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E-Trike

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Summary

The E-Trike focuses on being a convenient form of transportation. There has been an increase in the demand for the use of clean renewable energy. The E-Trike hopes to replace the need for vehicles that emit carbon. A very important aspect of this project is that it gave students the ability to apply what they have learned in their undergrad studies in a new and innovative way. This project required mechanical and electrical skill sets that will be helpful in the industry.

Problem Statement

The goal of the E-Trike is the build a vehicle that is both cost effective and energy efficient. Being there is a high demand for a better means of transportation that limits the usual of fossil fuels and pollution in the air. Hopefully the E-Trike will demonstrate these qualities. The thought process that it took to create these designs/conclusion was developed throughout our four years of undergraduate studies. The assembly of the E-Trike consists of the knowledge from both mechanical and electrical engineers.

Our goal for the 2018-2019 school year for the E-Trike was more on the energy conservation side. Due to cost and delay of parts our goals were slightly abrupted. Our goals were to implement a solar panel, incorporate a lithium battery, add manual power and elevated the seat.

However, the long-term goals have changed in comparison to the last year's team. The new long term goals consists of optimization of parts for cheaper prices, improve the framework for comfortability and compatibility to public chargers.

Design Requirement

In order to adhere to all Rules and regulations of the Consumer Safety Product Commission and the United States Patent and Trademark Office we have the following constraints:

Socio-Cultural Constraints

The front wheel must be at least 16in in diameter.

Economic Constraints

The total cost of the E-Trike must be less than $1000 to be profitable.

Environmental Constraints

Classified as a class 2 bike. Making it compatible with public chargers.

Structural Constraints

The total weight of the E-Trike will be between 80- 100lbs. Battery should weigh less than 20lbs

CURRENT STATE OF ART

Type	Price	Est. Max Range	Form of Power	PRO's
Recumbent Tricycle 	$2,200	15 mi	Pedal assist	✗ Cheap ✓ Comfortable
Moped 	$12,985	65 mi	Gas powered	✗ Cheap ✗ Comfortable
Bicycle 	$80	20 mi	Manual powered	✓ Cheap ✗ Comfortable
Electric Scooter 	$80	20 mi	Electric Assist	✓ Cheap ✗ Comfortable

