AOU
الجامعة العربية المفتوحة
Arab Open University
Faculty of Computer Studies

VIBRATED GLOVES FOR PARKINSON'S PATIENTS

Name: Nagham Tharwat Ramadan
Id: 21510350
Supervisor: Ramadan Fawzy Mohamed Babers

HEADLINES

1. Introduction
2. Problem
3. Objectives & Goals
4. Deliverables
5. Current Assistive Solutions
6. Comparison Between Existing Solution
7. Target Customers
8. Functional Requirements
9. Non-Functional Requirements
10. Diagrams
11. Project Plan
12. References

INTRODUCTION

This presentation explores the role of vibrated gloves in patient care, can help Parkinson's patients manage their hand tremors to provide real-time detection, analysis, and therapeutic responses.

PROBLEM

Hand tremors are one of the most visible and debilitating motor signs of Parkinson's disease, a degenerative neurological condition caused by the brain's loss of dopamine-producing neurons. Tremors have a significant impact on patients' quality of life, making it difficult to carry out daily activities and social contacts.

OBJECTIVES & GOALS

Create and produce vibrating gloves as a unique wearable device to aid in reducing and managing the motor symptoms of Parkinson’s hand tremor disease, specifically tremors, and improve the life quality of patients.

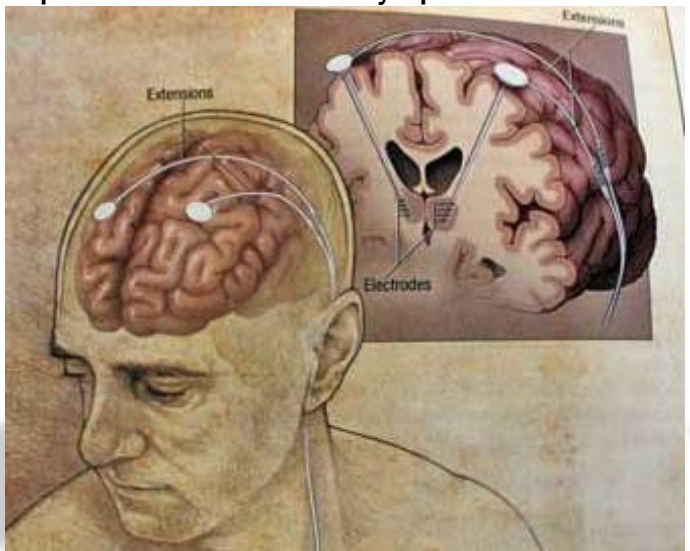
DELIVERABLES

- Prototype of the vibrated gloves. “Wearable Device”
- Easy Control system. ”Mobile application”

CURRENT ASSISTIVE SOLUTIONS

Neurostimulation Devices

Deep Brain Stimulation (DBS):
Surgical procedure that uses electrical impulses to reduce motor symptoms.



Tools

Writing Aids

Wearable Devices

- Gyro Glove
- Intelligent Gloves
- EMG-Based Systems

Feature	GyroGlove	Intelligent Gloves	EMG-Based Systems	My Project (Vibration Gloves)
Technology	Gyroscopes	Accelerometer & Vibration	EMG Sensors	Accelerometer, Gyroscope, Vibration & Ai
Tremor Detection	Indirect	Direct	Direct	Direct
Feedback	Gyroscopic resistance	Adaptive vibrations	Actuator-based forces	Adaptive vibrations
Ease of Use	High	High	Low	High
Calibration	Minimal	Minimal	Extensive	Minimal
Accuracy	Moderate	High	Very High	High
Cost	Moderate to High	Moderate	High	Moderate
Power Efficiency	High	High	Moderate	High
Integration	Yes (mobile app)	No (Mobile App)	Rarely implemented	Yes (Mobile App)
Key Limitation	Limited adaptability	Vibration efficacy reliance	Complex and bulky	Dependent on vibration algorithms

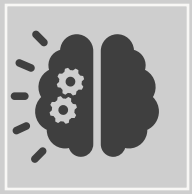
COMPARISON BETWEEN EXISTING SOLUTION

TARGET CUSTOMERS

1. Parkinson’s patients with tremors.
2. Caregivers seeking assistive devices for their patients.
3. Clinics and rehabilitation centers aiming for affordable and portable solutions.

FUNCTIONAL REQUIREMENTS

Real-time tremor detection using sensors.



