IPRO 324: NO STRAIN NO GAIN

PROBLEM STATEMENT

The goal of this IPRO is to develop a system that measures the applied torque at the crankset. This will then be combined with advanced signal processing providing the user with information on mechanical power input.
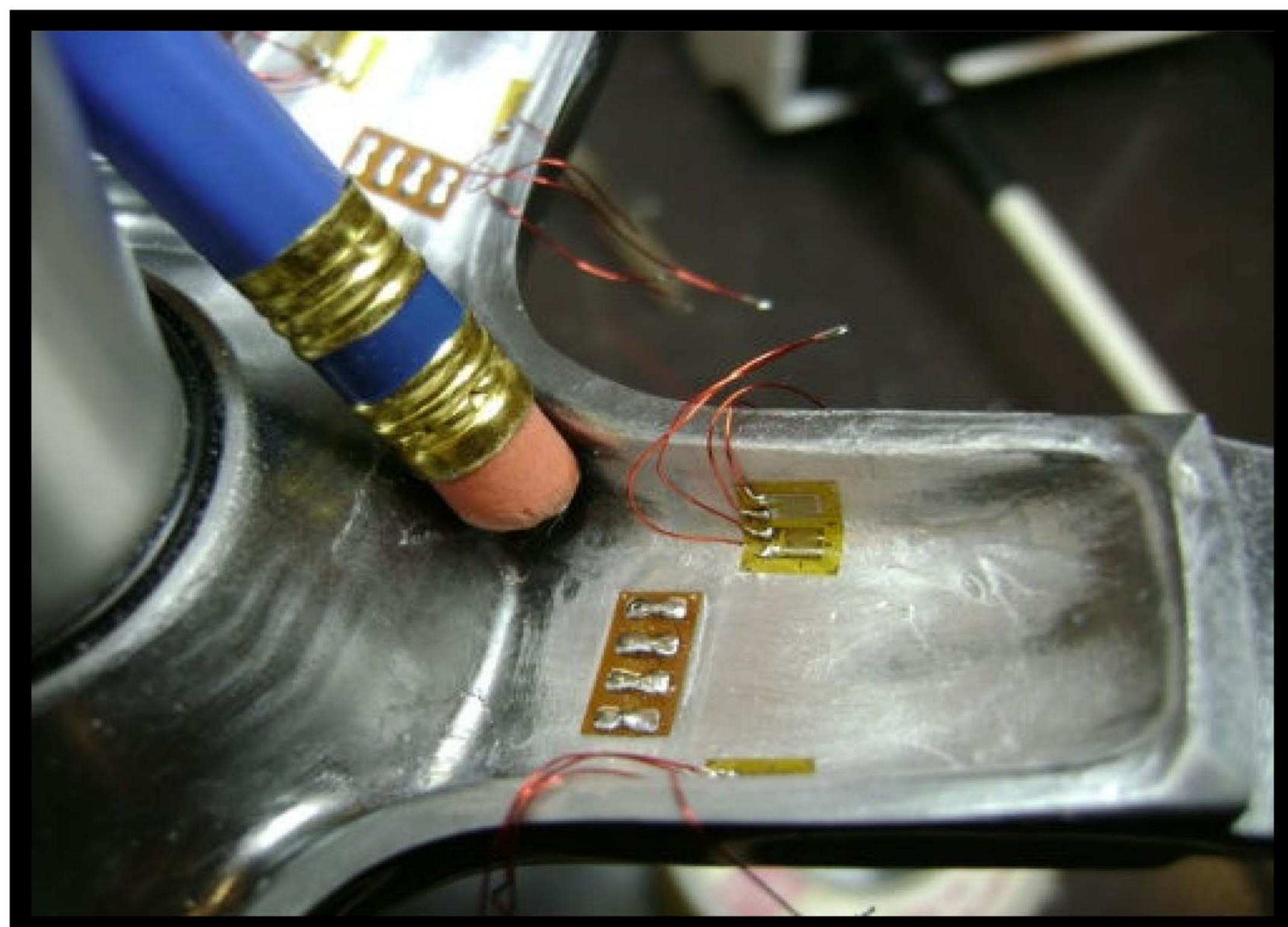
BACKGROUND

- Current systems measure power via:
  - Crankset (strain in crankset)
  - Free hub (strain in rear wheel)
  - Chain (vibration & speed of chain)
  - Opposing force (gravity, drag, acceleration, & wind velocity)

