

FINAL PROJECT

Motion Quality Wearable

A wrist/forearm wearable that monitors movement quality in real time by computing jerk — the rate of change of acceleration. Abnormal motion triggers simultaneous haptic and visual alerts, while the MAX30102 provides continuous heart rate context.

TARGET APPLICATIONS

- Physical rehabilitation monitoring
- Neuromotor conditions — tremors & spasms
- Movement quality assessment in athletes
- Early detection of motor control deterioration

SENSOR STACK

XIAO nRF52840 Sense
MCU · BLE 5.0 · LSM6DS3 IMU

BNO08x
Secondary IMU · I2C 0x4B · Fusion

MAX30102
Heart rate · I2C 0x57 · PPG

SSD1306 OLED + Motor
Display 128×32 · Haptic feedback

KEY METRICS

500
Jerk threshold
m/s³

×3
Confirmation
window

24B
BLE packet
6 × float32

PWA
Companion app
GitHub Pages

Detection algorithm

Dual-IMU sensor fusion (LSM6DS3 + BNO08x weighted average) → finite-difference jerk per axis → magnitude against threshold → 3 consecutive confirmations → haptic + OLED alert. Heart rate provided as physiological context.

Arduino C++

I2C 100 kHz

TPU 95A enclosure

Custom SMD PCB

Bluefy iOS

Prototype validated — BLE + PWA deployed

Custom motor driver PCB fabricated

TPU enclosure designed

github.com/rafalee235 · FabAcademy 2026