A MECHANICAL MEANS TO RECHARGE BATTERIES

IMPACT OF SOCIAL MEDIA ON NATURE

A Thesis Prospectus

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Bachelor of Science in Mechanical Engineering

By
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Hikers and others in the outdoor community may go days without electricity. Thru-hiking the Appalachian Trail, for example, takes about five months and covers 2,189.2 miles (The Appalachian Trail Conservancy, n.d.). During their several months of planning, hikers must account for charging their headlamps, flashlights, cell phones, and other electronics while on the trail as huts or small towns may be days apart. This report's technical aspect focuses on creating a device to charge cell phones using human movement, especially while hiking. Designing a new product requires understanding the targeted audience as well as other products on the market. Conducting this research will lead to a better, more practical design and product to help backpackers when they are on the trail and far from electricity.

Knepper's (2017) article title for *The Outline* best describes the scope of the STS research: "Instagram is Loving Nature to Death." The STS topic will focus on the effects of social media on nature and national parks and it tightly couples with the technical project. By creating a device to charge electronics while in remote places without electricity through the technical aspect of the project, there will be an increase in the use of electronics such as cell phones which may result in more photos and therefore more possible geotagging on social media. Though the technical project is helping hikers charge their devices, the use of technology may be harmful for the environment. The STS research will use Pacey's Triangle of Technology as well as the Technology and Social Relationships framework to describe the impact social media platforms such as Instagram have had and will have on the environment as well as other applications of the information gathered by location services.

A MECHANICAL MEANS TO RECHARGE BATTERIES

A cell phone is a multifunctional tool. It is a communication device, GPS, compass, and so much more. Although many hikers choose to disconnect from technology to enjoy their experience, many rely on their devices while on the trails. The technical aspect of the project is to design a device to recharge batteries using mechanical means such as the use of a hand crank, rip cord and flywheel, tiny windmill, etc. when access to electricity is unreliable or unavailable.

EXISTING DESIGNS; SIMILAR BUT … .

Many similar charging products are currently on the market targeted toward outdoor enthusiasts. A popular design is a flashlight that requires shaking to cause a magnet to pass through a coil to generate power (Martindell, n.d.). These designs incorporate Faraday's Law where the moving magnet in the coil of wire will induce a voltage in the system (Lucas, 2016). Patent US5818132A illustrates "a linear motion electric power generator for generating electric current from work done by an intermittent force" by moving a magnet in a linear motion though coils (Abstract section, 1997). The design of the technical project will incorporate this magnet-coil system but in a different application. The product will specifically be using human movement through arm and leg oscillations while walking and hiking to recharge cell phones when no other form of electricity is available.

A student group from California Polytechnic State University conducted a similar senior project to generate electricity using Faraday's Law of Induction with the rotational movement of a tire. They used kinetic energy generated by the user or engine and converted it into electricity to power their devices such as LEDs or rechargeable batteries (Gasper, A. & Omsberg, B., 2016). Their project is like the technical project in that the magnet-coil system will be charging a

battery which will then be used to charge a cell phone. However, these designs do not solve the specific problem of being able to charge a device while on the trails, away from electricity.

The nPower Personal Energy Generator (PEG) by Tremont Electric is another product that draws its power from kinetic energy. This device targets the outdoor community than the other products mentioned above as it can charge while walking or cycling. However, weight, size, and cost are major factors for hikers aiming to pack lightly and efficiently (Momot, 2019). The nPower PEG is listed at $200 and is about 10.5 inches in length which is much larger and more expensive than the group's projected design (Laskey, 2012).

THE PRODUCT DESIGN

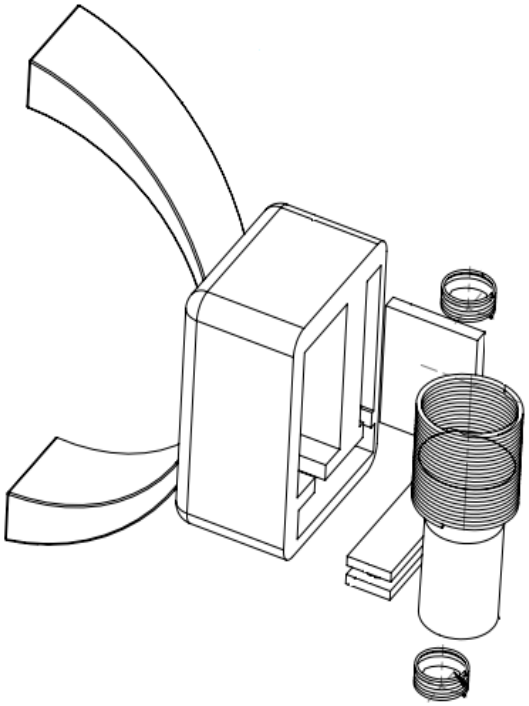

Figure 1: Exploded View: The expanded view of the product showing the detail and multiple parts in the design (Kim, 2019).

