TremorSense: A Novel Parkinsonian Tremor Monitoring and Suppression System

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Parkinson’s disease (PD) is the second most common neurodegenerative disorder. Tremors, which affect over 70% of PD patients, significantly disrupt daily activities of living. Currently, tremors are managed through medications but dosing is based on subjective clinical assessments, which fail to capture PD’s fluctuating course. There is a need for a wearable and quantitative tremor monitoring system to aid medication dosing. I hypothesized that I could develop an inexpensive and lightweight closed-loop tremor monitoring and suppression system using an accelerometer and vibration motors, which stimulate pressure-sensitive skin receptors distracting the brain from the dysregulated tremor feedback loop. To measure tremor frequency and intensity, I used an Arduino Nano 33 BLE. Tremors were detected using a frequency threshold. The frequency threshold was identified using an age-and sex-matched accelerometery dataset of patients from the Michael J Fox Foundation. Following tremor detection, coin cell vibrators are simulated to reduce tremors. A wearable tremor monitoring bracelet was designed to incorporate 7 parallel-connected vibrators powered by a 3 V battery. For device testing, tremors were simulated using a TENS unit. Lastly, I built an app using Android App Studio to display collected data to patients and clinicians. The Arduino sensor data is transmitted via Bluetooth and stored in Firebase. The TremorSense device met the engineering and design criteria: by weighing under 40g, costing under $40, and successfully differentiating between tremor and non-tremor movements with an accuracy of 92.31%. This tool enables physicians to better monitor and treat PD patients, improving their quality of life.

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