- The majority of products available are too expensive or not accurate
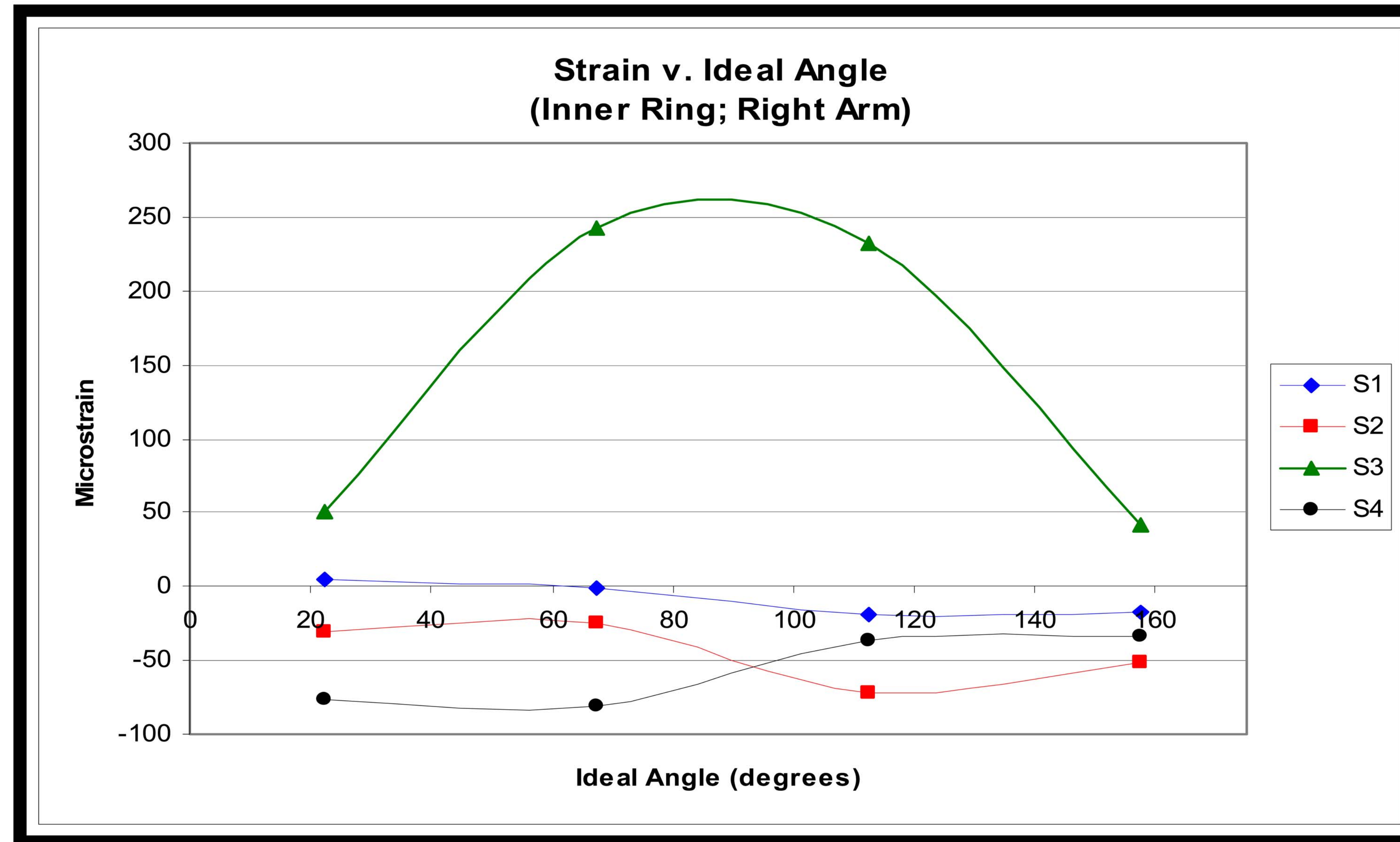
- Survey indicates the cycling community would like a more affordable system that does not require crankset or hub replacement.

- Continuing work and application of this technique from previous semesters.

(Strain gages on crank set)

Strain v. Ideal Angle
(Inner Ring; Right Arm)

(Mechanical Team Results from Testing)

GROUP OBJECTIVE

- Determine a configuration of gages
- Develop an electronic unit for processing the strain gages' signals
- Package the system
- Minimize costs

(GARMIN EDGE 705)

METHODOLOGY

Mechanical Team:

- Research current power measurement devices
- Design system of strain gages to measure strain in spider arm
- Four bridges of strain gages were applied to the apparatus
- An algorithm was created to relate the strain to the applied torque which allows the power output of a cyclist to be easily measured

Electrical Team:

- Resume work and troubleshooting from previous semester
- Component circuits are: strain gage amplification, ANT+ wireless communication, and RPM & Crank Angle monitoring
- All component circuits are combined to form final product
- Final product will use an algorithm to process strain gage data from mechanical team's results and provide a torque measurement
- Results are transmitted wirelessly to a cycling computer (Garmin Edge 705) which shows power output produced by cyclist