Thesis Portfolio

Human-Powered Vehicle

(Technical Report)

How the Wheelchair Contributes to the Equality in Society

(STS Research Paper)

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Sociotechnical Synthesis

Introduction

The bike has become an important, alternative option of transportation since 1818 (Ryzewski, 2009). The number of bikers who ride a bike to work has increased over 60 percent in the last decade (*Biking to work increases 60 percent over last decade*, n.d.). Due to the continued development and popularity of the bike, the Human-Powered Vehicle project aims to improve the efficiency of the bike with the considerations of environments and efficiency. However, the social and unintended consequences of innovation are necessary to include in the design. The STS study about the wheelchair's impacts on equality in society exemplifies a case study for improving the technical project. The study illustrates how mobile technology creates unintended results in society from emotional perspectives of the users, economic viewpoints from the organization related to the technology, and government policies related to the wheelchair. Therefore, the analysis from the STS project contributes significantly to future consideration and designs involved with the impacts of the Human-Powered vehicle into society.

Human-Powered Vehicle

The goal of the Human-Powered Vehicle team at the University of Virginia is to design and build *Blue Comet*, our human powered vehicle, to compete in the 2020 ASME HPVC E-Fest North. The team was established by 12 mechanical engineering undergraduate students with various engineering skills and experiences. Although this is the team's first time attending the competition, we have the passion and motivation to develop and apply our technical and interpersonal skills to completely build the bike. The design includes conceptual development, background research, manufacturing process, modeling, computational analysis, and

experimental testing used to build and optimize the vehicle's performance. The vehicle aims to obtain ride stability and high aerodynamic performance.

Blue Comet is a three-wheeled, tadpole recumbent-trike constructed from AISI 4130 Steel. An integrated Rollover Protection System (RPS) increases the rider's safety in the event of a crash. A removable transparent partial fairing is applied to increase the aerodynamic efficiency in the drag race while not compromising visibility. Since the members of our team have effective leg lengths ranging from 22 to 29 inches, we designed an extension rod for the crankset with seven inches of adjustability. The calculated average speed of *Blue Comet is 20* mph, according to gearing analysis of the design. With the high safety focus, the flexibility for riders, and the calculated high-speed capabilities, we are confident that *Blue Comet* will be a successful, competitive vehicle in this year's HPVC North.

How the Wheelchair Contributes to the Equality in Society

The purpose of this research is to study and evaluate if the wheelchair supports equality for wheelchair users in society. The stakeholders contributing influences on the research include policymakers, emotional perceptions of wheelchair users, and related industrial organizations such as wheelchair makers and employers. To analyze the impacts of the wheelchair from prior stakeholders, the study focuses on following research questions: how the wheelchair impacts better accessibility from legal regulations and social impacts, how the economic situation of people who use wheelchairs changes, and how the wheelchair affects emotional perception of wheelchair users in society. Methods in this research include documentary research, discourse analysis, and historical cases. The documentary research gathered prior wheelchair-related literatures to explore how the wheelchair improves public accessibility for wheelchair users. The discourse analysis collected a data set from Twitter and magazine interviews conducted with

wheelchair users to analyze wheelchair users' perception of the design and their positions in society. The historic cases emphasized the history of wheelchair makers and the Americans with Disabilities Act to analyze how the wheelchair systematically changes society. Therefore, Technology Fix is the main STS framework in this paper owing to the wheelchairs' effects. In the results and analysis, the wheelchair characterizes as self-representation and voice for wheelchair users in society. However, the STS framework shows that the wheelchair has been developed and impacted properly for equality of wheelchair users in society.

Conclusion

Both the Human-Powered Vehicle project and the wheelchair's impact on society STS study demonstrate how to build and innovate beneficial technology with important considerations for societal improvement. Without the STS research study, the team will not insightfully learn about how to best design and think further effects of the vehicle to the practical social issue. For example, the vehicle included safety tools, such as turning light and rear mirrors, in order to provide safety and signal communication for rider and other shared vehicles on road. Even though the current vehicle design does not integrate the ergonomic adjustment for people with disability, the team are motivated to examine how to add automatic and increase safety for a disabled rider in the future.

Citation:

Biking to work increases 60 percent over last decade. (n.d.). Retrieved October 16, 2019, from https://www.census.gov/newsroom/press-releases/2014/cb14-86.html

Ryzewski, K. (2009). *History of the Bicycle: A timeline*. 13 Things. https://www.brown.edu/Departments/Joukowsky_Institute/courses/13things/7083.html