

**Thesis Project Portfolio**

**Smart Shoe-Insole**

(Technical Report)

**Emerging Global Satellite Network: The Barriers to Connect the Unconnected**

(STS Research Paper)

An Undergraduate Thesis

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## **Sociotechnical Synthesis**

My technical project and STS research work evolves around engineering applications designed to benefit fellow human beings and I am proud to provide more details on the. The aim of the project was to evaluate gait, plantar pressure, and foot function with insole sensors that are reliable and durable enough to accurately capture data wherever activity takes place and without compromising natural motion. On the other hand, my STS project focused on a big picture analysis of low Earth orbit (LEO) satellites that are going to change our course of wireless communications forever. Although my technical and STS projects are only loosely related because the topics were pursued on different occasions, working on each of the projects allowed me to cover a breadth of topics that greatly contributed to my learning as an engineer.

My technical project was created over a long semester of hard work with my peers each: Eric, Kieran, Merron and Xinyuan, a team of dedicated engineers who I appreciate working with. The project was a smart shoe-insole with seven pressure sensors strategically placed throughout areas of the sole that experience the most pressure during physical activity. The data collected from these sensors then get transmitted using Bluetooth to an external software application, which will visually display the data in real time. The goal of this project was to enable this smart insole to be used as a medical tool for use in physical therapy and diagnostics, as well as a tool to be used by athletes to evaluate and improve their performance. Foot pressure distribution (FPD) is a useful metric for the diagnosis of potential issues in a person's foot or gait. FPD can be used to identify foot deformities, diagnose gait disorders, and provide strategies for preventing foot ulcers in diabetes. Outside of medical usage, the technology can be used by athletes and coaches; for example, golf players can use this data to assess the stability and the form of their swings. This project was chosen because each member in the capstone team has either actively played a

sport in the past or currently are engaged in sports. We wanted to provide a tool to benefit those who play sports. Upon doing further research about the benefits of knowing FPD, the scope of the project expanded to be both a sports improvement tool and a medical diagnostic tool.

As mentioned before, my STS project provides an analysis of low Earth orbit satellite internet by giant Silicon Valley companies using the framework of Actor Network Theory. Internet, a global network of devices that connect humans and non-humans, is a basic need in the 21st century, however, an estimated 4 billion people still do not have access to it. As part of the solution, a significant expansion of the satellite Internet sector is taking place, bringing with it big hopes for social and economic growth. Satellite Internet has resurfaced in recent years as a viable alternative to laying thousands of miles of fiber optic cable, a practice that is time and energy-intensive and associated with high operating costs. In order to compete with broadband service, new Silicon Valley-associated companies such as SpaceX, OneWeb and Amazon are developing innovative constellations of small satellites in non-synchronous orbits. The constellations reduce production costs and improves signal delay, allowing them to provide cheap, high-speed Internet access around the globe. The Actor-Network Theory (ANT) methodology is applied in this study to explain the increasing popularity of commercial satellites, as ANT highlights how linkages and their dynamic result in the emergence of new entities, for example the new emerging organizations and the uncertainties they face, which is core part of this paper. In this paper, ANT is applied to explore what are the factors that contribute to renewed interest in satellite connectivity and what are the non-human actors that pose challenges to the industry.