IPRO 324: Power measurement for road bicycles

IPRO It takes a team! INTERPROFESSIONAL PROJECTS PROGRAM

NO STRAIN NO GAIN…

ILLINOIS INSTITUTE OF TECHNOLOGY

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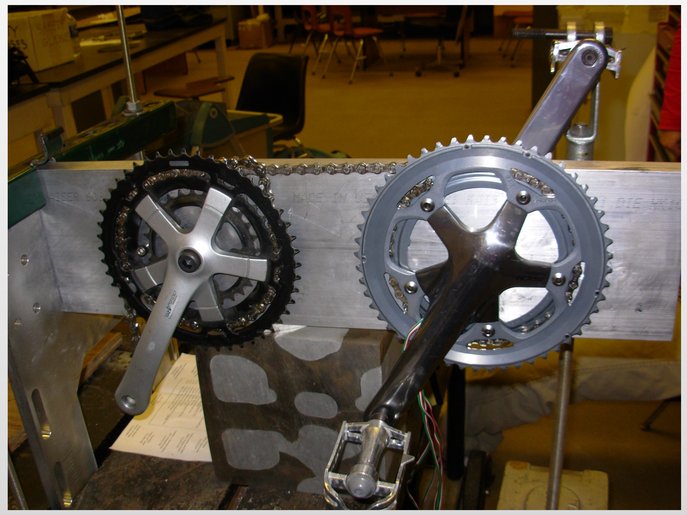
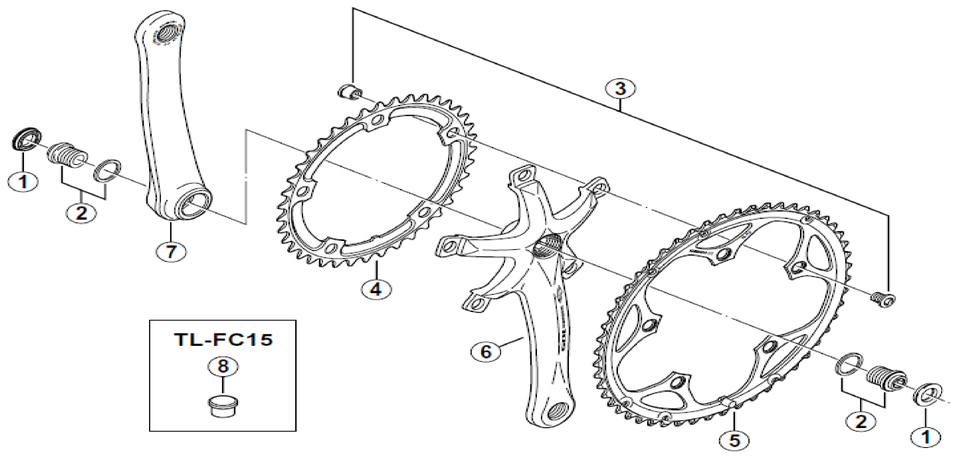


Problem

1. Available power measurement devices are expensive.

2. Solution MUST retrofit to existing cranksets.



Background

Current available systems on the market:

- Crankset (strain in crankset)
- Free hub (strain in rear wheel)
- Chain (vibration and speed of chain
- Opposing force (gravity, drag, acceleration, & wind velocity)

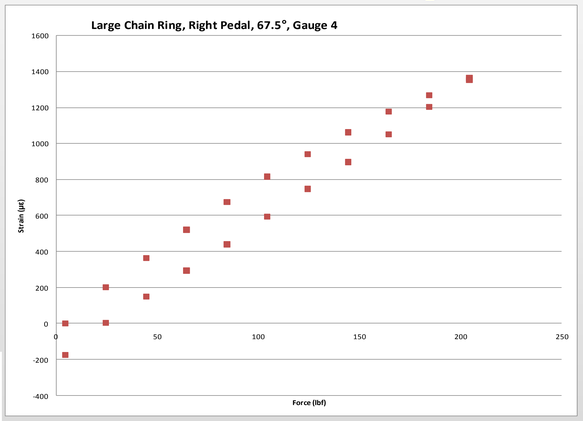
Pricing of these systems runs anywhere from sev-

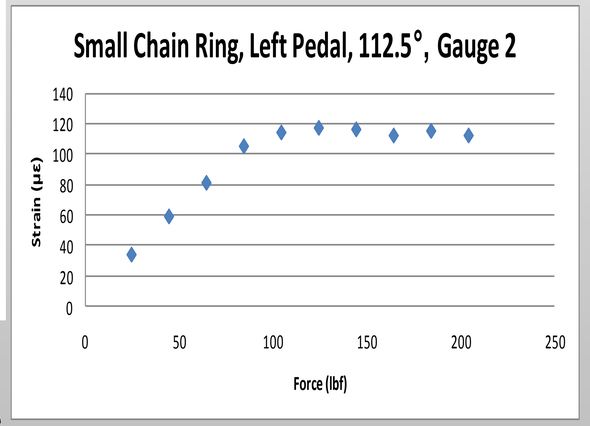
The Powertap SL 2.4 shown here for example is priced from $1500 up to $2000. And as we can see, it is not adaptable to a general crankset as the one shown above.

