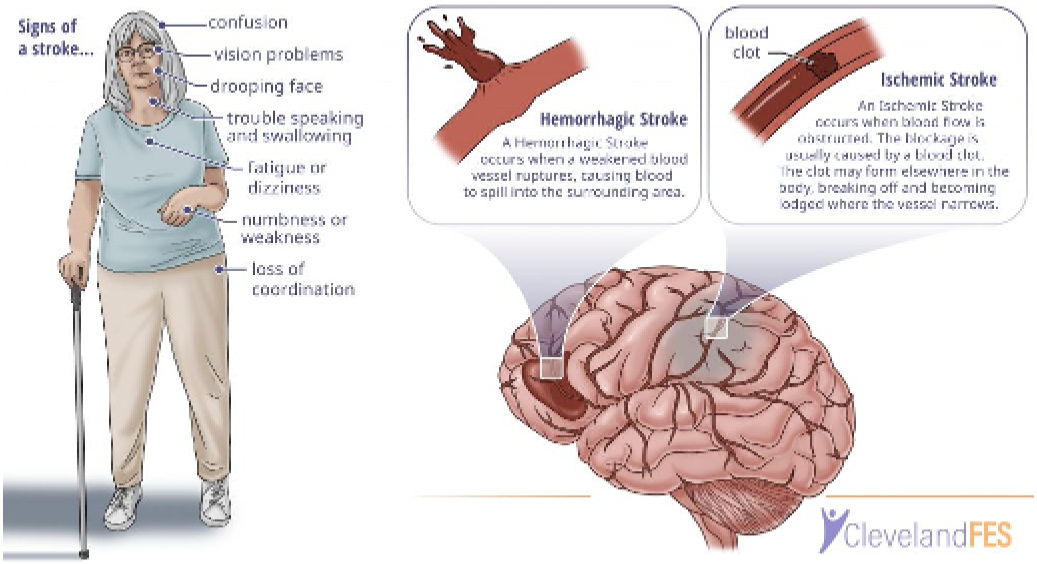
Group 14 Smart Robot

Motivation

1. To help people with disabilities or injuries gain the ability to perform everyday tasks that require hand movements.


Signs of a stroke...
confusion
vision problems
drooping face
trouble speaking and swallowing
fatigue or dizziness
numbness or weakness
loss of coordination
Hemorrhagic Stroke
A Hemorrhagic Stroke occurs when a weakened blood vessel ruptures, causing blood to spill into the surrounding area.
blood clot
Ischemic Stroke
An Ischemic Stroke occurs when blood flow is obstructed. The blockage is usually caused by a blood clot. The clot may form elsewhere in the body, breaking off and becoming lodged where the vessel narrows.
ClevelandFES