Adaptive vibration feedback based on tremor severity.

Mobile app integration for monitoring and control.

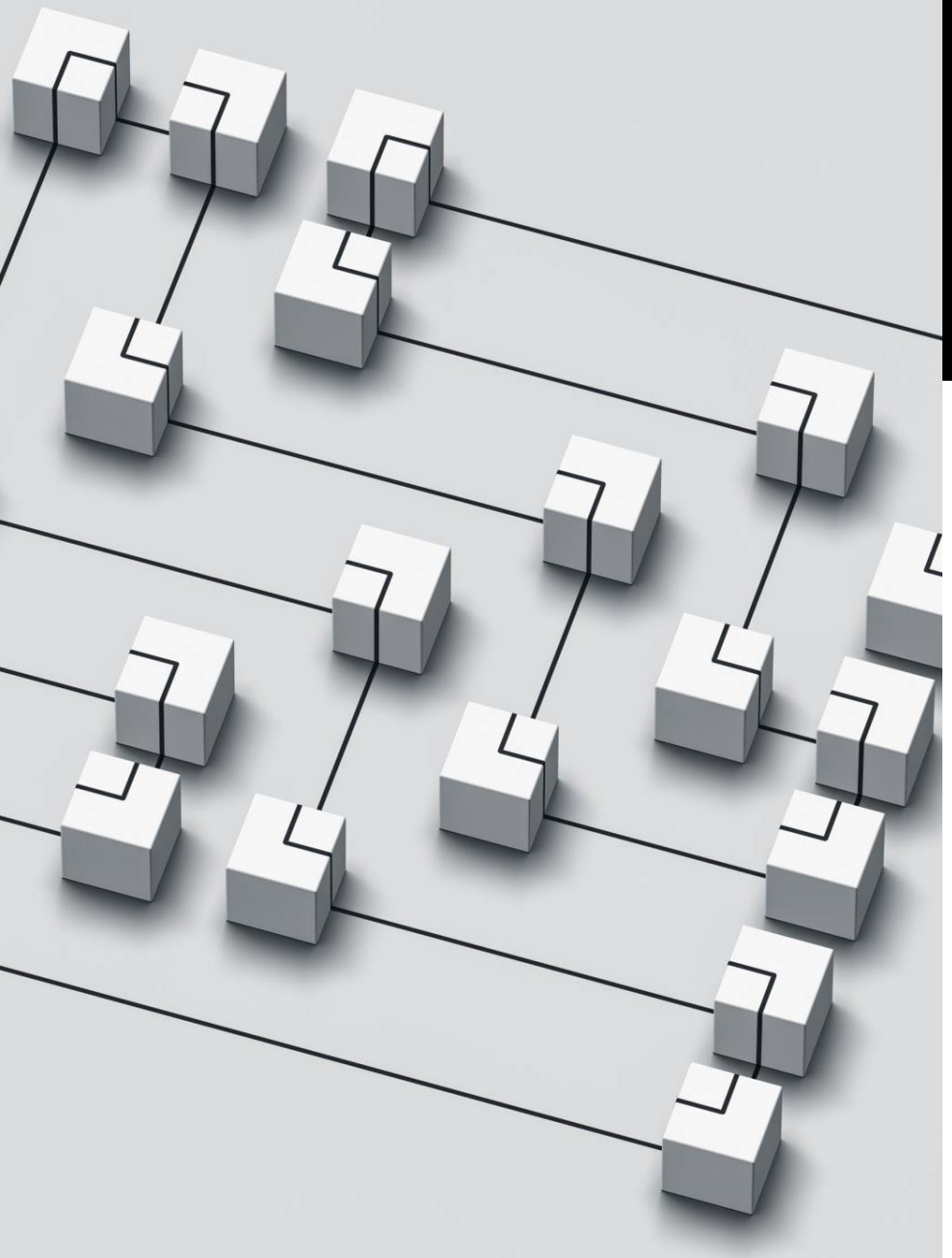
NON-FUNCTIONAL REQUIREMENTS

Lightweight, comfortable, and wearable glove design.

Long battery life and power efficiency.

Low maintenance with reliable operation.

Cost-effective production for affordability.

