18-883 Project Proposal
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Scenario:

Throughout winter and summer of this year, I lived for months at a time out of the back of my pickup truck while driving around the country. With a topper over the bed of my truck, my setup was fairly simple. I built a wood frame, a foam mattress, and some storage features, but I never dabbled with any electrical wiring. Particularly when the weather dropped below freezing, I wondered about the feasibility of installing a solar panel on the roof of my truck. An isolated, small-scale, off-grid system built off the back of my vehicle would help me power a heater for the winter, fans in the summer, signal boosters so I could actually do remote work from my truck, electric stoves, and a multitude of other gadgets that could improve my quality of life.

I realize this scenario is probably not what you had in mind with this class project, so if this does not fit the bill, let me know and I'll devise another proposal. However, this is a situation that I am passionate about and am interested in investigating further. I am genuinely thinking of building a PV system off my truck in the near future! I've added two photos of the truck on the next page just for reference. Vanlife is quite a popular lifestyle these days, so the results of this project have implications beyond just my minimal truck setup.

Analysis:

Ultimately, my goal with this project is to understand how the power generation of panels varies across the US. In other words, given a long-distance road trip route, I hope to design a model for predicting the average amount of time my panel needs sun exposure each day to fully charge a battery (likely a deep cycle car battery). When parked, sunlight isn't guaranteed, but if we make some assumptions and conclude that charging time happens only while driving and that all roads have clear view of the sky, then we can understand the time and distance that must be driven daily to live comfortably off the grid with a small-scale PV system on a van or truck.

Source of Data:

Given a google maps route, I can parse out coordinates and draw simple lines between points to get a fairly granular understanding of drive time needed along my route. I will have to make assumptions about the albedo across the US and will assume the roof panel is always orientated directly upwards. I will also assume the solar panel only receives any radiation when I am driving on roads. This is a simplification to account for tree cover and other obstructions when the vehicle is parked. Using these assumptions, I can understand the irradiance throughout the US and understand the max power point as well to estimate drive time per day to fully charge the battery.

Project Effort:

I'll be doing this project on my own.

I do not have much of an idea how long a model like this will take me to program. Ideally, I'd like to also generate charts showing max power point across the US and use this to generate another chart showing the approximate hours per day I would need to drive to fully charge the battery. At the least, I will design a program that, given the URL to a google maps route, determines the average number of hours a day I would have to drive to consistently fully charge the battery on the daily.

Photo:

I thought it might be worth including a photo of my truck, just for context! I've previously used a gas powered stove and I run my lights off a small 10,000 mAh battery pack. A PV system could vastly improve the setup!