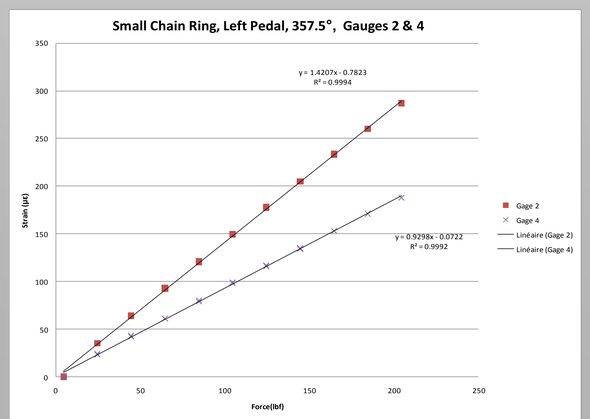
Objectives

. Miniaturize existing electrical system
. Update existing code for the power calculation program
. Obtain strain gauge coefficients
. Create a housing and mounting system
. Perform dynamic testing
. Minimize costs and power consumption

Some mechanical testing results







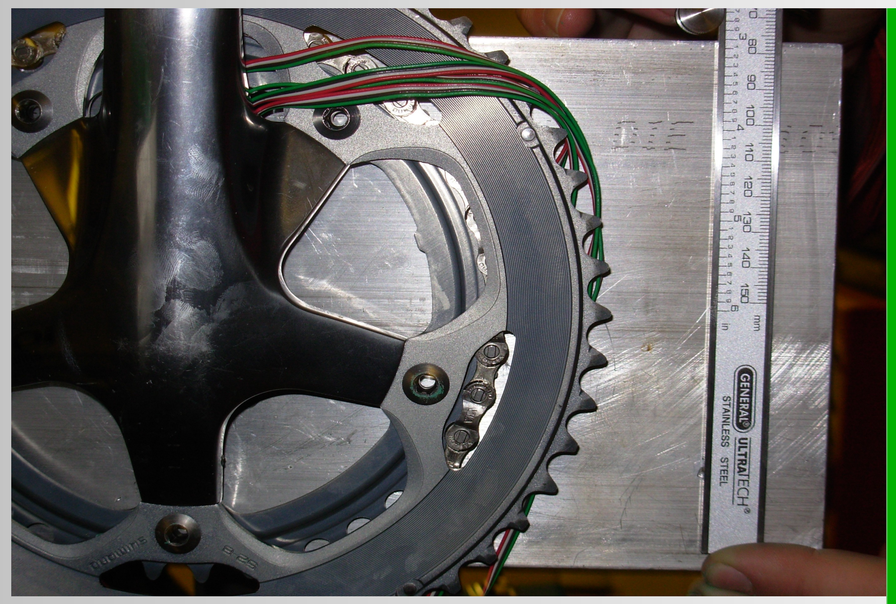
Methodology

Electrical Team

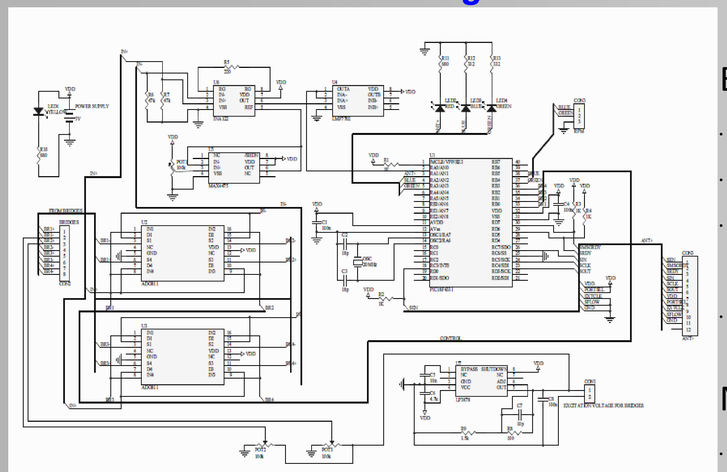
. Replace chip components with smaller and more efficient ones
. Remove redundant components
. Update code to automatically power down the system and adjust the torque formula upon startup

Mechanical Team

. Modify the test fixture containing the crankset to be perpendicular to its initial position
. Recalculate torque coefficients
. Create a universal housing and mounting system for the chip
. Perform road testing of the system



Electrical design



Obstacles

Electrical Team

. Miniaturization of the board to fit on the crankset
. Source code needs to take into consideration the change of angle to compute power output accordingly.
. Ways to increase power efficiency

Mechanical Team

. Attachment of all components to crank
. Finding a way to obtain a bicycle
. Integration of mechanical and electrical designs
. Performing road testing in a short amount of time

Results/Conclusions

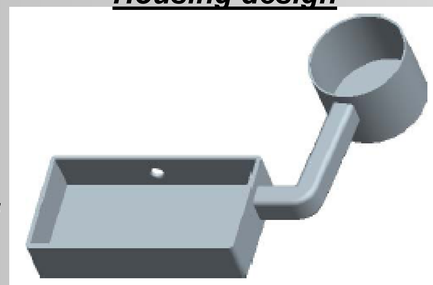
Electrical Team

. Power efficiency and size have been improved
. Circuit virtually laid out on a PCB board.
. PCB board manufactured and electrical components integrated onto board.
. Coefficients uploaded to the program and power calculations written for one over 8 angles.