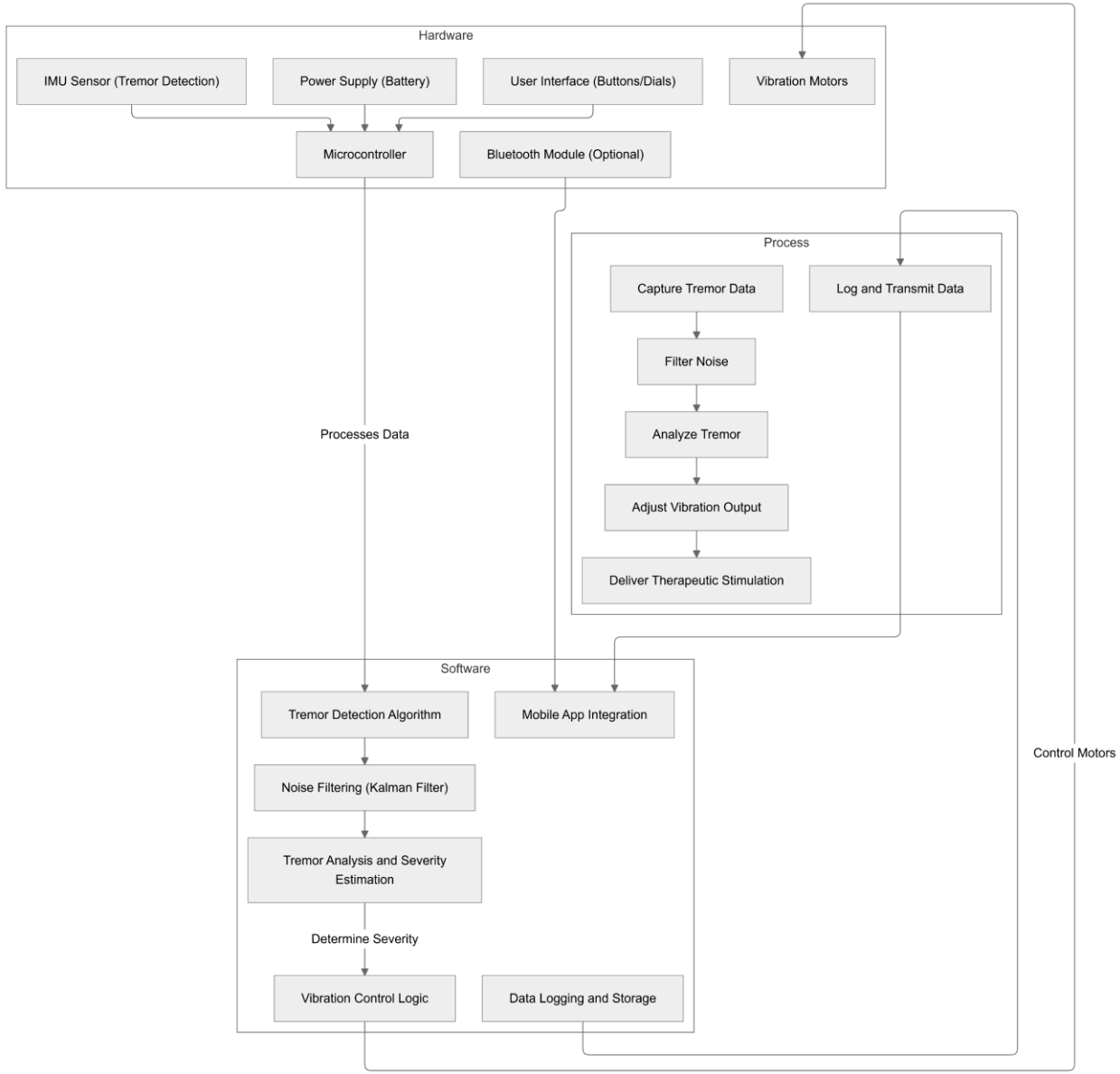


DIAGRAMS

- System Architecture
- Use Case Diagram
- Activity Diagram
- Class Diagram

SYSTEM ARCHITECTURE

The system combines hardware, processes and software to provide targeted vibratory stimulation to patients