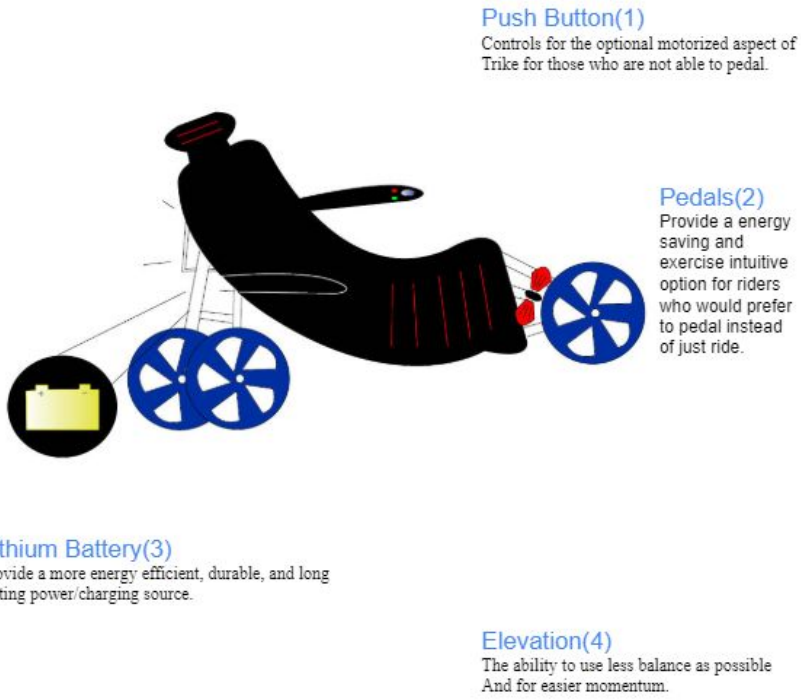
SPECIFIC COMPARISON OF E-TRIKE TO BIKE ON MARKET

The E-Trike Project is focused around an electric battery-powered tricycle, The Sinclair C5 and IRIS e trike are both relevant electric technologies that are currently patent. The sinclair C5 is discontinued, however, the IRIS e-trike is on the market for consumers. Due to its advantages and disadvantages. They are environmentally efficient, battery powered not ran on gasoline, easy to use and the world's fastest human powered long ranged cycle. However, the E-trikes are extremely expensive, not safe or comfortable for the roads and the highest speed is averaging around 50 MPH. Our E-Trike team will be aiming to create a safer body for consumers, less expensive, using a more accessible and convenient battery power. Sinclair C5 is a electric battery powered vehicle created in 1985, by its manufacturer Sinclair Vehicles. Although it was one of the very first battery electric vehicles its british market was not at all satisfied by its launching. There were an extreme amount of safety concerns, the bikes speed was at about 15 mph, it was not comfortable for people to sit in and once tested the battery motor could not sustain the control system. Within 3 months of being launched the Sinclair C5 had a horrible reputation and to make matters worst Sinclair vehicles inflated its prices to about 5000 from 400 just to meet sales reports. The Sinclair C5 was demise and the assembly line shut down for products. The IRIS e-trike is a new and improved version of the Sinclair CS electric powered bike, much more advanced than the Sinclair version after years of improvements but like minded concepts The IRIS e trike is costing about 5000, more comfortable, eco friendly traveling at about 30 mph. Currently, the products that we need to build the e-trike are on the market, and there have been advancements made in these products. A typical E-trike kit such as from makers like ISIS and Sinclair will include a lithium battery. The lithium-ion battery is a step of

innovation from the lead battery. There are many explanations as to why the lithium-ion battery is at the forefront of new e-trike technology. For one, it has more capacity, i.e. 15 AH versus 11 AH. It is lighter; 5 lbs instead of 8 lbs. It also has a better voltage match; 24.5-28.7 volts and a low resistance of 33 Milliohms. Overall, the current status of the e-trike components is available but costly. The E-Trike has a target market and demographic of people in their mid 40's and above. As a result of the E-Trike having a target market where individuals are prone to having more health ailments the E-Trike wants to cater to those elements while allowing our target market to 6 also be physically active to an extent. Now, although we want our target market to be physically active we don't want them to push themselves too hard. We desire to take some of the strain off of their exercise. We plan to do this by allowing the bike to do more of the pushing instead of the user's legs. The E-Trike caters to the needs of those with physical limitations. The seat has an obtuse angle formation that allows the user to sit at an angle that provides back support. The controllers on the side of it allows for the user to push themselves up and establish a balance. Due to different health ailments that may occur in users such as knee problems and back problems etc. our E- Trike team is striving to make improvements by providing more cushion in the seat. The seat is important because trike sits low and it's easy to feel the pain when you bike over big rocks or rough terrain. The users comfort is a big factor because our demographic would have increased sensitivity. The laws of the D.C. Bike Association state that the E-Trike is allowed to be mobile on the streets, therefore an improvement is providing the bike with tools to provide efficiency throughout traffic. Adding a turn signal on the front and back of the bike that includes a 1500 lumens LED bulb to provide notice to other vehicles when the eTrike will switch lanes or turn corners. Adding an electronic notification system that brings notice of how many

miles left until the battery dies. Our device can be improved by adding to various aspects of the device. One area would involve the affordability of the product. By saving money on parts we would be able to decrease the cost of the bike which would allow for more customers willing to purchase the Trike. Another area would involve safety, which is extremely important. Currently the Trike lacks seatbelt, seat belt requirements, turn signals, sensor signals, mile trackers, as well as battery low warnings. We wish to put in all of these technologies in order to keep the customer informed about what's happening. This will result in more cautious drivers and less avoidable accidents and issues. For travel convenience, we would work to decrease the weight of the battery as well as the weight of the entire Trike. This will come in handy when carrying the Trike up stairs or when storing. In addition, we propose to decrease the amount of pedaling needed to run the bike and increase the distance the Trike can reach in one trip. Which will aid in customers with limited mobility and those who live in areas with spaced out facilities and/or homes. We propose to decrease the issue with e-bikes climbing up hills as well. Users who live in Mountainous regions have had a difficult time getting up hills, however if we increase the amount of gears involved and increase motor use during uphill riding the rider should have better mobility on hills. Finally, we look at aesthetics and user convenience for improvement. We can make the Trike's design more appealing to users with color or shape. And we can add to the user convenience by installing a phone charger.

