

Instrumented Glove

Specifications and Project Plans

Overview:

This project aims to provide a fully functional glove that enables monitoring and improvement of patients with neurological problems that need hand rehabilitation. The glove is used to introduce gamification in the rehabilitation process as a motivation factor for neurological improvement.

General Specifications:

- Low Weight
- Final Product Representation with no loose wires.
- Easy access interface in casing for USB power supply and data
- Vents to avoid PCB/MCU overheat
- Glove Overall size and intended audience (adult right hand)
- Can be used reliably by people with no engineering background.
- Simple Desktop Application with interactive games and medical reports
- Control Computer peripherals (mouse movement and arrow keys)

Technical Specifications:

Mechanical Specifications:

- Maximum weight of glove: 200grams
- Electronic casing maximum footprint size: 60mm*50mm
- Overall glove maximum dimensions: 200mm*200mm*50mm
- Design should have routes for finger sensors to reach electronic casing
- Recommended Material: Cloth, Velcro Belts, 3D Printed Thin Plastic

Main Constraints:

- Glove can allow human hand normal motion with no aid or hindrance
 - Fingers can bend to reach thumb finger
 - Hand can squeeze objects with thumb + any other number of fingers
 - Hand Palm can rotate (left/right and forward/backward)
- USB Cable is not getting tangled or limit arm motion (1meter cable)
- Design should have CG near wrist joint to enable extended time of usage

Electrical Specifications:

- Maximum USB Power: 500mW
- PCB should have IMU unit and Arduino Microcontroller pin interface + DIO pins
- PCB should agree with mechanical specifications of casing
- 4 Force sensors are used at the tips of the glove fingers to measure holding force and thumb interaction
- 5 Flex sensors are used to measure the angle of each finger
- IMU unit is used for hand orientation measure and acceleration

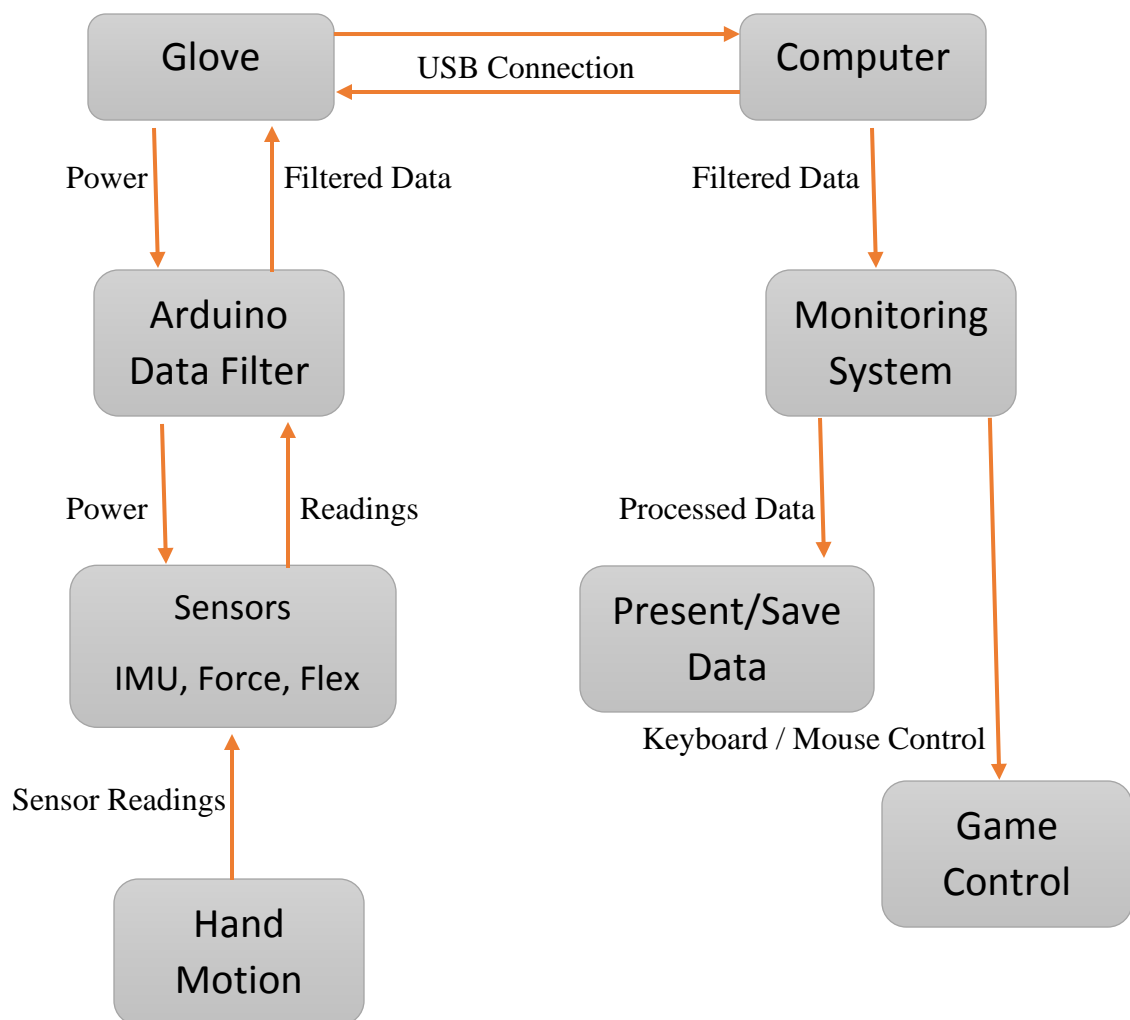
Main Constraints:

- All wires are soldered for reliability
- Controller: Arduino mini (Small size, easy to fix, no. of i/o pins sufficient to sensors)
- Sensor readings are reliable (filtered)

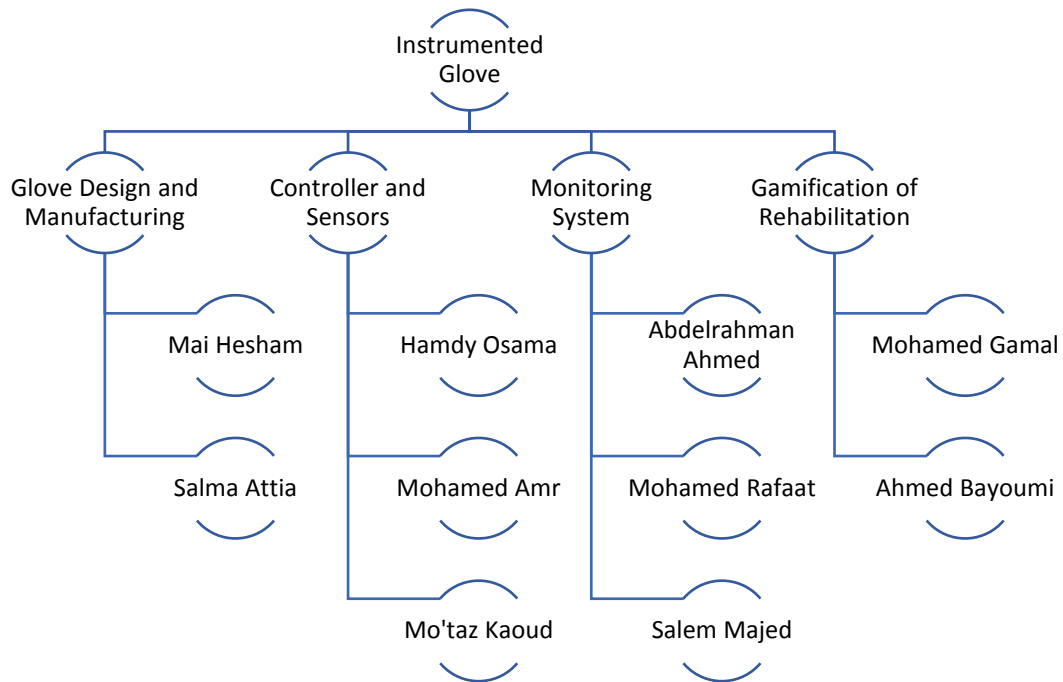
Software Specifications:

- Desktop Application that shows real time readings of sensors (graphs)
- The application saves a file with the patient data and readings for tracking improvement
- The application has a game mode with suitable games to motivate patient
- Recommended Application: MATLAB UI Designer
- Monitoring System on glove data

Functional Structure:



Project Layout and Responsibilities:



- **Glove Design and Manufacturing:**

- 1- Responsible for designing the glove to suit the requirements.
- 2- Responsible for technical form of the glove and manufacturing.
- 3 - Assemble the sensor inside the glove and make a test for the glove.

- **Sensor& microcontroller:**

- 1- Responsible for determining the appropriate sensors and controller.
- 2 - Writing the drivers for the sensors and filtering the data.
- 3 -Integrate All subsystems (Glove + Computer).

- **monitor system:**

- 1- Responsible for writing the application for analyzing and displaying Glove data.
- 2 - Writing the code for controlling the games.
- 3 - Patient database with all processed data graphs to keep track of improvement.

- **Games:**

- 1- Choose the appropriate games.
- 2 - Games development.
- 3 -Integrate All subsystems (Glove + Computer).

List of Components:

Instrumented Glove Requirements				
Requirement Name	Price per piece L.E	Quantity	Link	Comment
FSR Sensor	185	4	https://ram-e-shop.com/product/sf9375/	
Flex sensor 56mm	225	2	https://ram-e-shop.com/product/sf10264/	
Flex Sensor 114mm	375	2	https://ram-e-shop.com/product/sf8606/	
IMU MPU 6050	95	1	https://ram-e-shop.com/product/kit-imu-mpu6050-original/	
Arduino Pro Mini	85	1	https://ram-e-shop.com/product/arduino-mini-pro/	Suggestion
USB Cable (1Meter)	25	1	https://ram-e-shop.com/product/usb-cable-mini/	