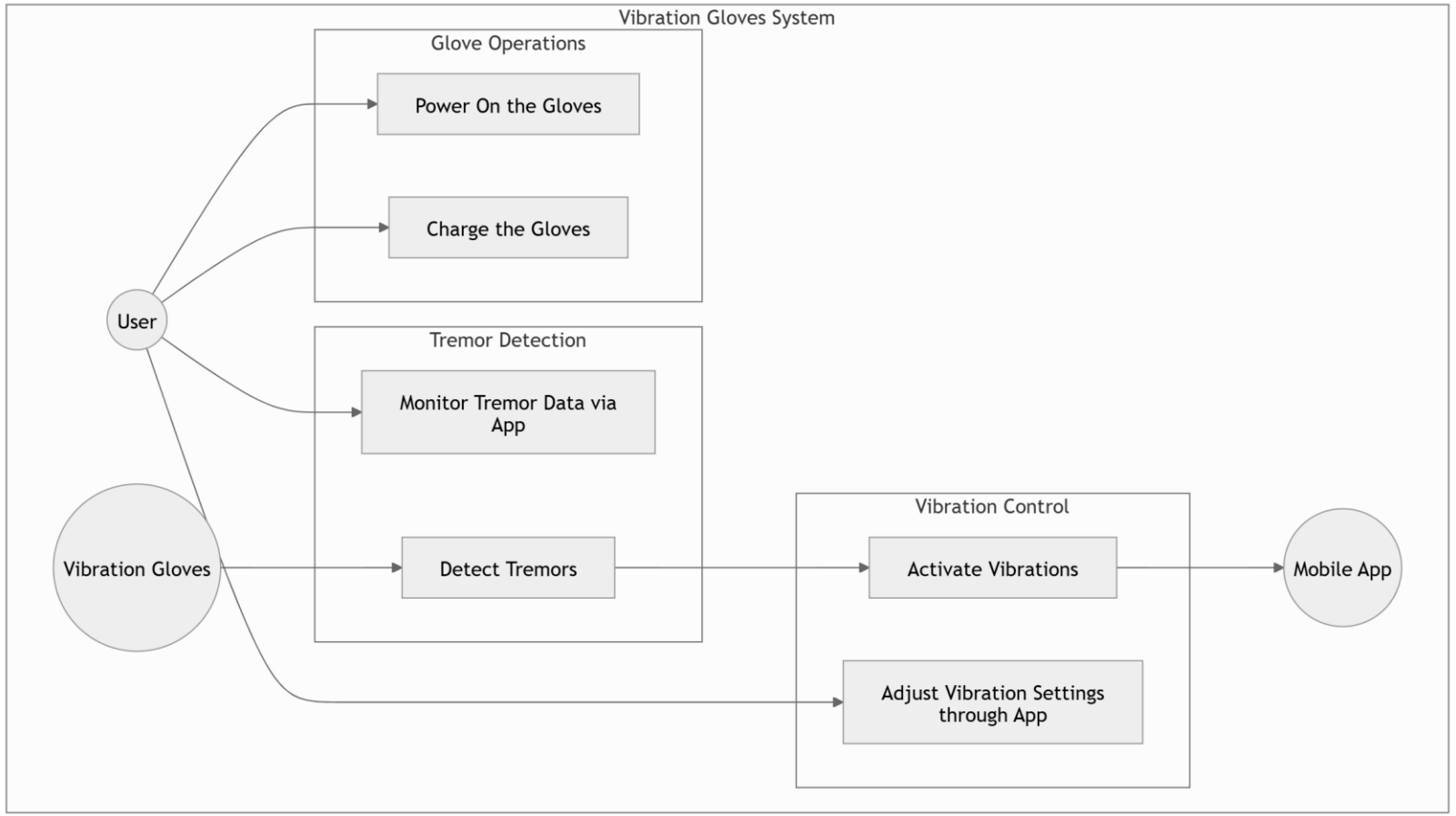
USE CASE DIAGRAM

Actors:

- **User:** Wears the gloves, adjusts settings, and monitors performance.
- **Mobile App:** Interfaces with the gloves for customization and feedback.

Use Cases:

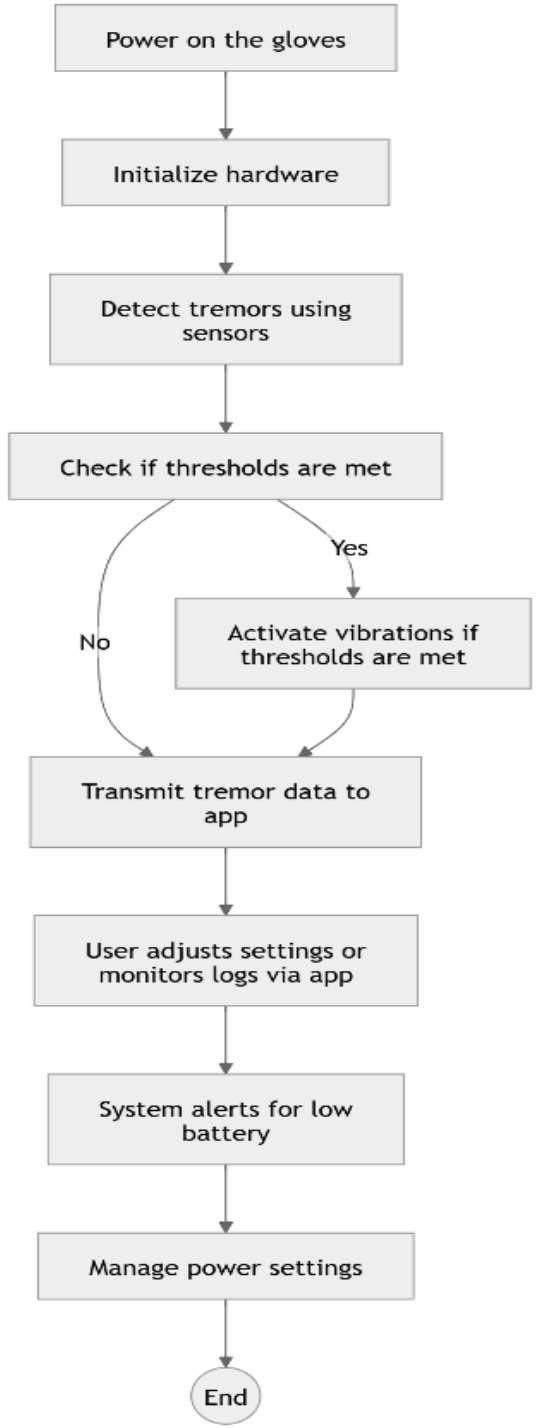
1. Detect tremors using the MPU6050 sensor.
2. Activate vibration motors for stimulation.
3. Adjust vibration settings via the app.
4. Monitor tremor data on the app.
5. Provide low-battery alerts



ACTIVITY DIAGRAM

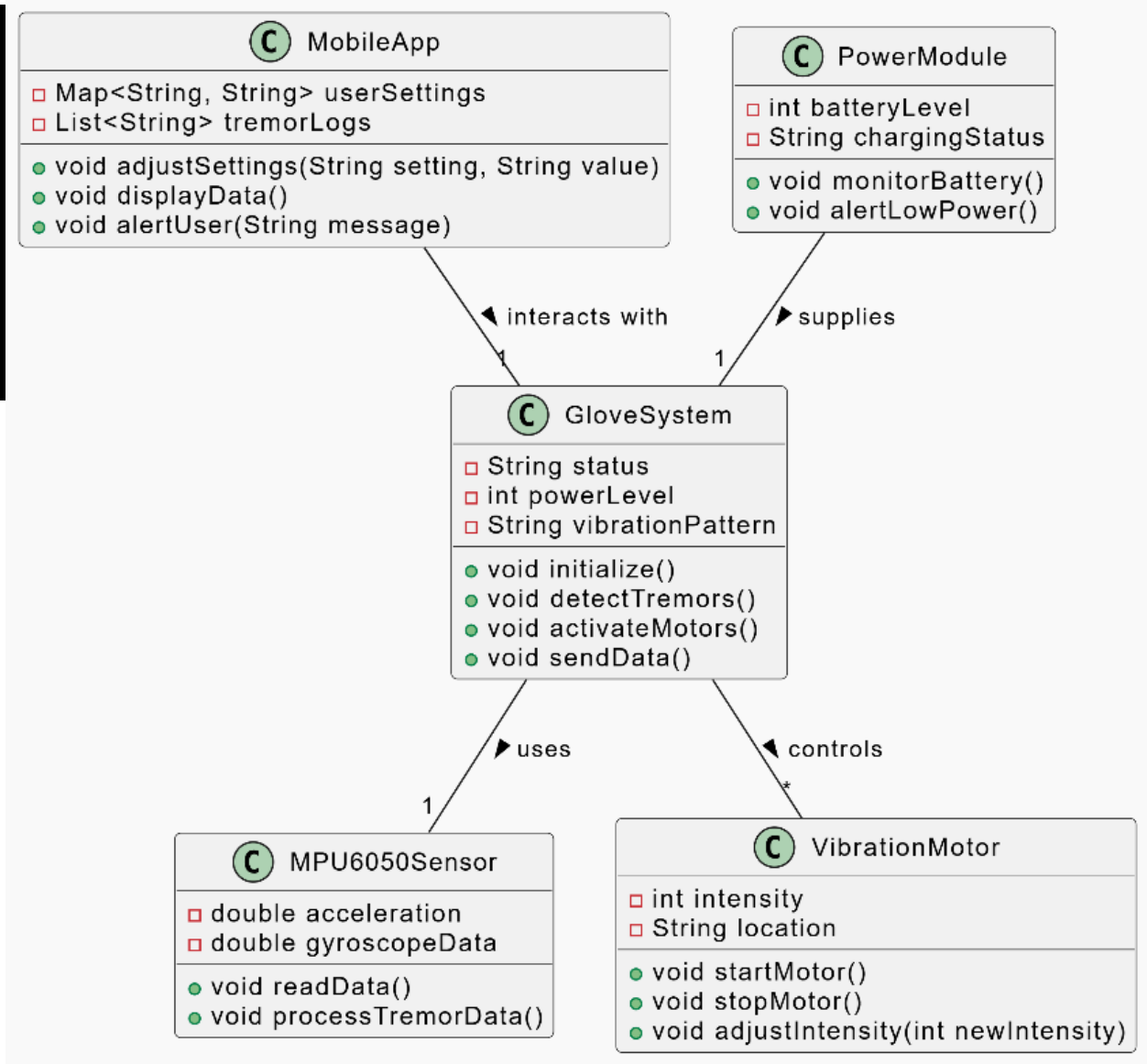
1. **Start:** User powers on the system.
2. **Initialize Sensors:** The MPU6050 and motors are initialized.
3. **Tremor Detection:** The MPU6050 monitors hand movements.
    - **If tremors are detected:** Activate motors.
    - **If no tremors are detected:** System continues monitoring.
4. **Data Transmission:** Send tremor data to the mobile app.
5. **User Interaction:** The user adjusts settings via the app.
6. **Battery Monitoring:** Notify the user if the battery is low.