Solution Design



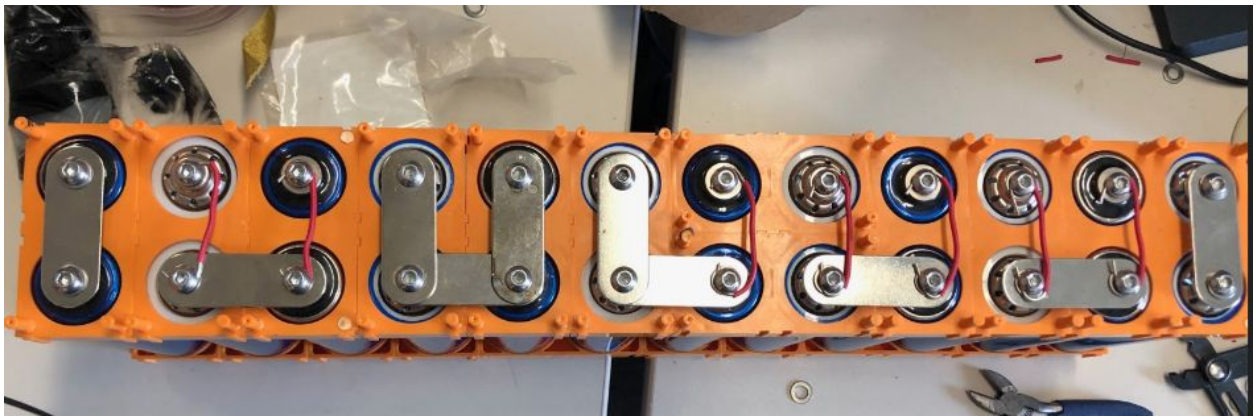
(1)We included a throttle that increases the acceleration as the user pedals. Attached to the left handle is a digital speedometer. (2) The pedals are extended from the front of the the tricycle. (3) As shown in the diagram above, the E-TRIKE includes a lithium battery. This design was selected based on the idea that lithium-ion batteries has a very small cost tradeoff for efficiency that the lead acid battery doesn't have. Lithium batteries are considered practical to regularly use 85% or more of the rated capacity of a lithium battery bank. Lithium batteries can be charged quickly to 100% of capacity unlike lead acid where there is an absorption phase that accounts for the last 15-20% of a charge. (4) There is an aluminum 2 inches by 2.5 inches block attached with two elbow brackets and six long ¼ inch screws.

Project Implementation Plan

Plan vs. Achievement

Date	Task	Completion
Jan. 21-25	Order the necessary parts	Complete
Jan. 28- Feb. 1	Disassemble the trike	Complete
Feb. 4 - 8	Order a new motor controller	Complete
Feb. 11- 15	Begin assembling the trike	Complete
Feb. 18 - 22	Assemble the base of the trike without the microcontroller	Complete
Feb. 25 - Mar. 1	Continue to reassemble the trike	Complete
Mar. 4 - 22	Establish minor connections	Complete
Mar. 25 - 29	Calculate voltage/power requirements	Complete
April 1 - 15	Have a functioning trike to demonstrate during presentation	Complete

Project Implementation Process



We were able to figure out the power supply for the motor controller by looking at the specifications of the controller. Then tested the voltage range with an outside power supply. The voltage necessary for the desired miles per hour is 40 volts. We then did calucaltion to figure out how many battery cells were mecessary to power the trike.

Conclusions

The E-TRIKE aims to be a better alternative to current innovative Trike designs. Howards youth and elderly or disabled people. We achieved our set out goals, our goals were correctly stated and the team functioned as a unit with each member contributing in different ways. The future plans for the project include less prices, public charging units, solar,,etc.

More effort can be put into development past crude mechanical levels and larger scale teamwork levels including but not limited to mergers of different existing teams.

References

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