SMART SHOE-INSOLE

THE GLOBAL CHIP SHORTAGE: AN ANALYSIS OF SEMICONDUCTOR SUPPLY

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SOCIOTECHNICAL SYNTHESIS

Modern electronics demand a steady supply of semiconducting "chips," which are designed to carry out processes for a variety of applications. The "Smart Sole," a Bluetooth enabled shoe sole designed in the technical research project, utilizes these chips to enable a user to view a real time pressure map of their shoe sole, and store the data for later visualization. Semiconductors are essential for this project, which gives proof of concept for a technology that could provide valuable data for several purposes. The science, technology, and society (STS) research project is an exploration of one of the limiting factors of the technical project; semiconductor supply has been kinked by the COVID-19 pandemic and several other influences. After investigating the causes of this shortage, and using the effects on the automotive industry as a lens through which to identify the core problem, a plan to alleviate the effects of the shortage is proposed.

Foot Pressure Distribution (FPD) can be a useful metric for both medical and athletic applications. It can be used to predict where ulcers will form on diabetics, or be used by golfers to measure and evaluate the stability of their stroke. The technical research project was driven by a desire to provide data for this metric at a low cost, so that anybody can utilize FPD. Additionally, the software used in the project is open-source, allowing future users to change the program to best fit their use case. The technical project went through several revisions, as it was conducted using an iterative design process.

The Smart Sole consists of three main parts: the main sole, a box containing the circuitry and battery, and the software application. Sensors placed on the main sole provide an analog signal to the circuitry, which is processes the signal and sends it digitally to the software application via Bluetooth. The software application successfully visualizes the data, allowing the

user to see which area of the foot is experiencing the most pressure. In the future, the project could be expanded upon by increasing the number of sensors placed on the sole, which would give the user a more detailed pressure map. Additionally, the footprint of the circuitry box could be reduced, which would serve to improve the user's experience.

The STS research paper investigates the factors that led to the global semiconductor shortage. Moreover, it displays how the shortage has had a disparate effect on industry, using the automotive industry to show that shortages do not affect industries equally. Semiconductor trade data, news reports, and research papers are used to give context to the issue, and determine what has been affected. The issue is created by both human and non-human factors. Consequentially, Actor Network Theory was used to propose a method to alleviate the shortage and prevent similar problems from occurring in the future.

The central actor in this shortage is the COVID-19 pandemic. With the shift to online life, chips became an essential product, allowing society to continue to work and learn from the safety of their homes. However, workers at factories also had to go home, creating a kink in the supply chain that severely disrupted the distribution of chips. Other factors had an effect, including national borders and the development of new technologies. The research concludes with an emphasis of the need for domestic semiconductor production and detailed chip distribution plans.

Component scarcity can have a massive impact on technological development, and it is largely negative. Even the technical side of the project was affected by the shortage, as semiconductor stock quantities have become extremely volatile. However, young engineers learning to maneuver the shortage may benefit in the long term, as they have been forced to become crafty and shrewd to meet their goals.

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