Name(s)	Project Number
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Project Title

Tremor Monitor: Detecting Signs of Parkinson's Disease Using Piezoelectricity

Abstract

Objectives

Due to the limited availability and high prices of devices that measure body tremors, I developed a cheap, portable device that can measure vibrations in the hand. This can be used by patients who have Parkinson s disease to monitor tremors periodically and follow the progression of the shaking. Using the principle of piezoelectricity, or the conversion of kinetic energy into electrical energy, I was able to monitor tremors by tracking the output voltage of the sensor relative to my input of tremors. In order to simulate the Parkinson s tremor, I referred to The Clinical Evaluation of Parkinson s Tremor, and attempted to mimic the vigorous shaking by building a simulator that clamps on your wrist. The simulator could be run at different speeds to simulate different levels of shaking in Parkinson s disease and was intended to replace testing on actual patients.

Methods

The tremor monitor device was put together using the piezoelectric sensor, Arduino board, breadboard, and LED lights and would also display results on the computer through a wired connection. The LED lights would show green for normal or red for high, based on a preset threshold. Moreover, I developed an algorithm that waits for the input to become stable before accumulating tremors from the pointer finger placed on the device for fixed time and computes the score based on this data. To make the device self contained I designed a custom box using Tinkercad, a 3D printing software so that all parts of the circuit would fit and allow access to users to place finger and observe results.

Results

The results of my testing showed that scores reflected the progression of Parkinson s shaking as score value was directly proportional to the vibrations in the Parkinson s simulator attached to my wrist. When the readings of the essential tremor are compared to the readings of parkinson s tremor it shows that the device is accurate in detecting an increase in tremor activity as the average score of parkinson s tremor is 309.5% higher than the average of Essential tremor. The device is also capable of detecting change or Progress of parkinson s tremor as the parkinson s tremor simulation at 100 power or 2.5 HZ produced 73.55% higher score than Parkinson s tremor simulation at 1.5 hz

Conclusions

My device was also able to meet all the constraints of being portable using the custom box, accurate (in terms of being sensitive to minor vibrations), cost-effective (under $100) and was easy to build as it had only 4 basic components.

Summary Statement

The objective of my project is to detect signs and progression of Parkinson's disease based on the principle of Piezoelectricity, or the conversion of kinetic to electrical energy.

Help Received

Mita Mallik (Mom), Swapna Mayya (Teacher), Jason Reynolds (3D Printing Assistant)