The product will be an attachable device that is worn on the arm or leg that uses human movement to oscillate a magnet within a coil, creating voltage to charge an external battery. The initial iterations of the product reflect a hands-free device like a running sleeve that holds a phone as the user exercises. As seen in Figure 1, the device will attach to the body using straps. The device body will lay flat on the users' arm or leg,

secured by Velcro fastenings. Figure 2 provides a closer look at the magnet-coil system. Though still in its initial planning phase, Figure 2 illustrates where the magnet-coil system (parts A and B) sits in the design. Other important aspects of the design are the extra springs on either side of the magnet housing (part C). These springs sit on either side of the magnet to create more oscillations of the magnet within the coil. More calculations and research are required to determine the strength of magnet necessary to charge the external battery chosen for the device. The next steps in the design phase are to use Faraday's Law to determine the relationships between the user's movement and the number of oscillations of the magnet within the coil that is necessary to result in the desired charge of the device. The technical capstone group will then use their allotted funds for each semester to purchase and 3D print the necessary parts and further redesign the product with the dimensions and specifications of the gathered parts for the device.

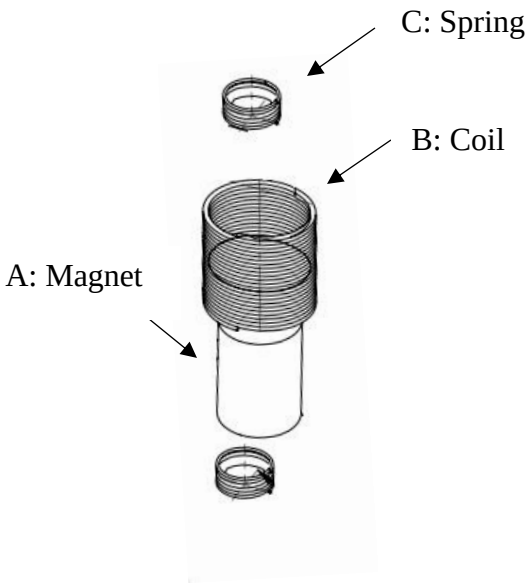

Figure 2: Magnet Coil System: The detailed view of the magnet coil system within the device (Kim, 2019).

EXPECTED DEVICE DESIGN OUTCOME

The group will conduct the technical project during a two-semester Mechanical Engineering design capstone class where they will turn in weekly project reports and follow a GANTT chart, as seen in Figure 3 below on page 5, to stay on schedule. With the help of faculty advisor Professor Momot and technical project team members Maria Contreas, Grant Kim, Alex Nazon, and Rachael Osborne, the group will design a device to mechanically charge a cell phone using human movement. The desired outcome of the final design is to create a device that will

provide enough charge to power a cell phone after a set amount of time. At the end of the semester, the group will turn in detailed drawings with fits and tolerances taken into consideration, as well as an assembly drawing. Next semester, the group will focus on manufacturing and creating prototypes of the final device that will be evaluated by their peers and Professor Momot and summarize the work with a technical paper.

