E- TRIKE Team - CURRENT STATE OF ART

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The electric bike is made up of 4 main components. This includes the frame, the battery, the motors and the controllers. The frame of a bike mainly composes of the gears/motors, wheels, handles, brakes and the actual frame. The battery is one of the most important components because the type of battery an electric bike has can determine how heavy the bike will be overall.. The capacity of the battery used in each bike varies depending on the specifications of the bike but generally the energy that is stored is up to at least 400W per hour. The quality of the battery determines how many cycles it takes to charge, it also determines how long after the fixed running time the battery is still functional. Though there are many different types of batteries that have been tested the most popular ones used for electric bikes are NiMH, Ni, or Lithium-ion batteries. NiMH batteries take around 400-800 cycles to recharge while Lithium-ion batteries can take up to 1000 cycles. Battery type determines how long charging time can take and this time can range from two to nine hours. Of the three most commonly used batteries for electric bike lithium-ion is the most popular due to its light weight, durability, and ability to deliver power to a system for a longer period of time.

Brushless hub motors part of the frame, still obey the basic principle: turning stored energy into electric power. The convention as stated for bushed hub motors is to pass an electric current through a tightly coiled current which creates motion that can turn a wheel because of the force. So usually, you have the battery passing current to the motors to create the force to turn the wheel. However in brushless hub motors, instead of having one motor creating the force and relying on gears and chains to pass the force to nearby wheels, each wheel has it's own motor and instead of the usual brushes turning in the motor to create the turning force, the motor consists of several small coils and circuits just large enough to create the same turning force but with more efficiency.

Electric Tricycles use electronic controllers to provide real time data to control when the additional power to augment the rider's pedalling comes into play. There are various factors considered and various school of thought for the controllers, some controllers measure the cycling of the pedal and augment it with enough power to keep it consistent. Other controllers sense the pressure, when the foot is placed on the pedal and automatically augments the rider's effort. Regardless of how the sensors work to augment the rider's pedalling the controllers operate in a closed feedback loop, adjusting its output

by the input. Real time data is extremely important, so the controllers make use of the simplest data representation and send pulses containing the information(PWM). There is another option of using a cheap hall sensor which does not require closed loop feedback, however they work with brushed motors which are not efficient.

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 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 t rike 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.