Information Technology and Telemetry

How to improve your car's efficiency through data science!

About Me

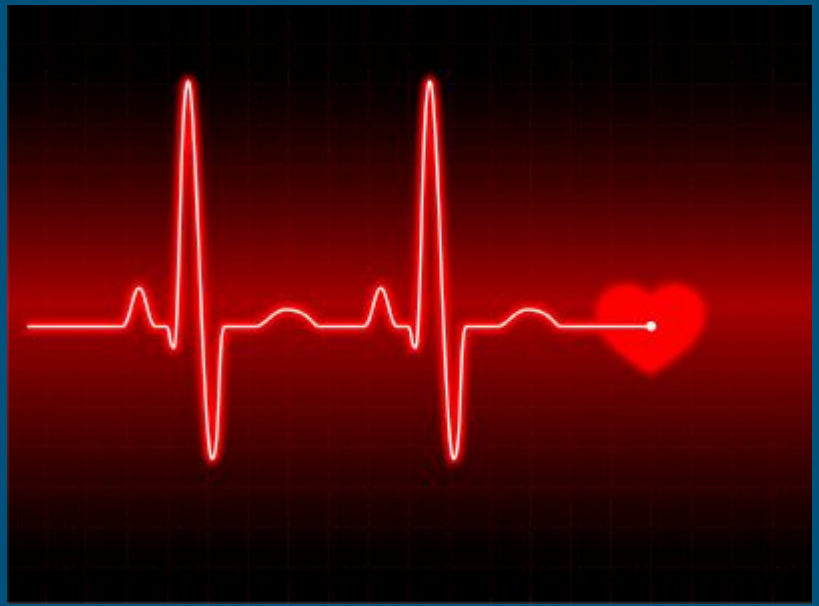
- Freshman in the College of Engineering studying computer science at the University of Michigan
- Previous captain of the Okemos Solar Racing Club
- 12-time hackathon champion
- White hat hacker

- Currently working with a research team at U of M to try and find weaknesses that would allow remote control of a car running Android Automotive

What is Telemetry?

- Collecting data about your car, including but not limited to:
  - Voltage at various points
  - Current draw from various components
  - Temperatures of components
  - Speed and GPS data

- Can be thought of as the heart rate monitor of your car



Why is it important?

- Planning:
  - Anticipating daily lap counts and adjusting speed
  - Watching for cloud cover and slowing down
  - Optimizing and balancing performance and car health
- Troubleshooting:
  - Unexpected abrupt voltage drops
  - What components are heating up abnormally quickly
  - Components drawing more current than anticipated
- Communicating:
  - Emergency messaging systems
  - At-a-glance information about warnings and cautions

Total Watt Hours in the Race = (total panel wattage * 6.25 charge hours per day * 4 days)

Estimated Total Distance = Total Watt Hours / car's average watt hours per mile

Estimated Average Speed = Estimated total distance / 23 race hours

For the Okemos car:
1475 watt array * 6.25 * 4 = 36,876 watt hours

36,876 watt hours / average efficiency of 83 watt hours per mile = 444.3 miles

SCC Official totals had us at 460.5 miles (so only 3.5% off)

(Does not factor in initial battery capacity or battery efficiency not being 100%)

Collecting Data

To be able to adequately understand the data you are seeing, you will need to run your car through some testing.

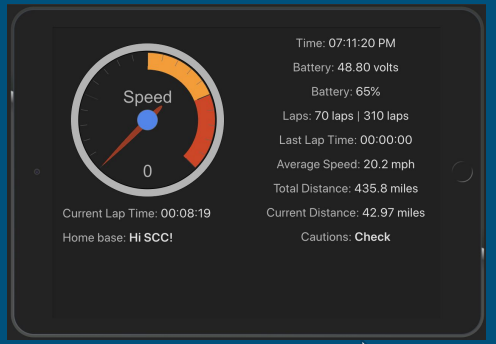
This can be a short drive around the school parking lot, or, ideally, a few hundred miles put on at a test track.

What to make of the data

To start understanding what you are seeing, try dumping your data into Excel or Google Sheets and generate a graph of all the data points over-laying each other.

You may start to see some correlation between various data points, perhaps ones you wouldn’t have even expected.