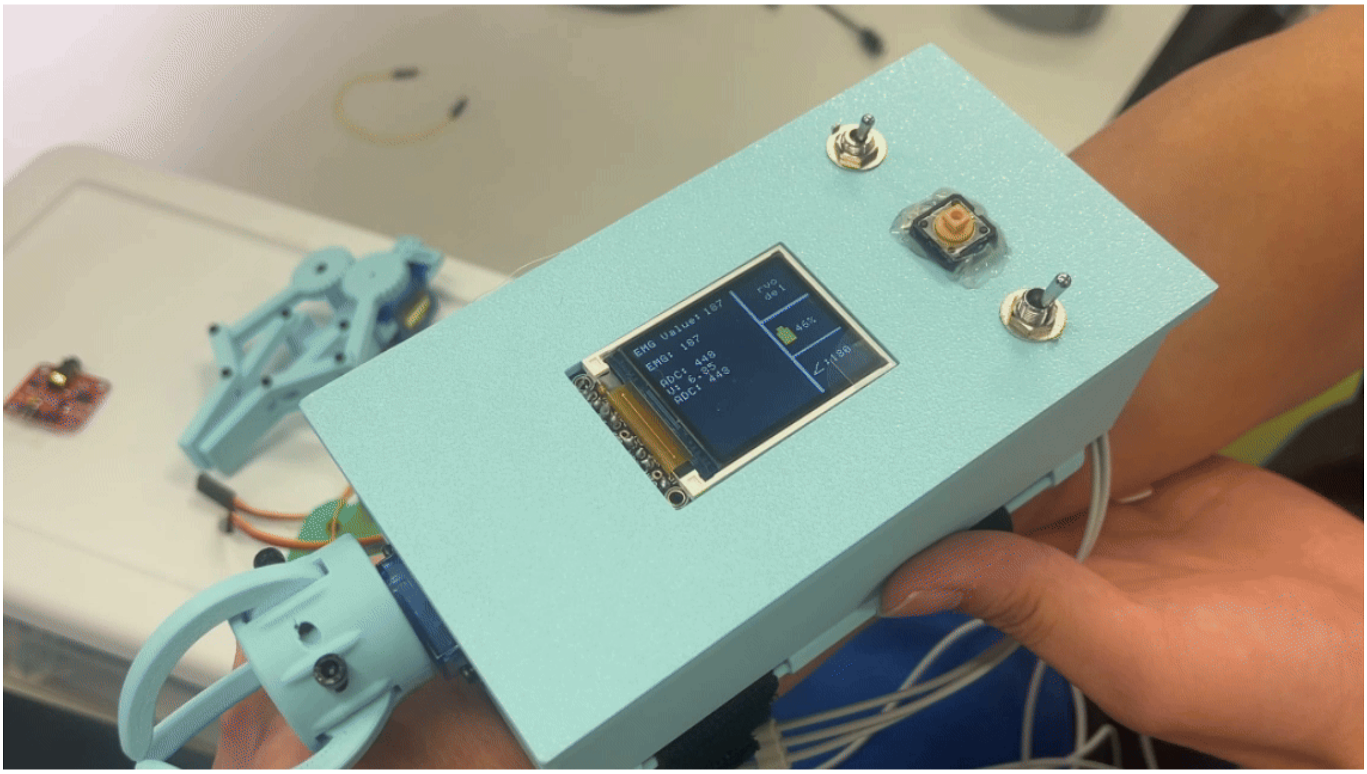
2.To show the human-machine interaction like the Spider-Man

