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Hand Cranked Generator For Mobile Devices

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Hand Cranked Generator For Mobile Devices

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EGN 301: Professor Davis

ABSTRACT

It's estimated that over 90% of American adults own cell phones while over 70% of the United States land area belongs to rural counties. It is a challenge to charge mobile devices in these remote and rural areas given the lack of access to power sources. This lack of power in remote destinations limits the general use of mobile devices for outdoor enthusiasts, as well as a survival means for all who need access to a portable power generation device, especially in emergency situations. There are other portable generators currently available on the market, but our project wanted to take a different approach. The design and fabrication of a portable hand powered generator, that is lightweight, small, powerful, durable and easy to operate by anyone is the goal of this project.

BACKGROUND RESEARCH

A portable device was thought of as the best option, as outdoor enthusiasts will need to be able to carry it around in order to easily charge their devices. For safety purposes, everyone usually leaves their home with their devices fully charged, but as the device gradually discharges, emergency situations may arise where the person needs to make a simple phone call or send a message. This is why we thought of a portable mobile charging device specifically for such situations.

- Who: Outdoor enthusiasts and motorists
- What: A portable way to charging a mobile device
- When: As emergency situations
- Why: To increase the chance of survival
- Where: Remote areas.

DESIGN REQUIREMENTS

- The final design shall have dimensions no larger than (0.15 m x0.15 m x 0.15 m).
- The final design shall weigh less the 4.5 Kg.
- The final design shall require a torque less than 5 N-m to crank.
- The final design shall be able to withstand a 1.5 m drop.
- The final design shall have a IP rating of IP24
- The final design shall deliver at least 2.5 watts, 5 volts, 500 mA.

PROBLEM STATEMENT

It is a challenge to charge mobile devices in remote areas given the lack of power sources. This lack of power in remote destinations limits the use of mobile devices for general use of outdoors enthusiasts as well as for survival means of all.

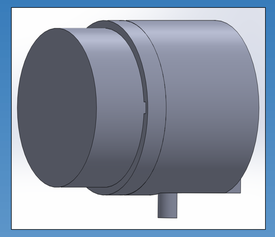

Fig. 1 - Complete model showing the crank arm folded into the case, and the storage cover in place

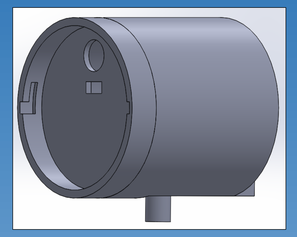

Fig. 2 - Front/Side view with storage cover removed

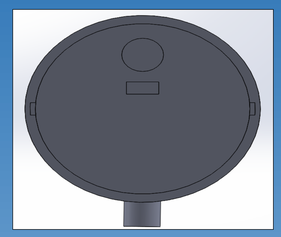

Fig. 3 - Front view with storage cover removed

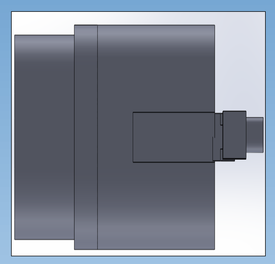

Fig. 4 - Bottom view with the crank arm extended

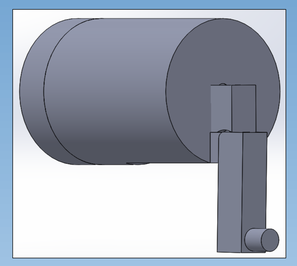

Fig. 5 - Back/Side view with crank arm extended

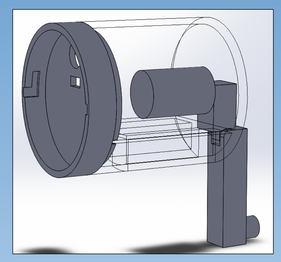

Fig. 6 - Front/Side view with handle extended; wireframe shows the internal motor

DESIGN DETAILS

- Cylindrical Design
  - Ensures components are safe from impact
  - Less likely for housing to crack when dropped
  - Crank modeled to fold into housing
  - Compact / Easy to carry
  - Will be fully sealed to protect from possible water damage
- Storage Cover
  - Protects the LED & USB port
  - Large enough to store extra utility tools
  - Easily removable by utilizing two slotted pins

INTERNAL CIRCUIT

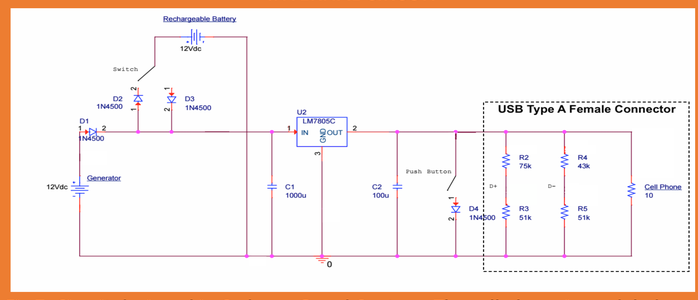

Fig 7: Circuit designed in Cadence Orcad Capture. The cell phone is modeled as a 10 Ω resistor to simulate a 500mA current draw.

DROP TEST

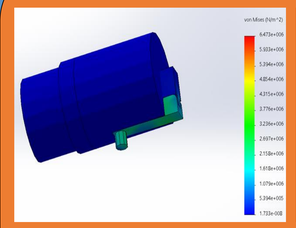

Fig 8: 1.5m drop test on crank handle

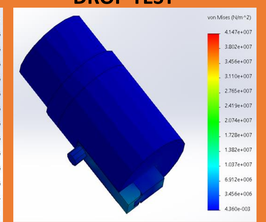

Fig 9: 1.5m drop test on crank hinge of housing

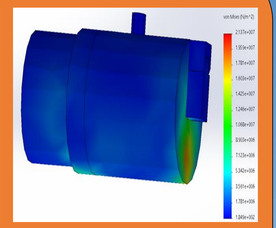

Fig 10: 1.5m drop test on side of housing

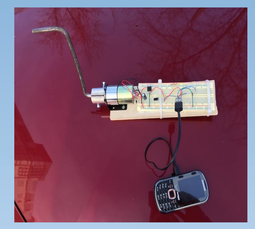

Fig 11: Prototype using circuit from Figure 7

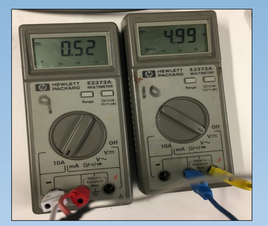

Fig 12: Current and voltage measured for 2.6 W of power

Fig. 13: Tested with tachometer: 360 rpm to deliver 2.5 W of power

Fig 14: Bottom view of 3D Printed Design

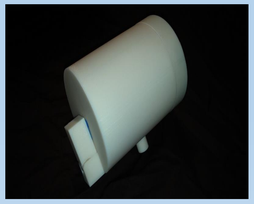

Fig 15: Side View of 3D printed model

Fig 16: Side view with handle extended of 3D printed model

Thanks to Professor Davis for his guidance, and all of our classmates in EGN301. Thanks to all the professors and faculty in Engineering Department at USM