How to set it up?

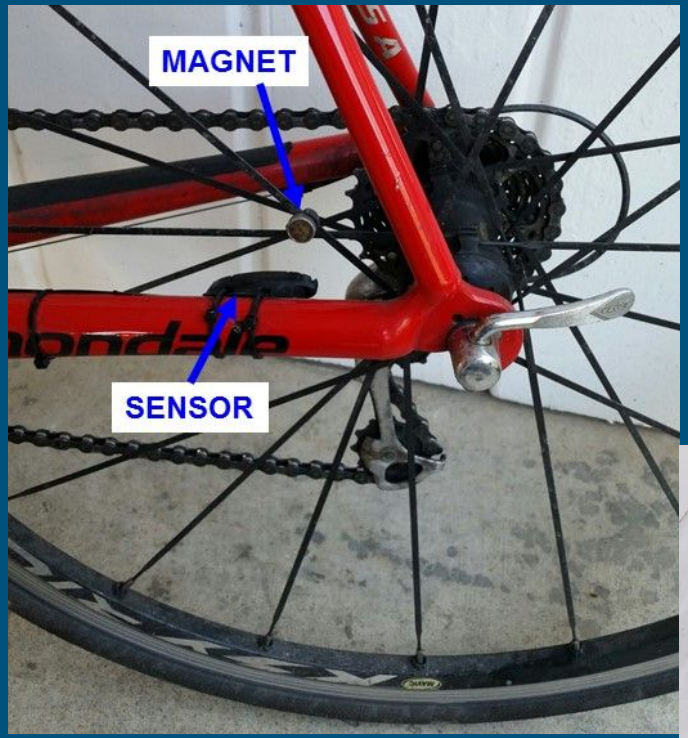


Less Complex — Complexity — More Complex

GPS device like a smartwatch or phone recording speed data for the driver to relay back to the crew and to base pace off of. Bonus points if it stores a copy of the data for further analysis later.

PiTop setup ready for plug and play with various sensors and capable of transmitting in real time to the team. This setup is not extremely customizable or easy to change, but allows for much more data collection than less complex methods while being relatively straightforward to integrate.

Custom built solution like Okemos's. Built to meet specific needs and can show as much data as desired, while being able to be modified to allow for more detailed analysis automatically. More difficult for future years to maintain.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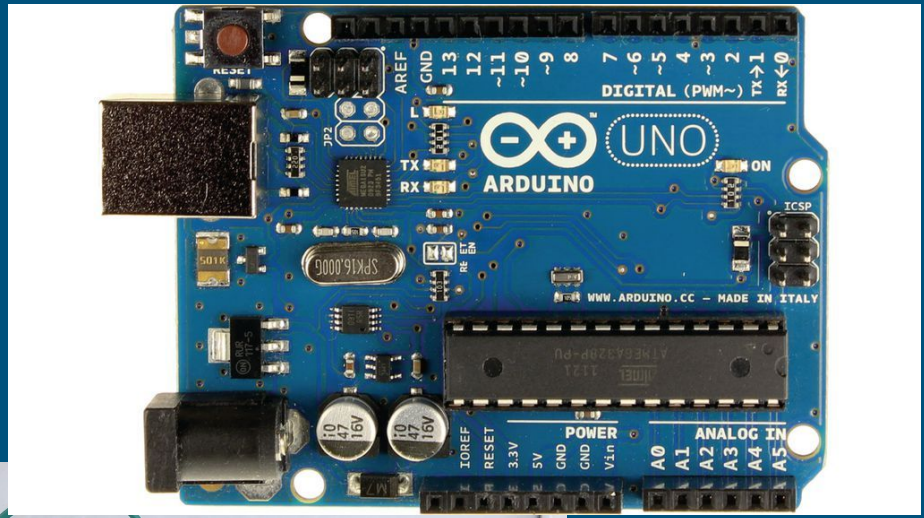
SENSOR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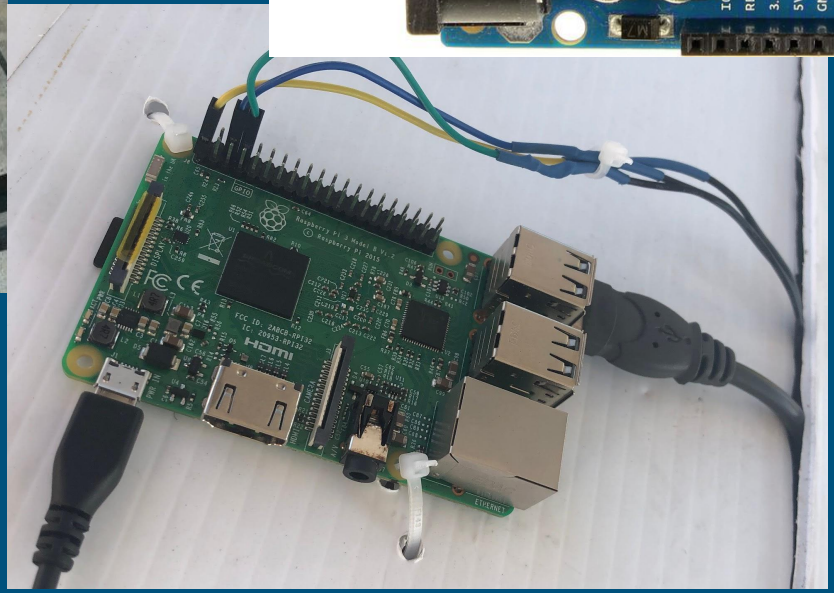


