Sensor Crosstalk Testing Device

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Background

A group of students from the Faculty of Sustainable Design Engineering (FSDE) have partnered with Stepscan Technolgies Inc. to assist with the continuous improvement of their developed product called Stepscan®.

The Stepscan® product is a pressure sensing electronic flooring tile which is linked with an analysis software to provide Real-time data of a patient's mobility as they apply pressure by walking across the flooring tile. The product has a variety of applications which include; rehabilitation, military training and sports training.

Problem Statement

As a patient places weight on a tile, the force is directly above a single sensor. This causes mechanical deformations in the materials resulting in force being distributed onto the adjacent sensors. This distributed force is called sensor crosstalk. Sensor crosstalk creates inconsistencies within the data analysis and must be accounted for as one of the company's quality tests.

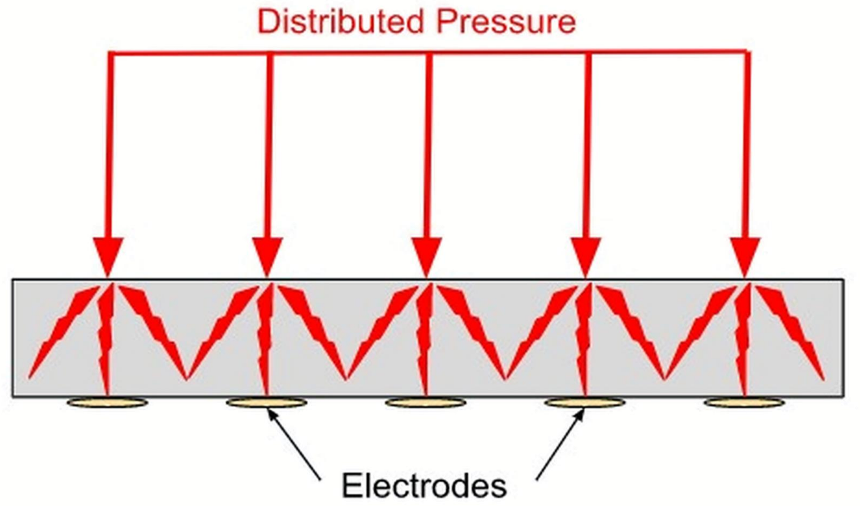

Figure 1: A visual representation of Sensor Crosstalk in a Stepscan® Tile.

The students from the FSDE have been tasked with designing a device which can determine the amount of crosstalk between neighboring sensors by being implemented into the current testing and calibration process used by Stepscan.

Completion of the task will result in an increase of accuracy in the tile data and will benefit the customers of Stepscan.

Conceptual Design Overview

The students from FSDE have created an insert suitable for the client's current hydraulic press used for initial quality assurance.

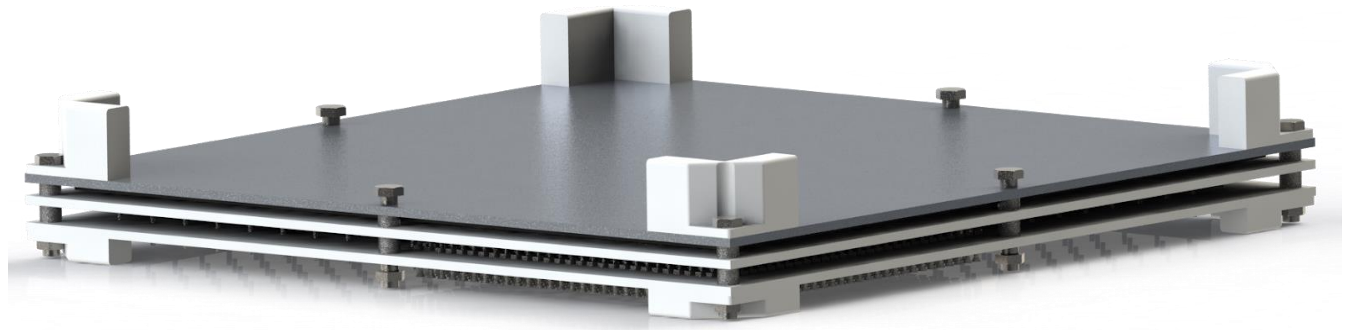

Figure 2: Computer Aided Design (CAD) of final design.