Video demonstration

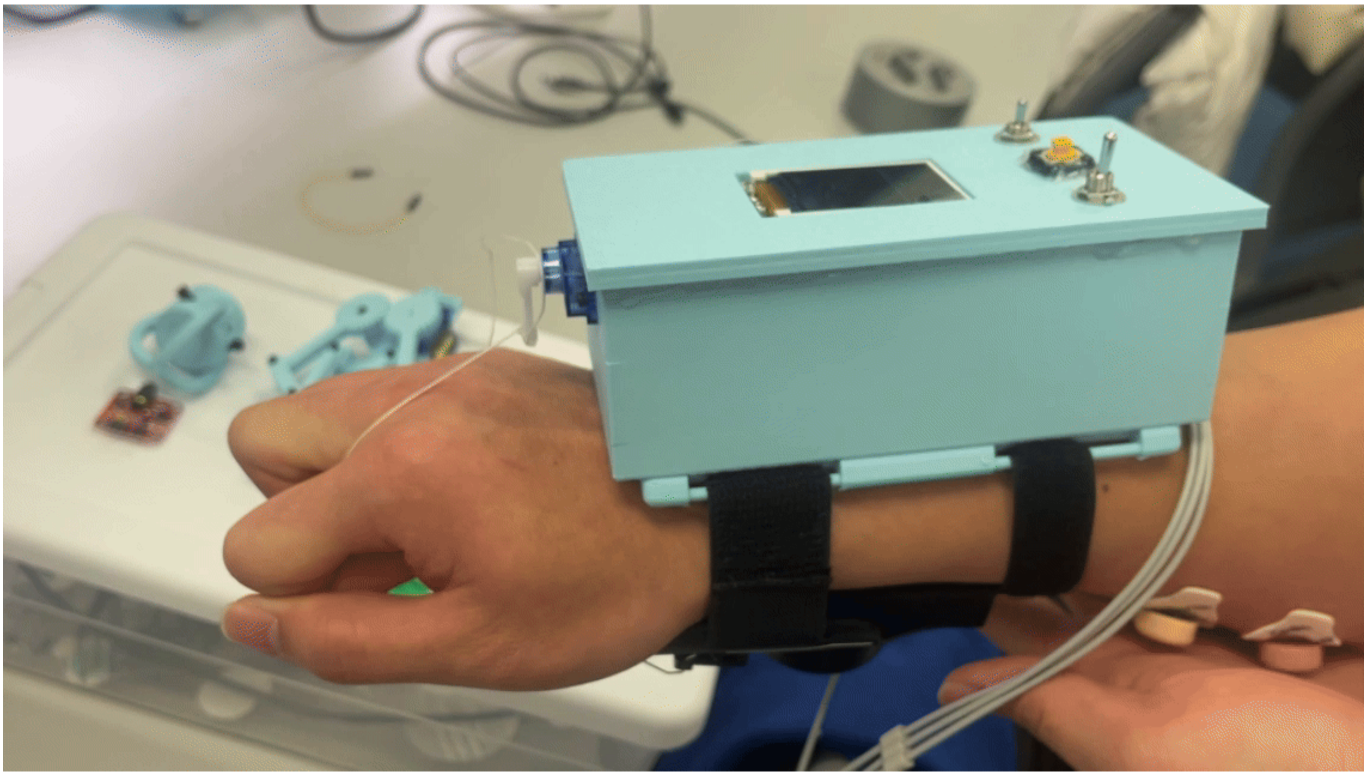
Video

GIF demonstration

Gripper part

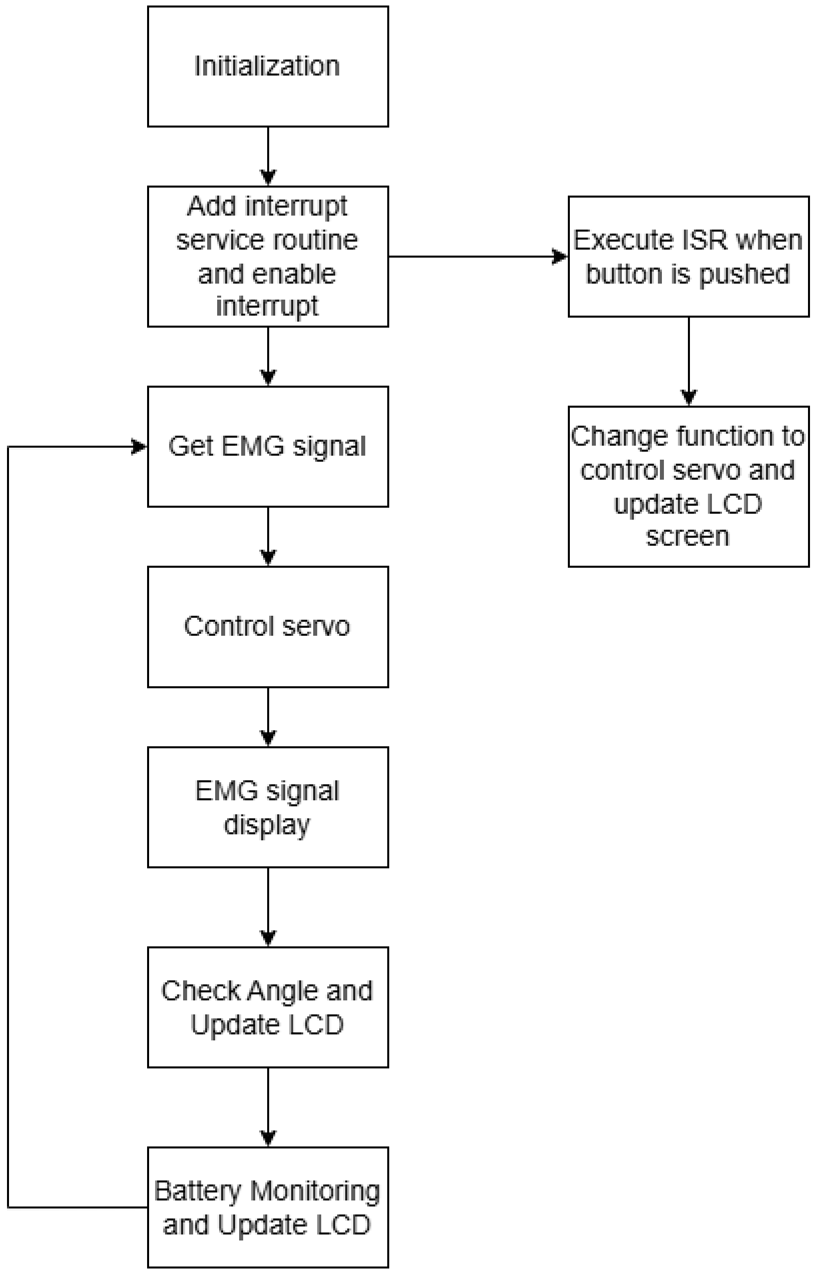


Spider shooter

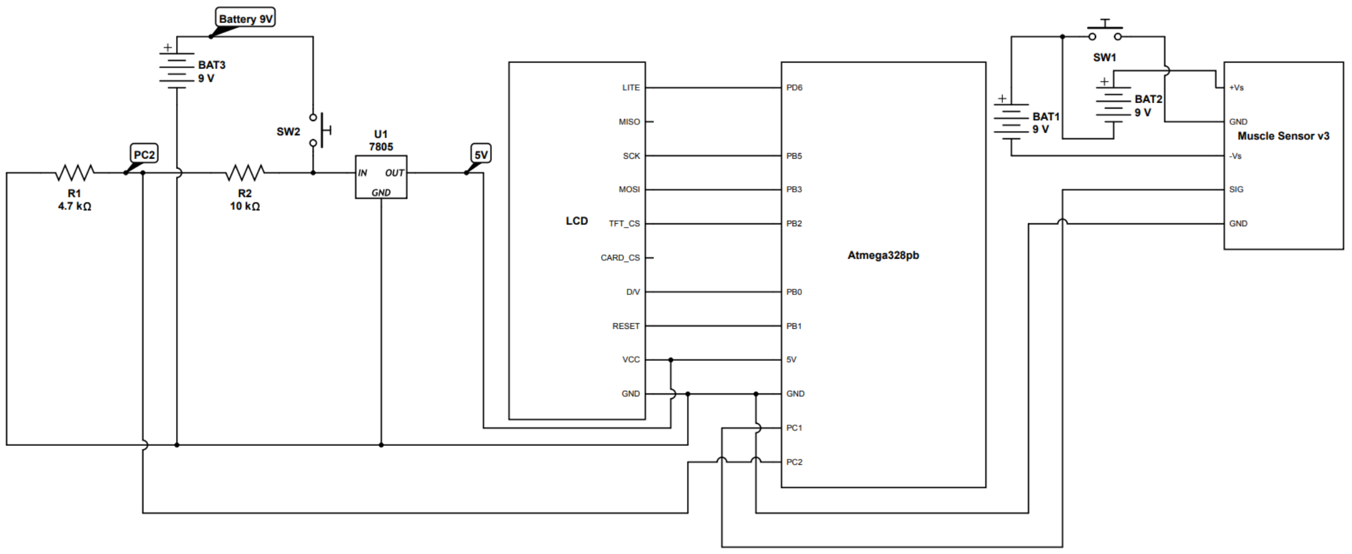


Images demonstration

