Undergraduate Thesis Prospectus

Increase in User Situational Awareness of Wearable Haptic Ultrasonic Object Detector

(Technical research project in Computer Engineering)

Technological Consumerism: Planned Obsolescence and Imbalanced Lifestyles

(STS research project)

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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General Research Problem

How can the advantages of technology best be balanced with humans' need for autonomy?

Ubiquitous technology is evolving as major companies are competing for the most reputable brand in the market. They strive to launch the first functional, foldable smartphone, to release varieties of Bluetooth earphones, and to launch new products. Consumers are attracted to these new technologies that are changing lifestyles, and refuse to be excluded from emerging trends to avoid envy and dissatisfaction.

Strong majorities believe that technology has improved the overall quality of their lives (71%) and encourages people to be more creative (68%), however, some fear technology is creating a lazy society (73%), has become too distracting (73%), is corrupting interpersonal communications (69%), and is impairing literacy (59%) (Harris Poll, 2015). Technology can interfere with human autonomy and skills. GPS and mobile applications can impair map reading; graphing calculators can lower math skills; smartphones and laptops can degrade face-to-face communication.

Such effects can be mitigated by both technical and social means. A device could prompt the human decision-making process to take action as needed. Social groups have developed ways to maintain a healthy balance between technology usage and other activities.

Increase in User Situational Awareness of Wearable Haptic Ultrasonic Object Detector

How can engineers avert consumer vulnerability from growing technological innovation?

The capstone advisor is Harry Powell of the Electrical and Computer Engineering department, and I will collaborate with Joshua Arabit, Renée Mitchell, and William Zhang. We want to increase the user's situational awareness by building a haptic wearable device that will

alert the user of objects approaching in blind spots. Constraints include size and portability, power budget, safety standards, and component availability. The device must be lightweight and mountable on the user's body.

Vulnerability cannot be eluded. The birth of innovation came from rebels who created solutions to fight weakness (Coeckelbergh, 2013). This led to the technology that drives change in our economy (Hall & Rosenberg, 2010). The focus of technological affordances now accommodate corporate and government interests, affecting consumer well-being (Naughton, 2016). Roughly 1500 were pedestrians treated for injuries related to using their devices while walking due to situational neglect when multitasking with complex physical actions (Levy, 2016).

This project will increase awareness in user blind spots with object detection. Consider the field of autonomous vehicles and its association with object detection studies. Robots can identify objects to navigate office settings and perform basic tasks, such as aiding nurses in hospitals by helping with bed transports (Kovala, 2015). Similarly, but even with nonmobile systems, electromechanical surveillance systems deploy object recognition techniques. In military applications, image processing object detection establishes security measures, such as hyperspectral imaging (Gade et al., 2014). This finds anomalies in order to detect objects that "stand out from the cluttered background" (Ke, 2018).

Without these initiatives, the innovation paradigm focused on human survival will unravel until humanity cannot live without technology. New anxieties will emerge with the evolution of human preferences and behavior, resulting in new technological products, repeating the degrading cycle (Coeckelbergh, 2013).

While there are existing projects that produce wearable systems to aid in situational awareness, this project is simple and unique. The device will be mounted on a wireless headphone collar with vibration motors located at the ends and the MB1010 ultrasonic sensor on the middle back (fig. 1).

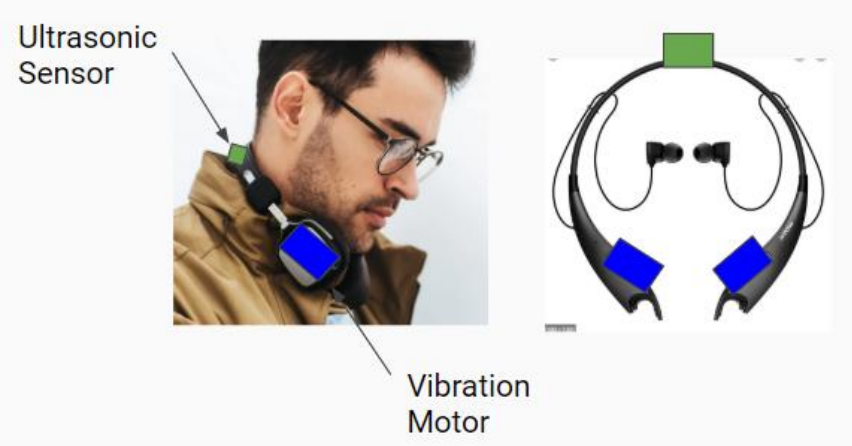

Figure 1. Wearable Device Contraption Design (author)

The PCB and the battery will be in a 3D printed box designed using SolidWorks software that can be attached to a belt loop, with wires extending to the collar (fig. 2)

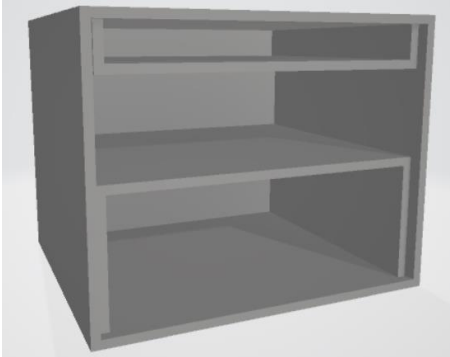

Figure 2. PCB and Battery 3D Box Model (author)

The project is unique because of the haptic feedback response from object detection. A C algorithm was programmed in the Texas Instruments MSP430G2553 microcontroller that takes analog distance input from the ultrasonic sensor and sets the threshold values, such as speed and

minimum distance, that will determine when to trigger the vibration motors to draw attention to the hazard (fig. 3).