Design includes 1,882 pins able to individually move freely in a vertical motion. A compressible material is used to prevent any discrepancies in the tile surface from affecting testing results. The remaining components are structural along with 8 alignment brackets implemented for the positioning of the device with respect to the tile.

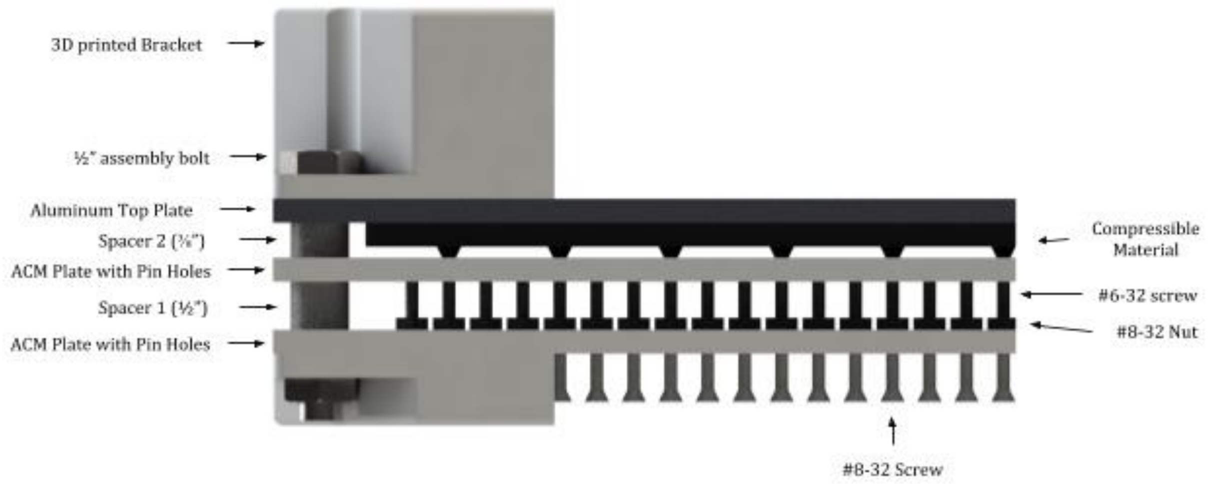

Figure 3: Final design component labels and layout.

The design consists of four quadrants, two of which are densely populated with pins to help increase the surface area in contact with the tile being tested. The other two quadrants with lower densities, are strategically placed above electrode sensors to acquire accurate data from the cross-talk testing.