End: System shuts down or recharges.



CLASS DIAGRAM

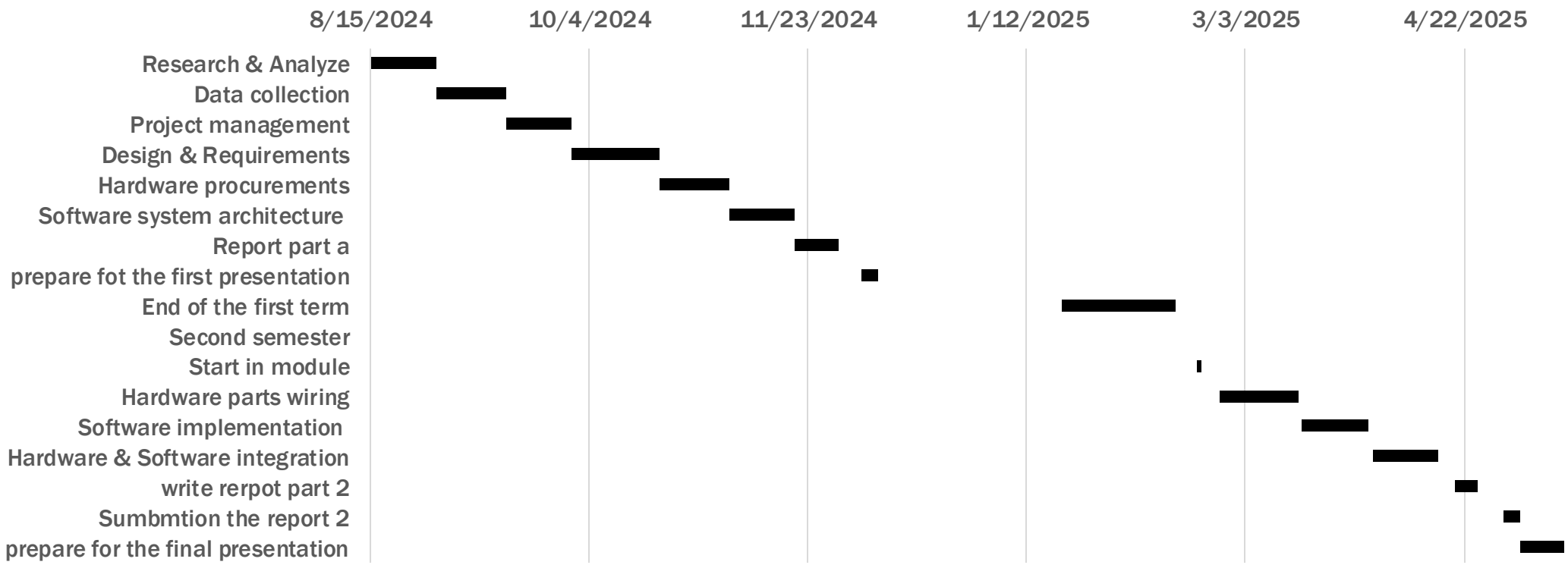
Shows the system architecture components (sensors, controller, motors, and app).