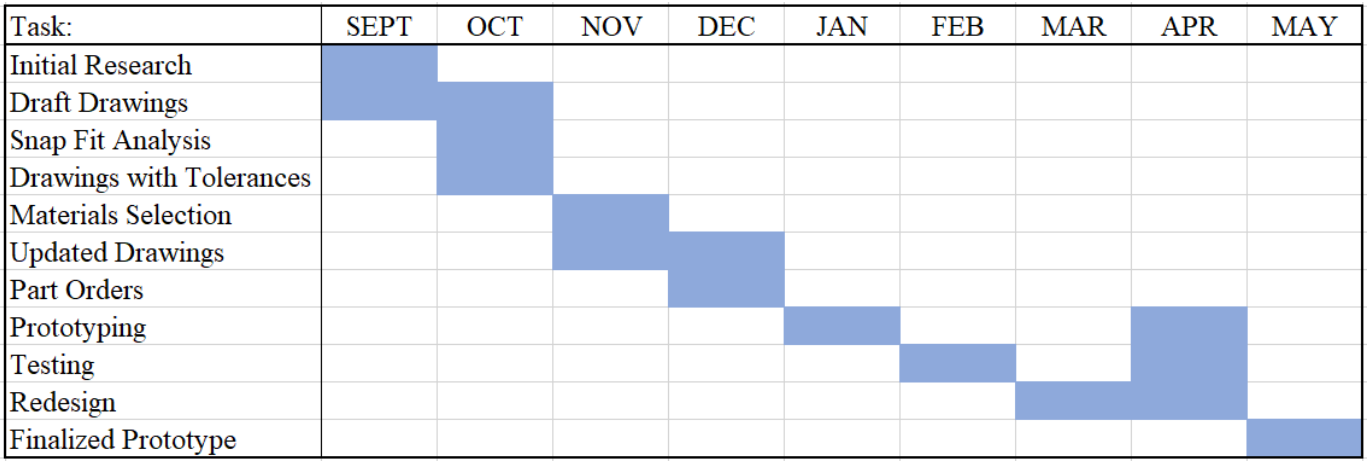

Figure 3: GANTT Chart: The breakdown of the capstone schedule. The timeline shows the steps that will be taken to complete a final prototype of the design. (Kamali, 2019).

SOCIAL MEDIAS INTERACTION WITH THE ENVIRONMENT

The number of visitors at Horseshoe Bend, a canyon off the Colorado River, increased from 1,000 people a year to 4,000 a day from 2012 to 2017 (Knepper, 2017). This great rise in popularity strained the small bend, causing new amenities to support the tourist attraction such as more parking and platforms around the canyon. The cause and effect of overcrowding has been seen throughout multiple national parks with an increase in visitation being connected to the increased use of photo sharing platforms. Although social media connects virtual visitors and the National Park Service (NPS) to a wider audience, location services are causing detrimental overcrowding and negative effects on the environment.

IMPACT OF GEOTAGS

Geotagging locations on social media has led to increased traffic in natural parks resulting in harmful effects on natural wonders. A geotag is "an electronic tag that assigns a geographical location to a photograph or video, a posting on a social media website, etc" ("Geotag", n.d.). Figure 4 provides an example of tagging a location on Instagram. After tagging a location, viewers can click on the link and look at other photos from the same place or look up the location and find photos tagged under the same name such as "Grayson Highlands State Park" as seen in Figure 4.-==-p[]

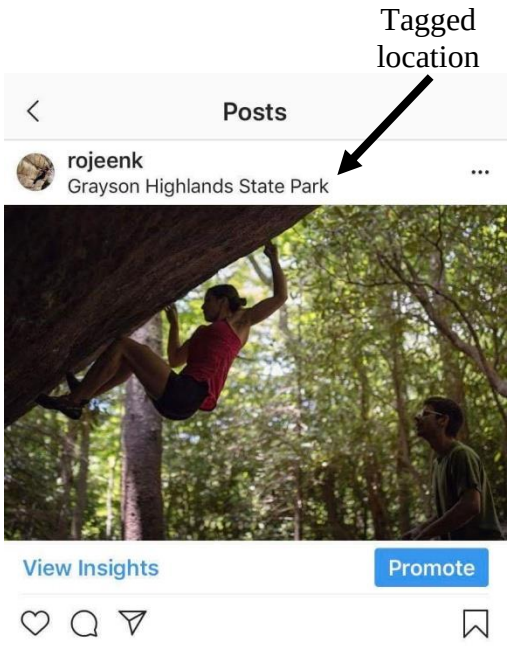

Figure 4: Instagram Post with a Tagged Location: This post shows a geotag at Grayson Highlands State Park (Kamali, 2019).

In *The New York Times* article "Is Geotagging on Instagram Ruining Natural Wonders? Some Say Yes," Holson (2018) describes how the Jackson Hole Travel and Tourism Board has asked visitors to

stop geotagging to protect Wyoming and its natural forests and remote lakes. Beautiful photos on social media such as Facebook and Instagram attract more visitors and tourists. Lulu Garcia-Navarro (2017) emphasizes that the issue stems from visitors "who neglect responsibilities of their visitorship" (para. 8). In the article, she uses the Conundrum Hot Springs in Colorado as an example where the attraction had to get shut down because visitors "ran out of places to go to the bathroom…they [park rangers] literally had to shovel up everyone's waste and pack it out for them" (Garcia-Navarro, 2017, para. 10).

