2/27/21

Design Brief

Client	Car Owners
Target Consumer	Drivers
Designer(s)	Devi C., Chloe Y., Dominic H., Quincy M.
Problem Statement	**What is the problem?** Car batteries being dead and requiring another car to jumpstart them when there aren't any cars around to help. **Who has the problem?** Car owners especially in rural areas, people who live in colder climates with a higher chance of the battery dying. **Where is the problem happening?** All over the world, however there is more of a problem in rural areas and areas with colder climates **Why is the problem important?** This problem is important because when people's car batteries die it's not only an inconvenience, but it can strand people anywhere. When that happens and no one is around to help, people have to sit and wait for either someone to come, or they would have to walk to some place where they can get help.
Design Statement	**How do you plan on solving the problem?** By constructing an electrical generator that is powered by a hand crank. Ideally the output will be at least 13VDC, and the efficiency will ideally be as close as we can get it to 100%.
Criteria (To meet)	1. Operated easily by hand/including time and effort 2. No electrocution/not deadly 3. Charge car (Must output at least 13VDC) 4. Portable

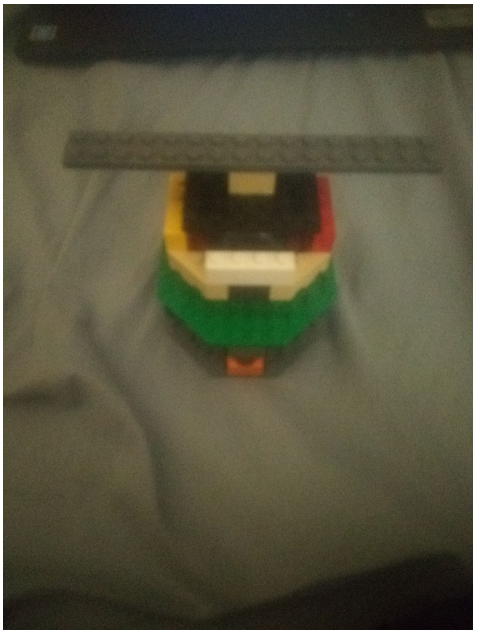
Constraints (To limit)	1. Finish by Jan 30 2. Lowest cost possible 3. Fit in a typical trunk 4. Size/time of 3D printing

Bill of materials and budget

- 1 steel ring, forged then delivered on 2/18
- 75ft of 22ga wire, obtained on 1/08, cost $7.40 (Not all used in final prototype)
- Various lego pieces
- 1 3d printed rotor frame (See the 2/18 entry)
- 10 ceramic magnets, cost $2.00

1/09/21

When we first started this project we created an initial prototype rotor that was made up of four magnets arranged with alternating polarity inside a body created with legos as seen in the photos underneath. The magnets were set around a central lego piece with more legos set around them to help hold them in place.

1/11/21

We experimented with ways to create the coils needed for our project using 22ga wire. The first thing tried was creating the coil inside of a pepsi bottle which has the correct shape needed. However, it did not turn out particularly well as it was irretrievable from the bottle.

1/15/21

Made a coil using a steel can as a template and core, then assembled the unit. After assembly it was discovered that the design would only work with a linear mechanism, while the intent was to produce one that could be operated by rotating the inner portion of the generator.

1/21/21

Lego rotor design finished. As a circular stator is necessary, we are working on a design for a 3d printed rotor that can be mounted on a lego axle

2/12/21

The prototype rotor has been printed and tested. It is compatible with a lego axle, and can securely hold the magnets being used, however a defect causes it to not be able to hold the full ten magnets in the design, so it is going to be redesigned slightly and reprinted.

2/18/21

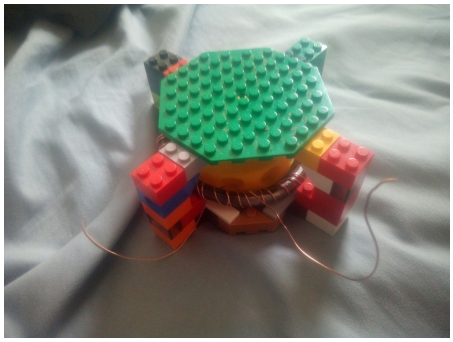
The reprinted rotor has been tested, and found to work with the magnets properly in all ten spots, however the slot for the axle shrunk partly and as a result is not compatible with lego axles.

2/25/21

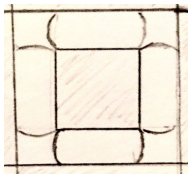
Obtained a steel ring for use as a core in the stator of the generator. The stator is the aforementioned steel ring with approximately five feet of 22ga copper wire wrapped around it, with the coil stretching around the circumference of the ring twice.

2/27/21

Final assembly was completed. The structure of the resulting prototype was not particularly durable, and needs work, however was sufficient for a fit test and with some improvements should be suitable for a functioning prototype.



Misc. Sketches



This diagram shows how the magnets are arranged in the original rotor design. The pole facing outward on each magnet is opposite to the pole facing outward on both adjacent magnets.