Mechanical Team

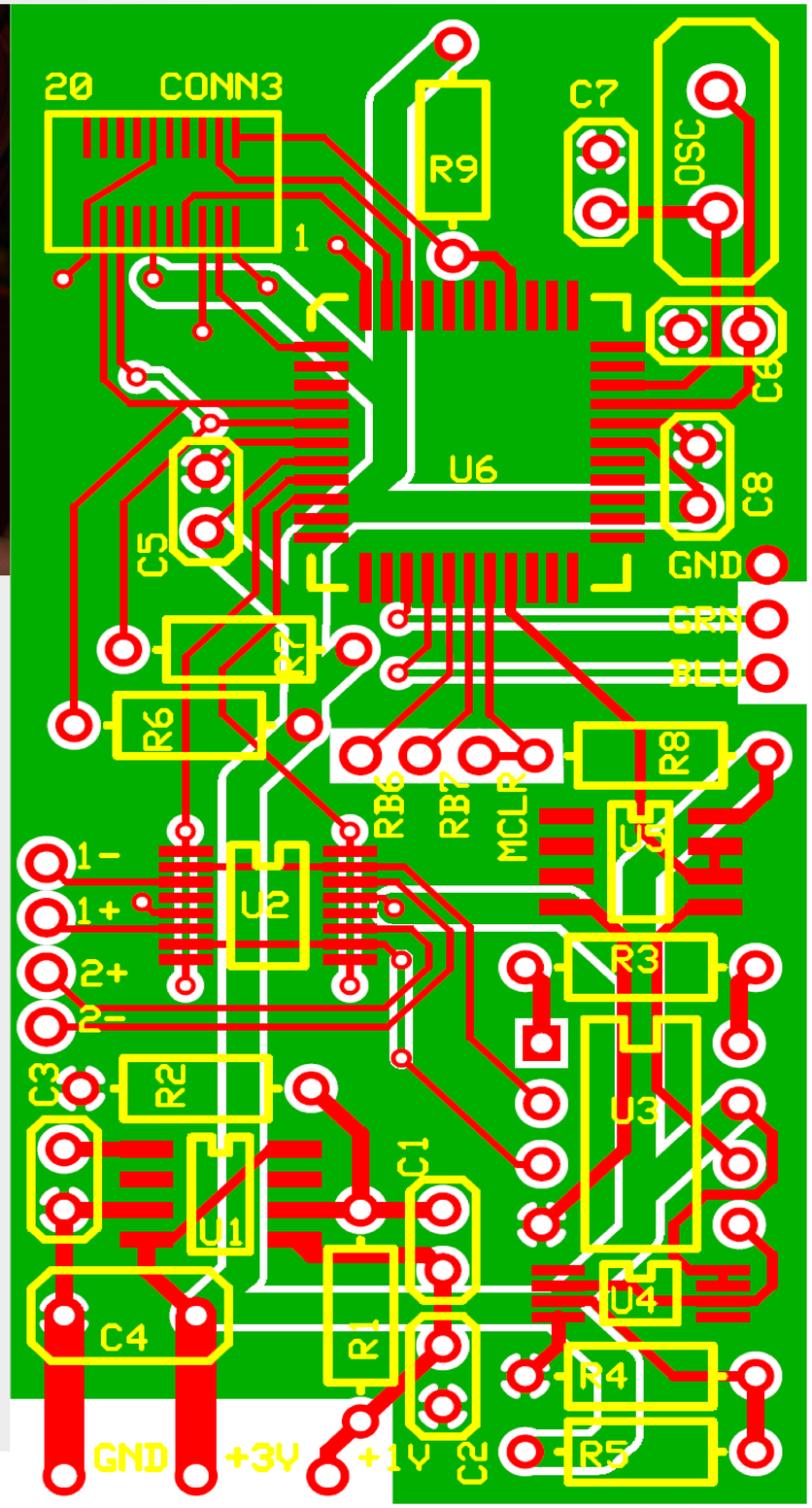
. New testing procedure used to test crank set at proper chain orientation.
. New crank attachment procedure developed to eliminate testing errors
. Coefficients for weight-strain relationship calculated.
. Circuit housing designed and integrated onto crank set

Housing design



Bike purchased at:

BLUE CITY CYCLES CHICAGO



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