TAGGED LOCATIONS CAN BE HELPFUL AS WELL AS HARMFUL

Hegyi (2019) credits the invention of Instagram for the increase of visitors to national parks. But while doing so, he also incorporates different viewpoints in the article such as Ashley D'Anonio, an ecologist and professor, who argues that the cause of overcrowding may also be a result of lower gas prices and a strong economy which allows for more visitors at national parks. D'Anonio also describes how social media is used to diversify crowds at national parks. Though Hegyi seems to blame the "selfie tourist" for some of the overcrowding, he opens the discussion to other causes as well (Hegyi, 2019). Further, W. Freimund and Z. Miller discuss how the NPS is using social media to promote civic engagement and public involvement. The research described in the article uncovers data about virtual visitors who are people that "like" and interact with NPS social media. Social media is a great communication tool and the NPS is using it to digitally connect with younger audiences. Although social media is promoting more traffic at national parks by promoting beautiful images all over their feed, virtual visitor traffic has also increased.

RELEVENCY OF THE PROBLEM

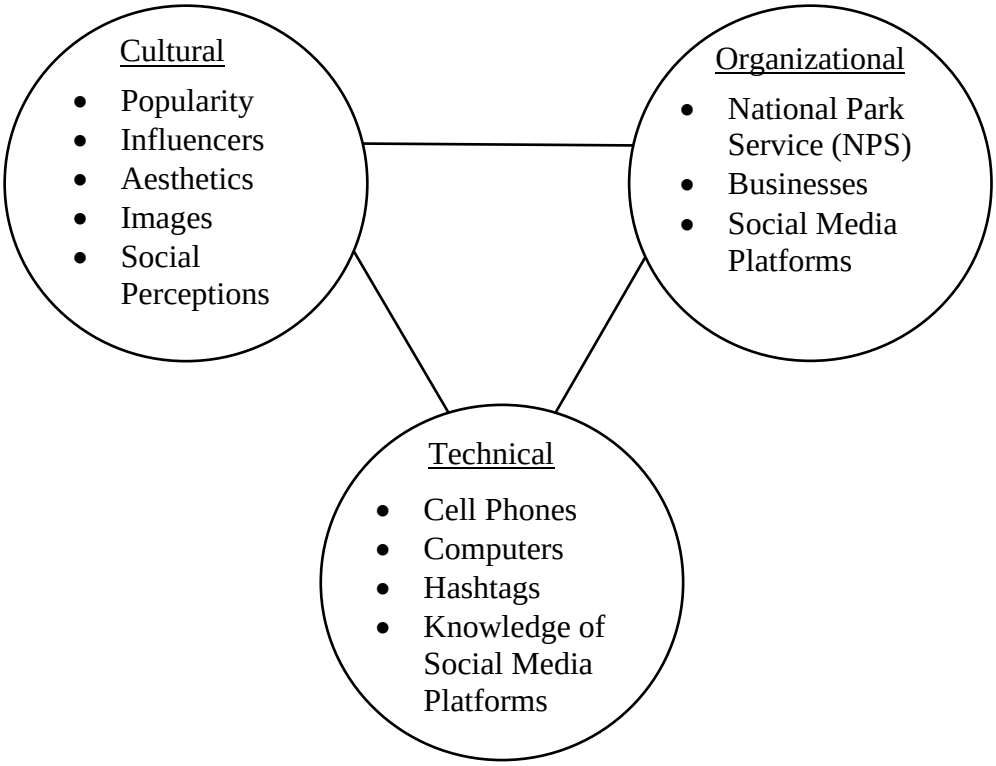

Figure 5: Pacey's Triangle for Location Technology: Cultural, technical, and organizational aspects of geotagged locations (Adopted by R. Kamali from A. Pacey, 2019).

Pacey's Triangle above in Figure 5 describes the context of location technology. It identifies a larger scope of which this technology is a part of (Pacey, 1983). Though the topic of a geotag may initially seem harmless, the graphic above shows the complexity of the technology. The organizational aspects such as the NPS and social media platforms such as Flickr and Instagram are battling the cultural aspects through technical means. The major stakeholders such as the NPS and social media platforms are involved in the organizational aspect of location technology; however, the social media user is the end user with the technology. Because of the cultural characteristics such as popularity and social perceptions through social media of the end user and the increased use of these platforms, how the end user decides to use social media will effect other users, influencers, and the NPS.