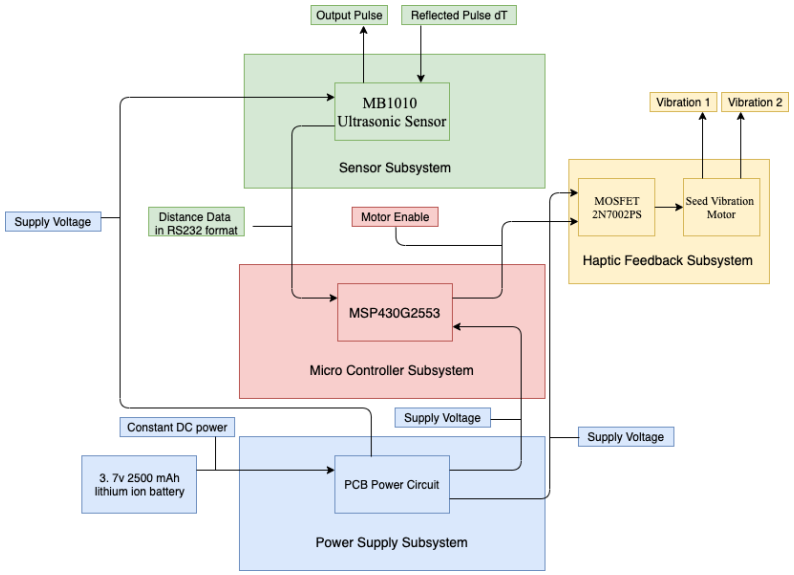

Figure 2. Subsystem Integration Design (author; data from Arabit, 2019)

Experiments will be conducted to ensure correct product functionality. The team will need signal analysis and measurement tools, such as a National Instruments Virtual Lab Bench, function generator, oscilloscopes, and multimeter, to verify that each subsystem passes all the phases of the standard test plan that consists of multiple decision trees. Furthermore, we plan to test the device outside of the lab environment and use multiple test objects to test the software algorithm. Upon success, the prototype will function with accuracy and precision in detecting objects in range and speed, and properly communicate with the user with haptics. It is the user's decision how they will react with the device; however, this success provides consumers guidance to be situational aware of their environment, reestablishing human independence.

Technological Consumerism: Planned Obsolescence Strategies and Imbalanced Lifestyles

How are social groups resisting ubiquitous technology?

Consumerism accelerates consumption without improving personal well-being. Schumacher (1973) concluded that such consumption is inconsistent with finite resources. In the 20th century, manufacturers introduced planned obsolescence, to promote consumption, seeking to instill in consumers the desire to own something "a little newer, a little better, a littler sooner than is necessary" (Stevens 1960).

The relationship between consumers and technology can be characterized as symbiotic: consumers change technology and technology changes them (Nye, 2006). With these changes, companies stimulate consumption as they learn what a consumer desires, promoting new products, but also compromising human autonomy (Keeble, 2013). Such manipulation to shift consumer from lifetime ownership was a difficult. Keeble (2013) suggests that consumers must return to this pre-consumerist pattern.

Major tech companies apply planned obsolescence techniques to expand their markets (Abdulla et al., 2017). Consumers buy devices in part due to such marketing (Deloitte, 2014). Responses to this phenomenon are diverse.

Slow Tech is a blog that promotes resistance to ubiquitous technology. It aggregates resources on the consequences to human health and recommends ways to seek a healthy balance ("SlowTech," n.d.). An extension of Slow Tech is a philosophy known as "Slow Tech Parenting," which bridges conscious living and authenticity with technology and family values to foster personal connections and interactions in everyday experience so that technology does not dominate habits and lifestyle (Hofman, 2013).

Parents Against Underage Smartphones (PAUS) is a nonprofit organization of parents, grandparents, and concerned citizens committed to finding a balance between helping children master technology without short-circuiting healthy development. They object to the "insane practice" of giving children smartphones and favor legal restrictions ("PAUS", n.d.). IndieWeb is a group of engineers and techno-utopians who want to develop an alternative social media platform outside of the "corporate web," decentralizing the experience through local servers ("IndieWeb," 2019).

Pervasive technology has induced a general anxiety and an aversion to technology. Many are seeking to recover control over their technology or to limit its intrusions. Some invoke the "precautionary principle": technologies must prove their safety before adoption. Others abandon some technology use or advocate simple living (Jones, 2006).

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