Pressure Sensing Actuated Seat to Prevent Pressure Ulcers

Individuals who are on bed rest, in wheelchairs, or seated for an extended duration are susceptible to developing pressure ulcers. Prolonged pressure in a concentrated location on the body limits blood flow leading to tissue deterioration. Pressure ulcers are common for people who are elderly, paralyzed, or injured. Current cushions provide support to minimize concentrated pressure, but there are no seating devices which incorporate biofeedback to prevent pressure sores. This prototype senses pressure applied to the seat in an array, and each module can raise or lower in order to decrease pressure across the seat. This prototype is a proof of concept, to eventually be improved in order for research teams to test. For example, if there is too high of pressure in one area, an Arduino will activate the power screw to lower, distributing pressure to adjacent modules. Ideally, refined seats with this concept may be produced commercially for people prone to pressure ulcers. This design is suited for direct digital manufacturing because for each seat, there is an array of modules. Each module is composed of 9 customized components specific to this design. For the prototype these are 3D printed pieces. Each module additionally has a DC motor, a power screw and standoff, an Arduino circuit, material for the sensor, and set screws. Since the purpose of this design is to show that it may be produced commercially, DDM is appropriate, since the 3D pieces need to be printed in large quantities. For each seat, there will be a total of 184 3D printed pieces: 40 connectors between modules or modules and wall of the seat, 9 pieces per each of the 16 modules. The total amount of material used to print all the pieces, including the supports in each piece, is 2.47 kg of PLA, which is 310 m of filament. The totally volume of pieces is approximately 3.89×10^{-5} m^3.

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