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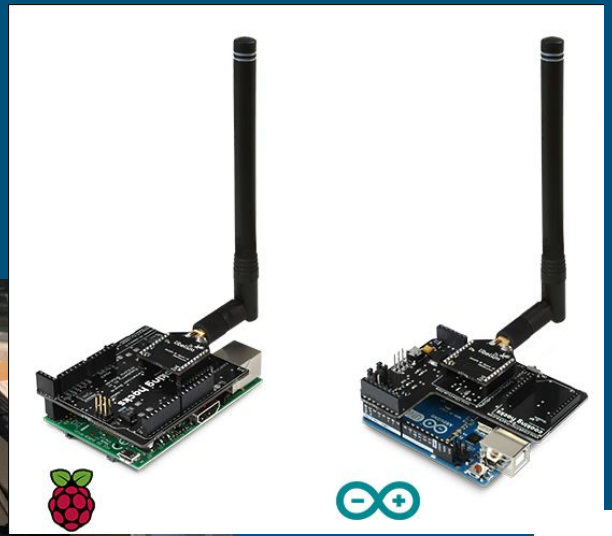

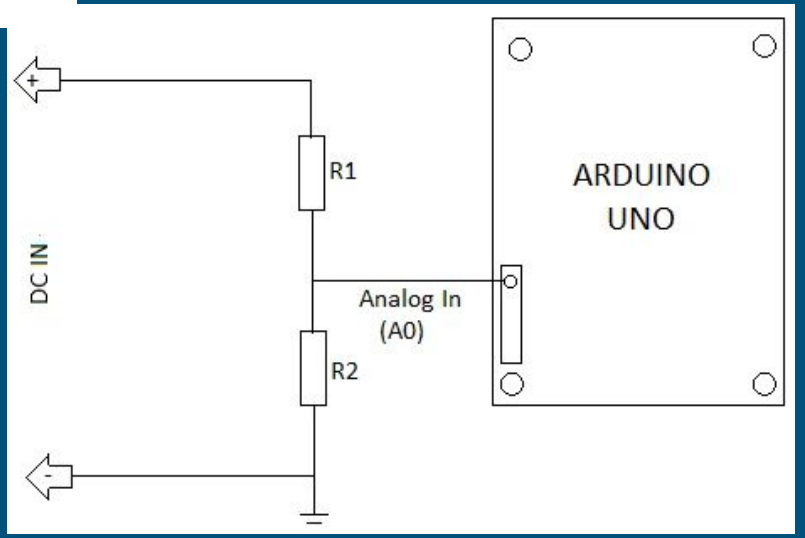
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Contact

Please don’t hesitate to reach out with any questions!

Email: eric@andrechek.com

Phone: 517-512-0419

GitHub: https://github.com/OkemosSolarRacingClub/Telemetry