Happy Feet: A Low-Cost Smart Shoe Utilizing Temperature, Pressure, Humidity, and Alcohol Levels to Detect and Monitor Common Foot Problems

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Foot conditions are an extremely prevalent issue worldwide, and are detrimental to the physical and emotional health of those affected by them as it prevents active and social lifestyles. Existing devices used to detect foot conditions suffer from not being unable to be used continually, measuring only one parameter, and being prohibitively expensive. These issues make it exceedingly difficult for people to constantly monitor their foot health as a preventative measure, leading to this project's guiding question: is it possible to engineer a low-cost, continually-worn smart device that can inform the user about their foot health? By incorporating sensors, processing logic, and a human interface into an ordinary shoe, this project aims to replace multiple devices with one. The device utilizes a human interface, an app with graphical representations, that conveys the user's foot health in an easy-to-understand manner. The device uses custom pressure sensors, designed to provide necessary functionality with minimum cost, to measure foot pressure distribution - a predictor of certain diseases and ulcers. Arch shape can also be derived from pressure measurements. Variations in temperature across the foot are used to detect possible inflammation, which can lead to ulceration. Finally, humidity and alcohol sensors are used to identify possible fungal infections. Through calibration and testing, I was able to ensure the functionality of the sensors and the processing logic. The smart shoe packages multiple diagnostics into one wearable device, providing information about many common foot conditions.

Awards Won:
Second Award of $2,000