

Embedded Challenge Spring 2025

Term Project

“Shake, Rattle, and Roll”

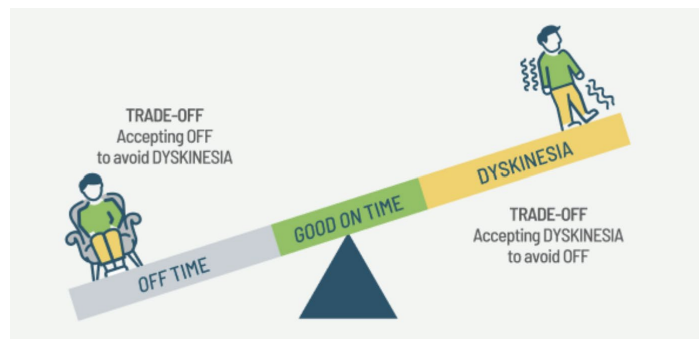


Objective:

- Use the data collected from a single accelerometer and/or gyroscope to detect tremors or dyskinetic hand movements, as exists in patients with Parkinson's disease. Use the resources and peripherals on your development board to indicate the presence and intensity of these two movement disorders in Parkinson's patients.

Motivation:

- One of the primary symptoms of Parkinson's disease is tremors in a dominant arm. Tremors are defined as rhythmic oscillations in the frequency range of 3-5Hz. The treatment for these tremors is typically a dopamine boost, which transitions the patient from the “Off” state to the “On” state. However, if too much dopamine is provided, an additional symptom called dyskinesia occurs. This is characterized by rhythmic dance-like movements in the frequency range of 5-7Hz. It is essential to have this information to properly medicate a patient so that the patient is “On”, but not too “On”.



Characteristics:

- Your development board contains an accelerometer capable of detection acceleration and/or rotation on three directions. It's is capable of acquiring data at the required rate and the required resolution to detect both movement conditions.
- You should design your system to capture 3 second intervals of data that you can process using an FFT library to return information on frequency distribution of the data in the 3 second interval. You can research what FFT library and how to use that library. In general, all will work the same way. You will provide an array of data and a sampling frequency. It will then provide back the frequency content of the data. We will discuss further in class.
- You should use the indicators (speakers, LEDs etc.) to creatively indicate if either of these conditions exist as well as the intensity. You can't use the serial terminal as a means of indicating anything.
- You can power your device with a simple power bank.
- Only you controller dev board may be used. No additional hardware.
- Only PlatformIO may be used.
- You will submit your PlatformIO project directory as a deliverable.
- You will prepare and submit a 1 minute video demonstration/explanation of your device functioning.

Grading Criteria:

- Ability to successfully detect tremors (25%)
- Ability to successfully detect dyskinesia (25%)
- Ability to quantify intensity of each symptom (10%)
- Repeatability and robustness of detection (via video demo) (10%)
- Ease of use (10%)
- Creativity (10%)
- Well written code (5%)
- Complexity (5%)