

Title – Exfoliated Graphite Resistance Based Pressure Sensor for Mapping Plantar Pressure

Program of Study – Mechanical Engineering

Presentation Type – Physical Poster

Subtype –Applied

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Abstract: Diabetics often have neuropathy that prevents them from noticing developing foot ulcers. Unhealing foot ulcers are responsible for most diabetic amputations. Pressure sensors can detect areas with abnormally high pressure, allowing earlier detection, prevention, and treatment of developing ulcers. Traditional plantar pressure sensors are usually limited to bulky or stationary systems, while more recently developed systems have other limitations such as lack of accuracy, slow response times, and high cost. New materials can help solve these problems. This research reports an affordable and durable system that uses a bilayer piezoresistive flexible sensor array for better accuracy in measuring pressure while standing on even and uneven surfaces. The piezoresistive sensors are made by spraying conductive exfoliated graphite solution on a latex substrate. The sensors are attached to a rubber padding to allow deformation and sealed for better durability. Electrodes are attached on the sensors to obtain change in resistance signals. Deformation induced resistance changes of the sensors are collected using an Arduino and the distribution of these change in resistances is plotted in Matlab. After calibrating the system, the color map can be related to the pressure and corresponding pressure distribution can be obtained on the foot. This system could be developed into a portable, wearable pressure sensing system for clinical use.

Christian worldview integration: Everything in my life has been influenced by my faith, and this research is no different. Research has been a test of my commitment to following God when I don't see how a situation will work out in the end, and the research itself is influenced by the need to live in a godly way. The design for this pressure sensing system is intended to help diabetics with neuropathy, who often have low circulation in their feet due to damaged blood vessels. The reduced blood flow and lack of tactile sensation in the foot combine to cause ulcers that often go unnoticed until they become a serious health problem and can lead to lower limb amputation. This pressure sensing system should be able to detect high pressure concentrations, allowing early detection for at-risk patients and effective treatment and prevention. This goal aligns with the Christian principal of loving our neighbors, and can help us live out the practice outlined in Philippians 2:4, that of valuing others so that we look out for their interests and make their lives better. The low cost of materials for the sensor could make this system easily affordable, which will increase the positive impact by allowing more people to be treated. The design of the sensor is intended to be as simple and cheap as possible without compromising accuracy. God is a creator and

designer. As one of his creations, using my abilities to design systems that can help people is stewardship of what I have been given. Taking my talents and following the example of God's creation and design is part of my calling as a Christian. This research focuses on creating a prototype for something that has never been done before and involves working with the awareness of who can be helped by it.

Things due today: Research Week submission and electrode attaching.