Improving the Accuracy of the FSR Insole Sensor by Inserting Intermediate Layer Material (Which Can Diagnose Parkinson's Disease)

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According to previous research, PD patients and a control group was conducted an experiment where they were given a task while standing still. The experiment measured the CoP time series, where PD patients showed larger "Postural Sway Patterns" than the control group. PD patients' CoP oscillated at a frequency of about 0.3Hz. Parkinson’s disease is not easy to diagnose. And commercial insole sensors show high accuracy but costs around $1,000, which isn't an affordable price for patients. So these make patients' early diagnosis and curing even harder. Thus, we aimed to create an economic yet accurate enough sensor using only eight small FSR(Force Sensing Resistor) sensors. These sensors will help detect CoP swaying patterns for patients without any spatial or economic constraints. In this work, we developed a Capacitance-type 3 layer insole sensor (a method of inserting the middle layer between two FSR sensors), and established models 1 ~ 3 that can accurately measure the time changes of CoP and CoP itself through sensors. As a result of comparing and analyzing models with the commercial sensor and the 1-layer FSR sensor in various experimental environments, the 3 layer FSR insole sensor showed less RMS error compared to the 1-layer FSR sensor. The maximum reduction error we got was 57.74% for Model 1, 88.70% for Model 2, and 86.37% for Model 3. Plus, our 3-layer FSR sensor showed accuracy close to the commercial sensor in both stationary and moving situations, which meant it will be possible to detect the postural sway patterns of CoP, the mutual characteristic PD patients had. Therefore, we expect our FSR sensors to be substantially helpful in the development of simple, economic Parkinson's disease early diagnosis devices.