Using an Inertial Measurement Unit to Objectively Quantify Symptoms of Essential Tremor and Parkinson's Disease

Kitaoka, Robert

Present tremor measurements of Parkinson's and essential tremor are based on subjective visual observation scales; clinical evaluations may vary between reviewers. A standardized, quantitative assessment is needed to confirm the severity of tremor motion. Ideally, clinical trials can be confirmed through biomechanical analysis; the study has three goals: interface a 9 axis sensor for movement visualization, investigate the applications of commercially available motion sensors, and construct a variable oscillation tremor simulator to assess the sensitivity and feasibility of an accelerometry-based system. An Adafruit inertial measurement unit with 9 degrees of freedom (accelerometer/gyroscope/magnetometer) was instrumented using the I2C bus in conjunction with a Raspberry Pi. Pololu's Minimu9-ahrs software was used for raw data output from the accelerometer (g's), the gyroscope (deg/s), and the magnetometer (gauss) to record and display a visualization of hand motion in three dimensions. An alternative such as the Kinesia, a commercially available device, utilizes Bluetooth sensors on hands and feet and comes with an Android tablet preloaded with user-friendly input software. Another readily available sensor uses cameras and infrared sensors to track individual finger measurements, demonstrating exceptional test-retest reliability A tremor simulator was constructed using a lower arm replica and vibrating saw, accurately replicating periodic motion from 6-12 Hz. Accelerometry allows for an unbiased, quantitative measurement of direction and position, objectively quantifying tremor and making subjective assessments more quantitative than qualitative. Clinical use of sensors in conjunction with visualrating scores have the potential to improve the quality of life