

Development of Wearable Real Time Monitoring System for Hand Tremor Through Wireless Communication

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INTRODUCTION

BACKGROUND

- Tremor constitutes one of the most important symptoms of neurological disorders.
- Tremor is an involuntary, rhythmic muscle contraction leading to shaking movements in one or more parts of the body.
- A common movement disorder that most often affects the hands



PROBLEM STATEMENT

Current Hand Tremor assessment is based on rating scales:

- solely based on clinician visual examinations, which are subjective and dependent on the clinician's interpretation
- dependent on patients' written and verbal accounts, which are unreliable and limited by recall bias

GOAL

To design and develop a wearable prototype with a three dimensional accelerometer sensor monitoring system to measure involuntary motion of Hand Tremor wirelessly for assisting data collection

OBJECTIVES

- To develop a wearable, wireless device to read and sense involuntary hand tremor movement
- To create a graphical user interface to display, monitor and record data
- Testing, analysing and comparing the hand movement

NOVELTY & INVENTIVENESS

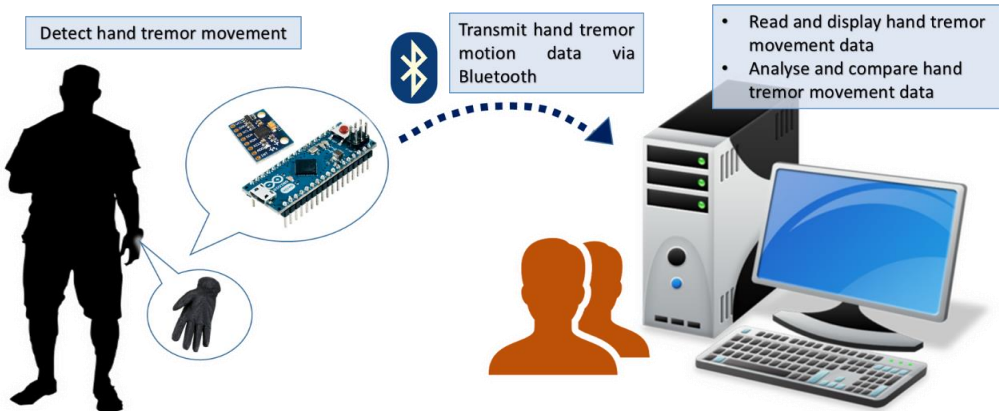
A new and efficient monitoring system that able to obtain, record, analyze and compare the hand tremor motion in 3 orthogonal axis via Bluetooth

BENEFITS & APPLICABILITY

- advantage for hand tremor data collection by continuously monitoring
- Provide a frequent assessments that potential to be used as parameters in clinical trials

DEVELOPMENT OF PRODUCT

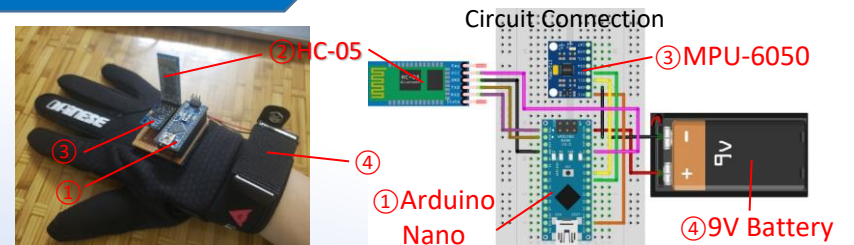
CONCEPT OF PRODUCT



Measurement of hand tremor motion is obtained by identifying acceleration of movement in 3 orthogonal axis

PRODUCT CHARACTERISTICS & FUNCTIONALITY

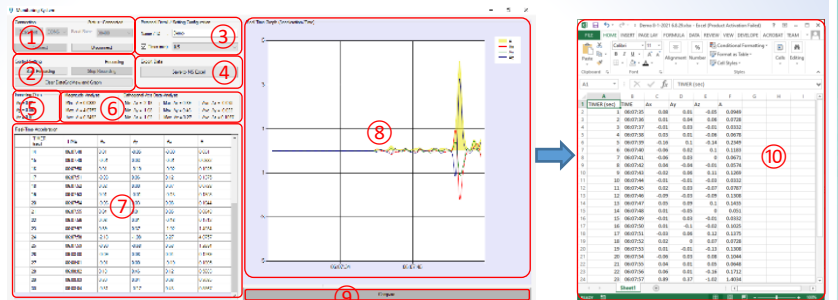
A) Measurement Module



B) Monitoring Center

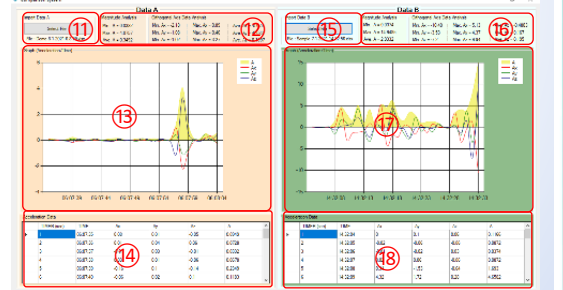
MONITORING SYSTEM:

- Port Number & Baud Rate Selection
- Recording
- Personal Detail/ Setting Configuration
- Export to Ms Excel
- Incoming Real-Time Acceleration
- Acceleration Analysis
- Data Grid View
- Graphical View
- Comparison Button
- Previous Data



COMPARISON SYSTEM:

- Load Data A
- Data A Analysis
- Graphical View A
- Data Grid View A
- Load Data B
- Data B Analysis
- Graphical View B
- Data Grid View B



A) MEASUREMENT MODULE – COMPONENT USED

MICROCONTROLLER

- Arduino Nano**
- 5V of operating voltage
 - 7 - 12V of input voltage
 - 14 digital & 8 analog Pins
 - 2 Reset & 6 Power Pins
 - 16MHz of CPU speed

SENSOR

- MPU 6050 Accelerometer**
- MEMS 3-axis gyroscope
 - 3-axis accelerometer
 - on-board Digital Motion Processor
 - I2C Interface

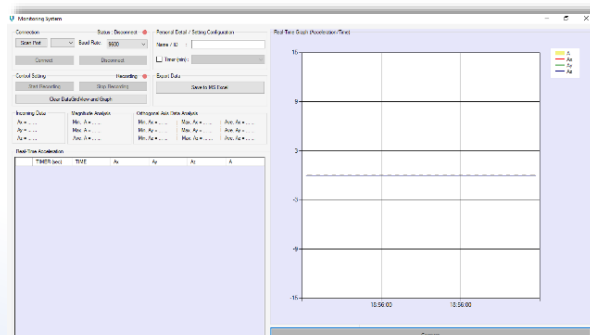
WIRELESS TRANSMISSION

- HC-05 Bluetooth**
- 3.3-6V of operating voltage
 - operating frequency at 2.4Ghz
 - a range test of 10m
 - date rates of 1Mbps

B) MONITORING CENTER – SYSTEM DESIGN

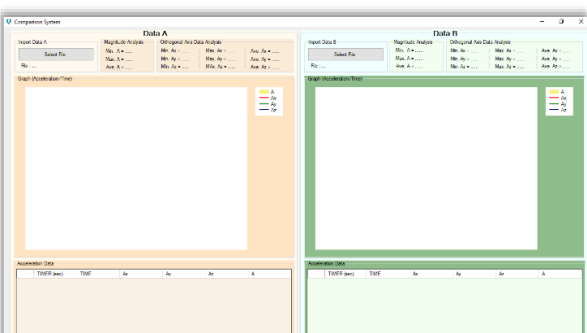
1. Monitoring System

- Display and record incoming hand arm movement acceleration in x-axis(ax), y-axis(ay) and z-axis(az)
 - Calculate magnitude of acceleration
- $$a = \sqrt{ax^2 + ay^2 + az^2}$$
- Export data of ax, ay, az and a into MS Excel



2. Comparison System

- Load MS Excel folder and display previous data for viewing or comparison
- Show minimum, maximum and average acceleration of ax, ay, az and a of involuntary hand tremor movement for analysis



ENVIRONMENT IMPACT

- This developed wireless hand-arm monitoring system able to assist health care providers on obtaining and monitoring performance and condition of human hand.
- The monitoring system could act as a unit center to connect and monitor more than one measurement module.
- With recording feature, this system could assist documentation by recording the data for future work and analysis.

MARKETABILITY

This development will further benefit the field of medical and healthcare industry as a basic in devising new system for monitoring or recording purposes. For example, as a program that can be helpful in obtaining and analysing different body motion that related with disability in movement.

CONCLUSION

The measurement and analysis of Hand Tremor through wireless transmission are presented. The proposed system helps doctors to measure the acceleration motion of hand tremor. It may also further to help doctors in identifying effectiveness of a particular treatment that a patient is undergoing through the information gained from monitoring.