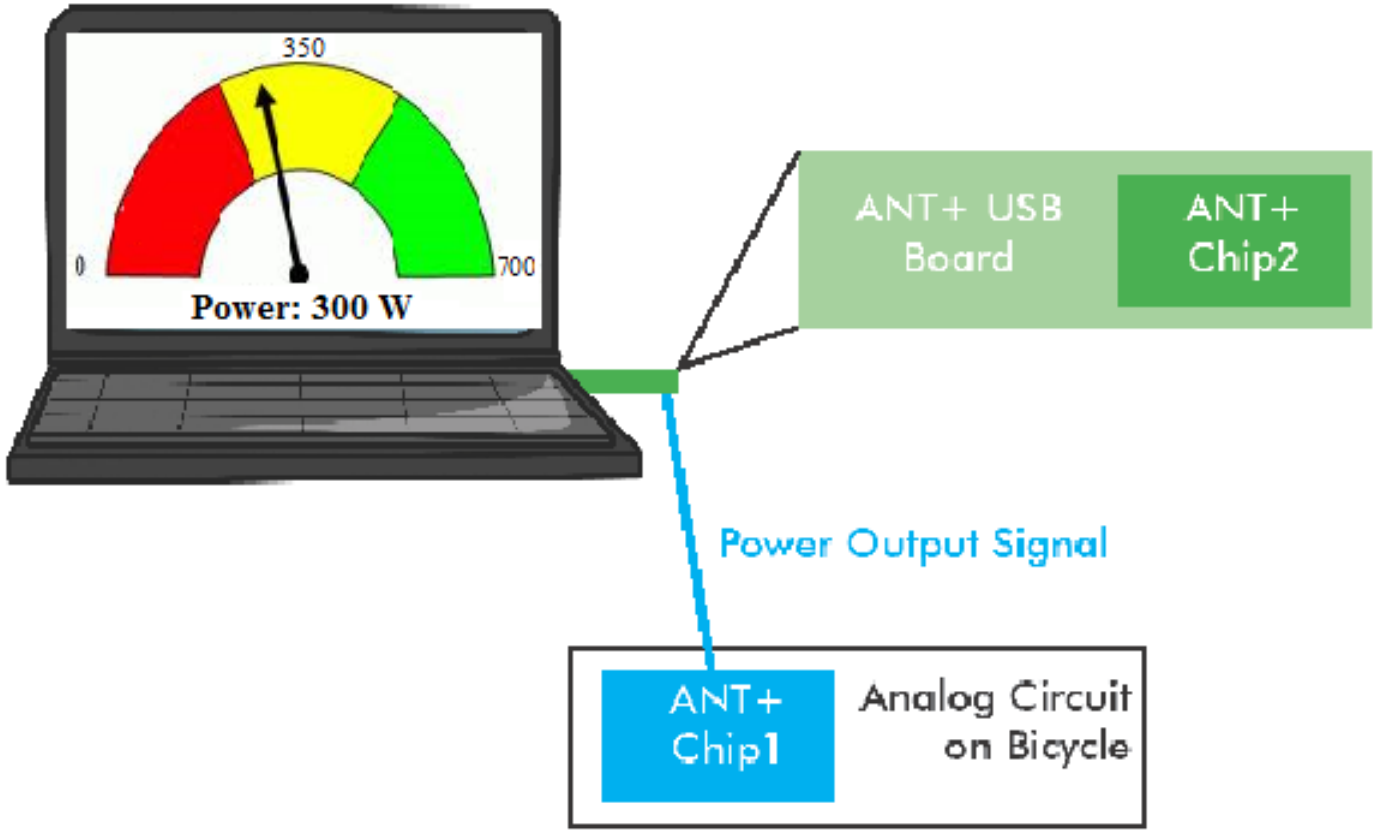
- Brainstormed solutions

1. Revert back to a simplified version of previous semester's code
   - Add microprocessor to current circuit

2. Move forward by using current circuit
   - Create interface for power signal output on a PC

Electrical/Programming Team:

- Final System



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Electrical/Programming Team:

- Future work:
  - Add a microprocessor
  - Program the microprocessor so the ANT+ can communicate with the Garmin
    - Code would be simple and minimal

Research Team

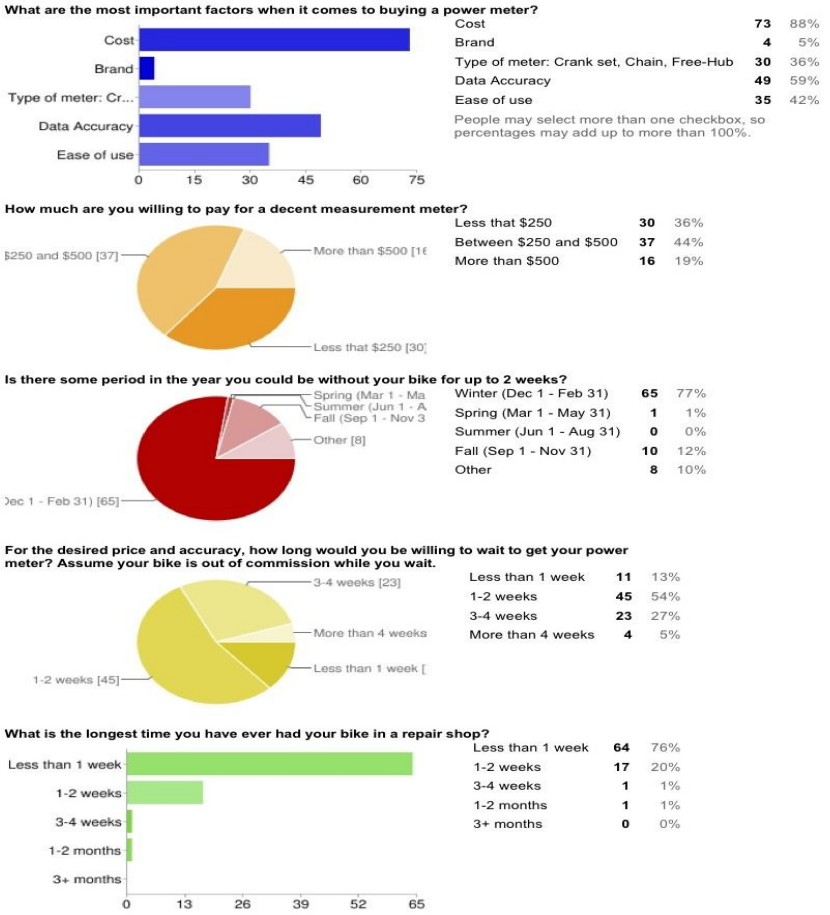
Accomplishments:

- Built an informative website for the project and document the work done.

Research Team

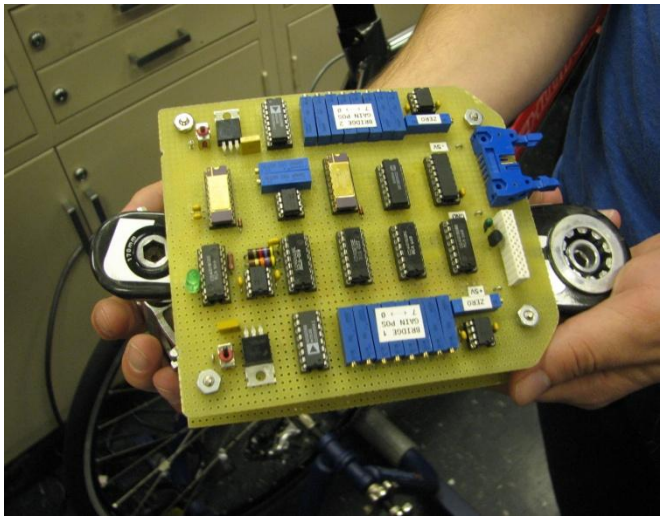
Accomplishments:

- Conducted a survey for Cyclists and collected data to refine the product/service features of iitorque



Conclusion

- Project idea has been successful
- Data collection is accurate as compared to data from powermeter
- For semesters to come, IPRO should fine tune system and determine how to reduce size of ANT+ data receiver



Questions?