Interactive Charging Station

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Abstract

NAU engineering students have an outdated interactive charging station on the second story of the NAU engineering building. The task for the team was to replace the outdated machine with a working one. The machine allows students to sit and work while they charge their electronic devices. While charging their electronic devices, students can see the power that they produce and play games on the small device if desired.

Requirements

The customer gave the team the freedom to use an original design with only one main request. The team is not allowed to use a bicycle design or any design that resembles a bicycle motion as the final design. The engineering requirements were to have a safe device, create power to charge smart devices, and have it be easy to use.

Final Design

The final design of the machine is a linear motion foot pedal design. It uses a Joomen CNC for the railing and bearing blocks. This design allows the user to sit in a chair and charge their smart devices by pushing the foot pedals. There is a desk mounted onto the chair that allows the students to do their work while they generate energy. The small touch screen display that is mounted on top of the desk will allow students to track the power that they create.

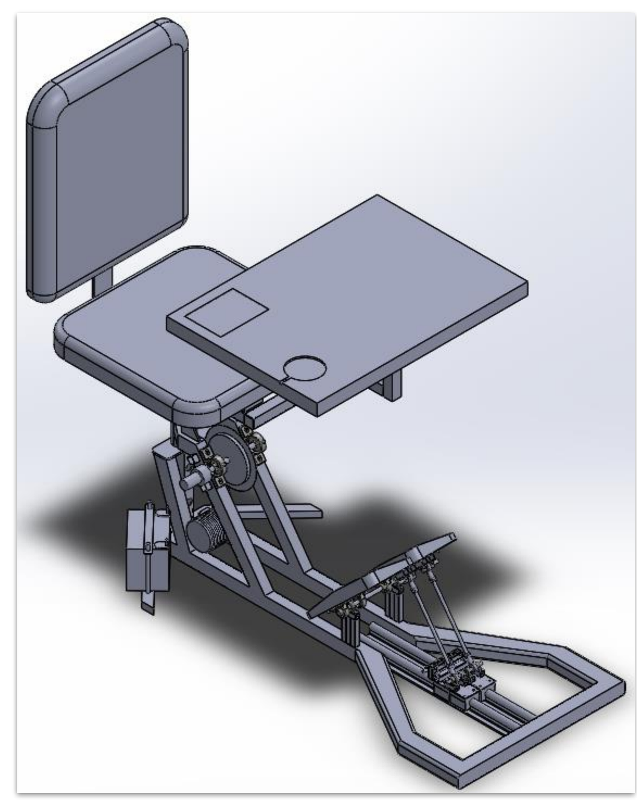

Figure 1: Elliptical Device CAD model

Figure 2: Finished Machine

Display

The machine has a small seven inch touch screen display. The touch screen display is mounted to the top of the desk and is easily accessible to the user. The user will be able to graphically track the power that they create. The users will also have the opportunity to play games on the small touch screen if they wish. The interactive charging station will also have the capability of charging different devices with the cords that will be provided and with the USB ports.

Figure 3: Desk and Display

Electronics

The way a user produces power is through spinning a flywheel, spinning a flywheel faster will allow the generator to output higher voltages. The voltage output from the generator is then transferred to the Buck-Boost Converter. The converter will either raise or lower the voltage to specifically twelve volts, the converter is there to make sure that the battery is getting its optimal input voltage. From the battery the voltage is sent to the inverter, where the students can directly plug in to charge their phone or computer. The power produced from the machine can vary from user to user, one user can produce more than others. The power produced will rely on how long a user operates the machine and how fast they are able to spin the flywheel. Results from the power produced will be displayed on the small screen that is connected to the desk.

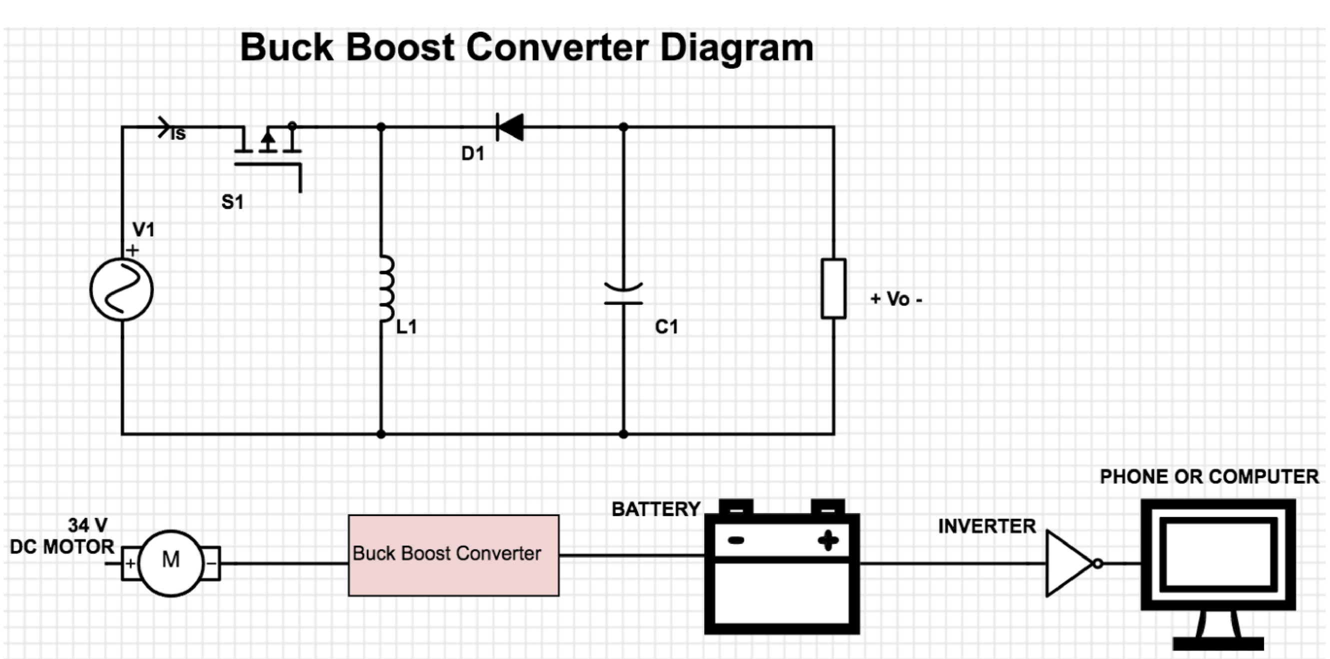

Figure 4: Electrical Schematic

Results

$$T = \frac{60 * P}{2\pi * \omega} \qquad P = V * I$$

Table 1: Average RPM and Power

Trials	RPM	Watts
1	322.8	422.8
2	363.4	463.4
3	404.6	504.6
4	459.2	559.2

Twenty trials were taken for the analysis of the machine. Each group member tried the device four times. The power calculated used the equation above and the variables were measured from the output of the generator. The analysis of the data concluded that the average rpm and power is 387.5 and 487.5 Watts respectively. Using the above equation for torque, the average torque produced was 12.01 Nm. With the power generated, the charging station can consistently charge a phone.

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Reference

[1] “Technogym Cardio Wave.” Technogym Cardio Wave, Primo Fitness, primofitnessusa.com/product/technogym-cardio-wave/.