

Thesis Portfolio

Wheel Surfer: A Device to Recharge Batteries from Mechanical Motion
(Technical Report)

The Thirty Meter Telescope and Mauna Kea
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

My technical capstone focused on creating a device that could charge a battery from mechanical work. My STS thesis focused on the conflict between Native Hawaiian activists and astronomers over the Thirty Meter Telescope on the summit of Mauna Kea. Professor Gorman, my STS professor, said there was no need for the STS thesis to be related to my technical capstone. Given this, I chose to write my thesis about the TMT, which is an important issue to me since I was born and raised in Hawaii. Since there is no connection between my technical capstone and my STS thesis, I will provide a short summary of both.

Technical Report

Our capstone group's goal was to create a device that could recharge batteries. Our group came up with a device that the user could attach to their bike, which would generate power from the rotational energy of the spinning bike tire. A plastic wheel that is in contact with the rear bike tire spins two DC motors, which generate electrical power. The device would be connected to a battery, which would allow the user to charge their phone or any other device with a USB charger. Our product conforms to engineering codes and standards.

Manufacturability, safety, and the environment were all taken into account when we designed our product. Our product can be manufactured easily, which would reduce costs. We designed our product to be safe to use. Our product is in contact with the rear tire of the bike and clear of any moving parts, such as the bike chain. Most of the materials in our product can be recycled and our product produces no emissions while it is in use.

Finally, a cost analysis was performed. Our product was rather expensive to make, the final cost came out to about \$120. However, the final cost could be cut significantly by using injection molding rather than 3D printing plastic parts and manufacturing some components, such as shaft couplers, directly rather than buying them from an OEM. Ideally, we would like to be able to offer our product for around \$200 to consumers if our product went to market.

Our product is mainly geared toward people who ride bikes: students, urban dwellers, and recreational bikers. Our product would offer them a convenient, environmentally friendly way to charge and use their phones while riding their bikes. However, in areas around the world where access to electric power is limited, our device has the potential to make a big impact. It would give people who ride bikes access to clean energy and could transform lives around the world.

STS Research Paper

The summit of Mauna Kea is one of the best sites in the world for astronomical observatories. A consortium of scientific groups has planned to build the Thirty Meter Telescope (TMT) there, which will allow for new astronomical discoveries. The construction of the TMT, however, has run into serious opposition by Native Hawaiian activists. In July of 2019, activists blocked the road to the summit of Mauna Kea, preventing the start of construction of the TMT.

The complaints of activists include feeling left out of the decision-making process that allowed the TMT project to move forward and that the TMT is going to be built on sacred land. However, the issues among the activists stem from the overthrow of the Hawaiian Monarchy in 1893 and subsequent treatment of Native Hawaiians. Resolving the conflict over the TMT will almost certainly involve addressing these deeper issues.

Some steps that can be taken to resolve the current conflict include trading zones between activists and organizers as well as anticipatory policies by the local and state governments. Trading zones can be helpful in establishing dialogue and trust between the two sides. A government that takes proactive steps rather than reactive steps can, in certain situations, address potential problems before they become serious. Anticipatory policies that focus on bringing the community together and doing more to benefit Native Hawaiians will also help to heal wounds among the Native Hawaiian people.

The future of telescopes on Mauna Kea remains uncertain. The University of Hawaii's lease on the summit of Mauna Kea ends in 2033 and the potential for conflict with activists have created uncertainty in the scientific community regarding investing in new telescopes or upgrading existing ones. However, trading zones and anticipatory government policies, among other things, can go a long way in resolving the current conflict and providing a way to benefit the Native Hawaiian community while allowing for continued scientific discovery from the summit of Mauna Kea.