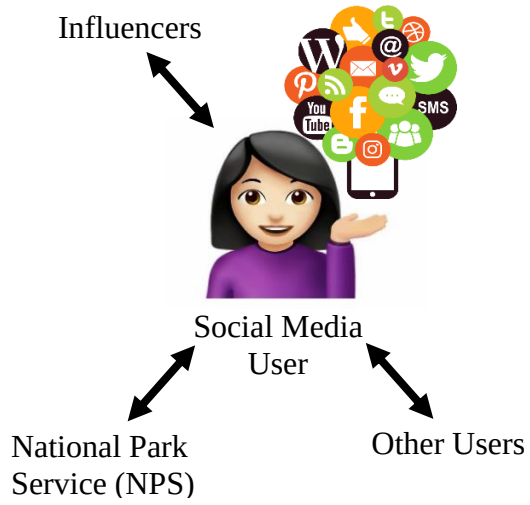

Figure 6: Media and Social Relationships: The end social media user employs technology and the individuals on either side can be affected by the end user engaging in social media location services (Adopted by R. Kamali from W. B. Carlson, 2019).

The technology and social relationships model by W. B. Carlson, an example of the social construction of technology (SCOT), accurately represent the role of social media users. The end user directly relates to influencers, NPS, and other users as seen in Figure 6 and these groups are directly affected by the actions of the social media user. The user can see where the influencers have been by clicking on the geotags on the influencer's social media posts and decide whether to visit the location. The NPS relates to the social media user by creating interactive, informative posts about national parks, promoting them to a larger audience. And the social media user can connect to other users by incorporating hashtags into their posts. All these users engage in social media and are interconnected by the actions of the end social media user.

FUTURE OF LOCATION TAGGING

The STS research will be presented in a written discussion of the interaction of social media and technology with an analysis of both the positive and negative effects of location tagging on national parks. The paper will explore the cultural and organizational characteristics of geotagging throughout the larger network of location services. Ideally, increased visitation will help promote national parks and simulate conversation about preserving the environment as well as bring more underrepresented groups to enjoy national parks; however, the negative effects on the surrounding environment should not be neglected.

WORKS CITED

Garcia-Navarro, L. (2017, November 12). Instagram crowds may be ruining nature. Retrieved September 26, 2019, from NPR.org website: https://www.npr.org/2017/11/12/563398606/instagram-crowds-may-be-ruining-nature

Gasper, A. & Omsberg, B. (2016). Faraday rechargeable battery system. *California Polytechnic State University Electrical Engineering Department.*

Geotag (n.d.). *Lexico Powered by Oxford*. Retrieved September 26, 2019, from https://www.lexico.com/en/definition/geotag

Hegyi, N. (2019, May 28). Instagramming crowds pack national parks. *NPR.* Retrieved October 8, 2019, from NPR.org website: https://www.npr.org/2019/05/28/726658317/instagramming-crowds-pack-national-parks

Holson, L. M. (2018, November 29). Is geotagging on instagram ruining natural wonders? Some say yes. *The New York Times*. Retrieved from https://www.nytimes.com/2018/11/29/travel/instagram-geotagging-environment.html

Kamali, R. (2019). *GANTT Chart*. [Figure 3]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.

Kamali, R. (2019). *Instagram post with a tagged location*. [Figure 4]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.

Kamali, R. (2019). *Pacey's triangle for location technology*. [Figure 5]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.

Kamali, R. (2019). *Media and social relationships*. [Figure 6]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.

Knepper, B. (2017.). Instagram is loving nature to death. *The Outline*. Retrieved October 7, 2019, from The Outline website: https://theoutline.com/post/2450/instagram-is-loving-nature-to-death

Kim, G. (2019). *Initial device design.* [Figure 1]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.

Kim, G. (2019). *Exploded view.* [Figure 2]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.

Konotchick, J. A. (1998). *United States Patent No. US5818132A*. Retrieved from https://patents.google.com/patent/US5818132A/en

Lasky, M. S. (2012, October 9). Review: tremont electric nPower PEG. *Wired*. Retrieved from https://www.wired.com/2012/10/npower-peg/

Lucas, J. (2016, January 28). What is faraday's law of induction? Retrieved September 26, 2019, from LiveScience website: https://www.livescience.com/53509-faradays-law-induction.html

Miller, Z. D., & Freimund, W. (2017). Virtual Visitors: Facebook Users and National Parks. *Journal of Park & Recreation Administration, 35*(3), 136–150. Retrieved from http://proxy01.its.virginia.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=125496701&site=eds-live

Momot, M. (2019). MAE 4610: Machine design I project statement [Course material]. Retrieved form Collab.

The Appalachian Trail Conservancy (n.d.). Shelter life. Retrieved September 26, 2019, from https://appalachiantrail.org/home/explore-the-trail/thru-hiking/shelters