THESIS PROJECT PORTFOLIO

Wearable Technology: Developing a Skin-Like Temperature Sensor

(Technical Report)

Wearable Devices and Trust in Healthcare Providers

(STS Research Paper)

An Undergraduate Thesis

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Wearable devices in healthcare sit close to or on the skin and are able to record valuable medical data about patients and present a promising future for telehealth. This data can then be analyzed to understand patient health, understand chronic conditions, and overall improve patient health. The biggest advantage of wearable devices is their ability to collect data and allow healthcare professionals to analyze it remotely. This has fantastic benefits for those who don't have easy access or reliable access to hospitals or their healthcare providers, specifically rural communities. While the benefits of these devices can't be reaped yet, the technology is quickly improving with current sensors manufacturable on a very small scale. Current sensors can measure heart rate, temperature, strain, and pressure with increasing possibilities as the technology progresses.

My capstone project was designing, manufacturing, and testing a wearable temperature sensor. The technical basis behind the design is that a change in temperature will incur a change in the resistivity of a piezoelectric material. Carbon nanotubes were chosen as the piezoelectric material and a decrease in resistance was correlated with an increase in temperature. PDMS (Polydimethylsiloxane) was used to encapsulate and create the carbon nanotube channels, allowing it to be placed on the skin with no adverse reactions. In the end, our sensor did work as there was a noticeable change in resistance for an increase in temperature. Noticeable improvements can be made by decreasing the size of the sensor as the final, working sensor was about four square inches, as anything smaller was too delicate and difficult to manufacture. Further improvements are increasing the surface area of the Carbon nanotube channels to provide greater changes in resistance to improve the resolution of the sensor.

My STS Research paper focused on the social and cultural issues stemming from the adoption of wearable devices. Wearable devices offer the great potential of monitoring patients

remotely, greatly increasing the potency of telehealth. This benefit has the greatest potential for those with chronic illness and those who do not have reliable and quick access to their healthcare provider. Current wearable devices are designed for more urban, richer Americans that have great potential to help those who don't have easy or reliable access to their healthcare providers. Rural communities, due to their further distance from healthcare providers, have the greatest opportunity to be helped from this technology. Other challenges, such as access to broadband internet, and a greater than average distrust of doctors and the governments, prevent the rapid adoption of wearable devices to communities that could greatly benefit from them. Without direct action and proper attention, rural communities will not see the same benefits that richer, more urban communities will see.

Wearable devices are a fantastic technological advancement and pave the way for the future of healthcare. In addition to the manufacturing challenges faced by the devices, there are social hurdles that must be overcome for them to help as many people as possible. For them to be properly implemented in the rural communities that need them most, there must be social and cultural changes to the technology and how it is used by providers. There must be a structure and plan so these rural communities get the full benefits and care of these devices. As the technology is still being developed, there. Further research includes designing and validating strain, pressure, and other various sensors. Finally, human testing can be done with our temperature sensor to validate its function as a wearable device.