Task	Start Date	End Date	Duration/Day
Research & Analyze	15/08/24	30/08/24	15
Data collection	30/08/24	15/09/24	16
Project management	15/09/24	30/09/24	15
Design & Requirements	30/09/24	20/10/24	20
Hardware procurements	20/10/24	05/11/24	16
Software system architecture	05/11/24	20/11/24	15
Report part a	20/11/24	30/11/24	10
prepare for the first presentation	05/12/24	09/12/24	4
End of the first term	20/01/25	15/02/25	26
Second semester	15/02/25	15/02/25	0
Start in module	20/02/25	21/02/25	1
Hardware parts wiring	25/02/25	15/03/25	18
Software implementation	16/03/25	31/03/25	15
Hardware & Software integration	01/04/25	16/04/25	15
Write report part 2	20/04/25	25/04/25	5
Submit the report 2	01/05/25	05/05/25	4
Prepare for the final presentation	05/05/25	15/05/25	10

PROJECT PLAN

GANTT CHART


8/15/2024
10/4/2024
11/23/2024
1/12/2025
3/3/2025
4/22/2025
Research & Analyze
Data collection
Project management
Design & Requirements
Hardware procurements
Software system architecture
Report part a
prepare fot the first presentation
End of the first term
Second semester
Start in module
Hardware parts wiring
Software implementation
Hardware & Software integration
write rerpot part 2
Sumbmtion the report 2
prepare for the final presentation

REFERENCES

" This project was developed in collaboration with my partner, Clinical instructor. Asmaa Sabry Nagy Elwany, from the Department of Mental Health and Psychiatric Nursing at 6th October University. She provided the idea and medical insights for using vibrating gloves to enhance the quality of life for Parkinson's patients ".

- Stanford Medicine Magazine, Vibrations Can Parkinson's symptoms be stopped y, B Holly illustration Alyssa MacCormick, by Harry Campbell, on October 14, 2021.
- Chu C. and Patterson R., "Soft robotic devices for hand rehabilitation and assistance: A narrative review," J. NeuroEng. Rehabil. vol. 15, no. 1, p. 9, Dec. 2018.
- Polygerinos P., Wang , Galloway K., Wood R. and Walsh C. "Soft robotic glove for combined assistance and at home rehabilitation," Robot. Auto, Nov. 2015.
- Xie, (2020). "Gyroscopic Wearable Technologies for Tremor Suppression: Effectiveness and Challenges." Medical Devices Journal. Available via MDPI and similar scientific repositories discussing gyroscopic devices like GyroGlove.
- Kumar, (2019). "EMG-Based Control Systems in Wearable Devices: Accuracy and Calibration Challenges." Frontiers in Neurology. This study explores electromyographic systems for tremor detection with high accuracy but noted challenges for everyday use.
- Chen, (2022). "AI-Enhanced Wearables with Vibration-Damping Actuators: Advancements and Scalability Issues." Research discusses prototypes like the Emma Watch and Cala Trio that use innovative features to suppress tremors, focusing on their future potential and current limitations.
- Medically reviewed by Nancy Hammond, M.D. — Written by Sarah Vevers on December 22, 2023
- Zhang, S., Liu, Y., & Hu, W. (2018). "Intelligent Gloves for Tremor Suppression in Parkinson's Disease." Medical Engineering & Physics, 40, 15-22.
- Opri, E., Cernera, S., Molina, R., Eisinger, R. S., Okun, M. S., & Gunduz, A. (2019). " Parkinson's Disease Tremor Detection and Management Using Wearable Devices".


THANK YOU