Team 6

Cyclo-Charger

Connor Smith

Eric Replogle

Christian Corcoran

Saud Alfawaz

Figure 1: SolidWorks model of Cyclo-Charger

Prototype 1: Our first prototype was made in the wood workshop. It was made of a cardboard, PVC pipe, and clamp. The PVC pipe is attached to a small box made of cardboard using glue gun. Also, the aluminum clamp is attached to the cardboard box.

Tests:

- **Simplicity**: The test was conducted in the wood workshop. We had a bicycle frame, so we tried to install the prototype and make sure that it's easy to install and dimensions are correct. The installation was unsuccessful because the clamp didn't suit the bicycle frame. This is when we had the idea of an adjustable neck to the Cyclo-Charger to ensure that it works for bicycle sizes. (Figure-2)
- **Durability**: The material that prototype 1 made of were fragile, especially that we used glue gun to attach each part together. Our test for durability was to drop the dynamo from a 1.5m height. The test was unsuccessful because the clamp was unattached as soon as the dynamo hit the floor. We had to glue the clamp again the cardboard box. This test opened our eyes toward considering a metal casing for the dynamo to prevent such accidents and ensure that all parts are attached strongly. (Figure-3)
- **Safety**: No physical test was conducted to determine our prototype safety. However, there will be no wires that are exposed directly to the bicycle rider.

Figure 2 Cyclo-Charger on a bike

Figure 3 Clamp is unattached

Prototype 2: Our second prototype of the Cyclo-Charger was drawn on solid works as seen in Figure 1. This prototype resembled our first one but has some distinct differences. One such difference is that the body of this prototype is wider, the wheel at the end is wider, and the clamps in this prototype are shaped differently. Instead of building our own motor, like we thought we would in the first round of testing, we will be buying a motor.

- **Simplicity**: The Cyclo-Charger failed this test because we are unsure whether the clamps will be simple enough to use, or even work. We will still continue to use this idea until we have the opportunity to test this part of the Cyclo-Charger.

- **Safety**: The Cycle-Charger passed our safety test. To improve the safety of the Cyclo-Charger, we installed a current limiter to ensure that the generator does not create too much electricity that the phone overcharges and catches on fire. This current limiter will be place in the rectangular part of Figure 1 that sticks out of the main body. Another concern was exposed wires. To ensure that there were no exposed wires in the Cyclo-Charger we thoroughly examined the outside of the Cyclo-Charger.

- **Durability**: The Cyclo-Charger passes the durability test. Its metal casing will protect the motor from breaking if the user drops it while installing it or if the Cycle-Charger falls off while riding the bike for some reason. The metal casing will also protect the motor from the harsh rains that are common in Zimbabwe

- **Usability**: The second prototype for the Cylco-Charger passes the usability test. Using the ratio of the bike tire size to the motor axle size, the user will need the bike's wheel to rotate at rate of 1 revolution per second. The amount of effort it takes to do that is not much.

- **Efficiency**: Although we were unable to actually test the efficiency of the Cyclo-Charger, the motor we will be using generates more than enough energy. With this in mind we think that the Cyclo-Charger will meet our expectations of charging a phone 10% in 9 minutes.

Cost analysis: After researching the costs of all of the parts necessary to build the Cyclo-Charger, it appears that we would be slightly over the $10 budget that we were given. The motor that we would use costs right around $7, the current limiter costs about $0.50, wire will cost $151 per 1000 feet, so roughly $0.15 per foot, the wheel that makes contact with the bike tire will cost $4.75 each and the axle will cost $2.00 per 6 feet, which is $0.50 per foot. The cost so far is roughly $13 dollars without the metal casing. If we were to have the metal case built over in Zimbabwe, it will be much cheaper than having it built in the United States, however, we can't determine what the exact cost would be in order to have it built. So, the total cost of the Cyclo-Charger will be $13 plus the cost to build the casing. Our solution is still desirable despite going over budget because it is easy to use, multiple families can share it, and gives the desired result in a reasonable amount of time.

User Guide: To use the Cyclo-Charger follow these steps.

1. Attach Cyclo-Charger to bike seat post by clamping Cyclo-Charger to it.
2. Have wheel of Cyclo-Charger flush against the back bike tire oriented so the wheel will spin with the tire.
3. Plug phone into the Cyclo-Charger.
4. Ride at a speed of at least 1 tire revolution per second.
5. As you ride the Cyclo-Charger will charge your cell phone.

Redesign: After our second prototype, it still wasn't perfect. We still had many changes that needed to be put in place so that it could sufficiently satisfy the user's needs. If HESE students were to start with our second prototype and build on it to make a third, we'd suggest a better clamp system to attach to the bike. In our prototype model, it was very unclear how the clamp actually worked. A simple clamp that can be fitted around any bike frame under the seat and then

tightened and loosened by a thumbscrew would be perfect. Also some feedback that we got at the showcase was how and where the phone would actually sit. The phone charging cord would run up along the main frame from the charging unit and up to the handlebars where it will have its own stand to put the phone. The stand would come with a cover so that if inclement weather occurred while the user was out the phone could be protected. Another redesign we would have is to have a bigger wheel on the Cyclo-Charger so that it ensures it will be touching the bike tire and able to spin and generate the electricity. We would do that because we are not sure what kind of bikes people will be using in Zimbabwe, some bikes could be different and the Cyclo-Charge needs to take that into account so that it can meet user needs.

References:

4" Caster Wheel, 300 to 999 lb., Wheel Width 1-1/4", Rubber, Fits Axle 3/8" (n.d.). Retrieved October 18, 2015, from http://www.grainger.com/product/ALBION-4-Caster-Wheel-26Y350?functionCode=P2IDP2PCP

Ametherm SL03 10001. (2015). Retrieved October 19, 2015, from http://www.mouser.com/ProductDetail/Ametherm/SL03-10001/?qs=sGAEpiMZZMuqZeNK75brDxRgT1KUh2F4XekWn89qFxE=

Common Tire Sizes. (n.d.). Retrieved October 19, 2015, from https://www.biketiresdirect.com/common-tire-sizes-article

Copper Building Wire. (n.d.). Retrieved October 18, 2015, from http://www.southwire.com/documents/pricesheets/Import_478_CR_10.5.15.pdf

Kysan Electronics. (2007). Retrieved October 18, 2015, from http://www.kysanelectronics.com/Products/Detail.php?recordID=2980

Plexiglass - Extruded Acrylic Rod ACREXR.250. (n.d.). Retrieved October 18, 2015, from http://www.eplastics.com/Plastic/Plexiglass-Extruded-Acrylic-Rod/ACREXR-250