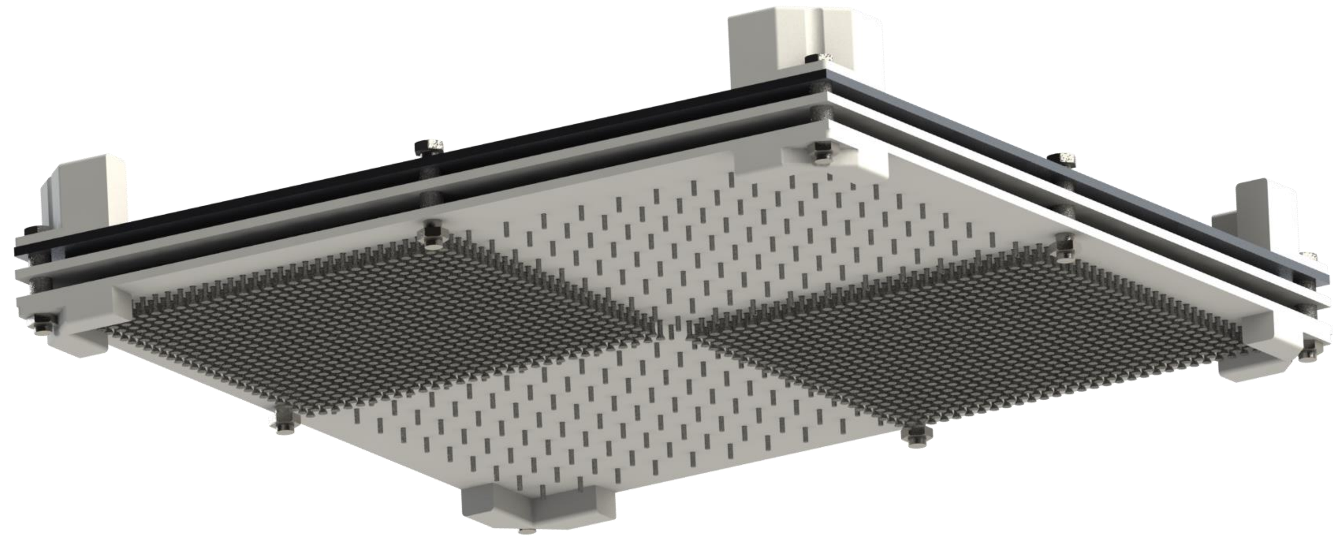

Figure 4: Underside of the design illustrating the different pin patterns

Analysis and Results

In order to determine the best material for the compressible layer, the team conducted small scale testing with various rubber materials to compare the deformation that would occur within a range of applied loads.

Figure 5: CAD models of the #8-32 and #6-32 testing apparatus, respectively.

Using the measurements taken from the testing phase, graphical analysis was conducted to compare the materials.

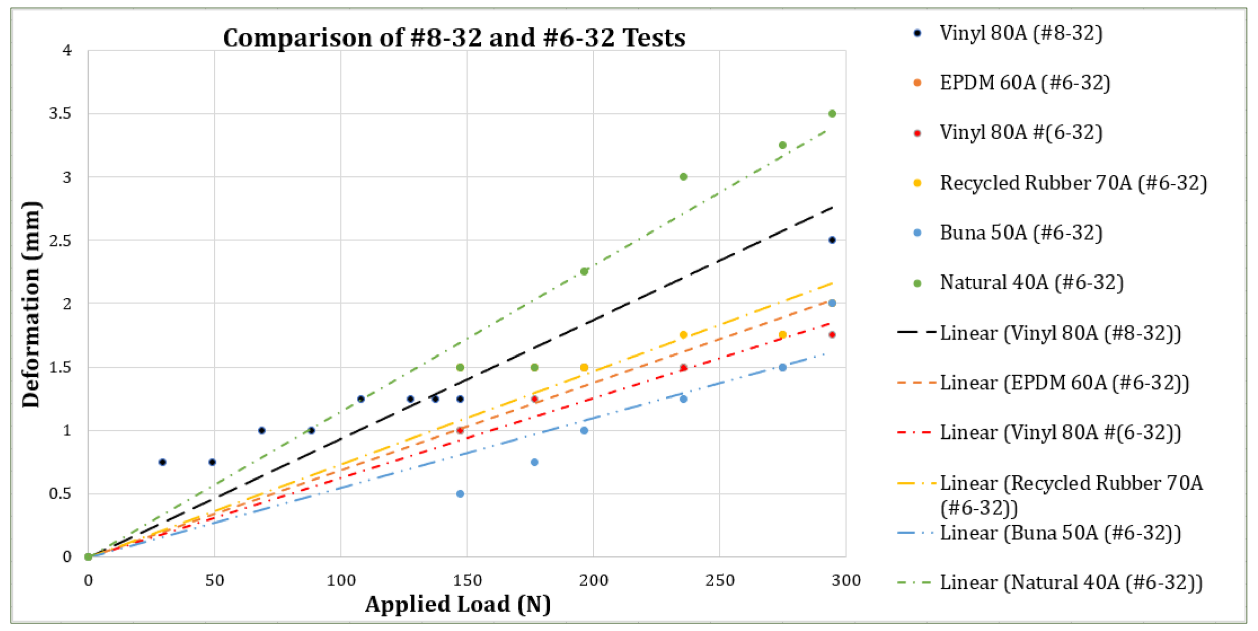

Figure 6: The deformation versus applied load for the various apparatus and material testing combinations.

Based on the results from the small-scale testing and some calculations, the team was about to finalize the materials list and begin to build the prototype.

Final Recommendations

Based on the students reflection, it is recommended that if implemented, the design should implement custom pins, as seen in Figure 7 and Figure 8. It is also recommended that the ACM sheets are replaced with aluminum to increase structural integrity and longevity.

Figure 7: Model of possible replacement for pins used to provide test results

Figure 8: Model of possible replacement for pins used to increase surface area