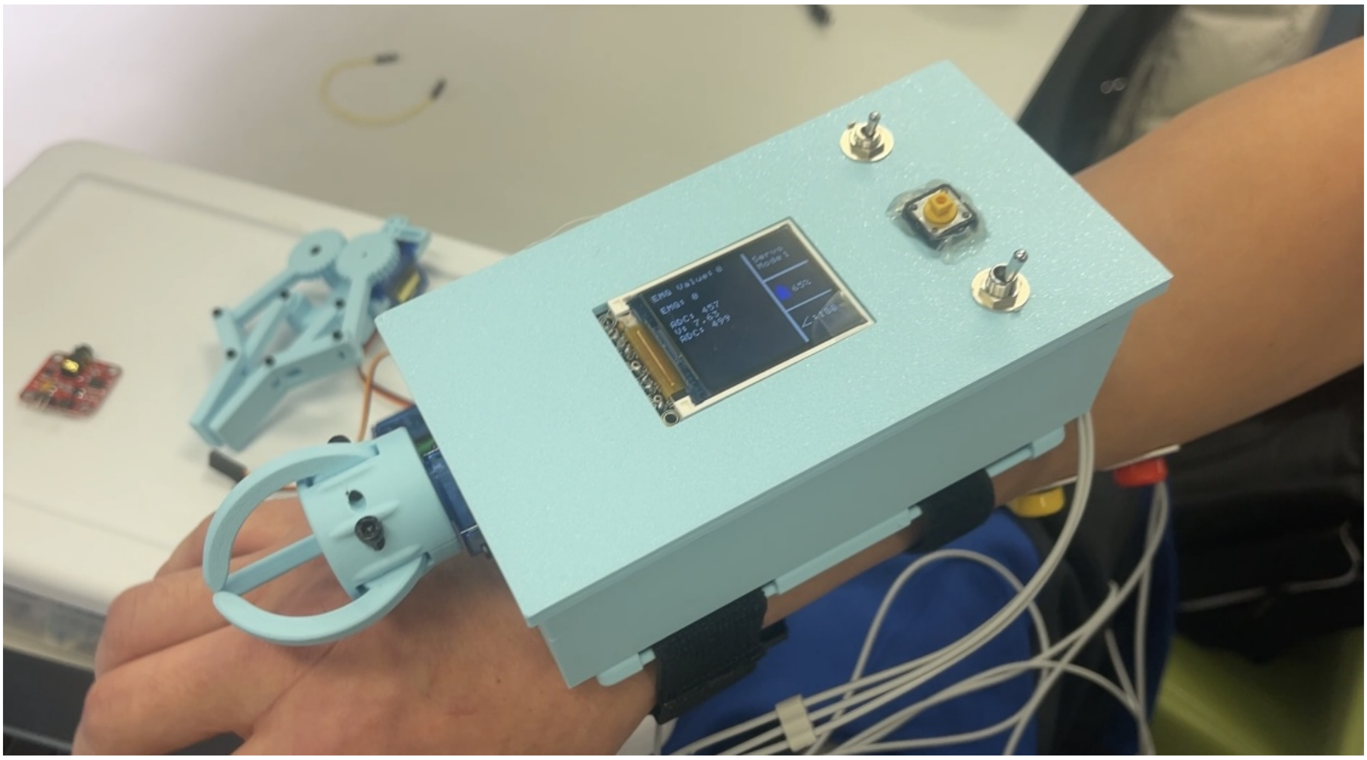
firmware_diagram


Initialization
Add interrupt service routine and enable interrupt
Execute ISR when button is pushed
Change function to control servo and update LCD screen
Get EMG signal
Control servo
EMG signal display
Check Angle and Update LCD
Battery Monitoring and Update LCD

Circuit


Battery 9V
BAT3
9 V
SW2
U1
7805
IN
OUT
GND
5V
PC2
R1
4.7 kΩ
R2
10 kΩ
LCD
LITE
MISO
SCK
MOSI
TFT_CS
CARD_CS
D/V
RESET
VCC
GND
Atmega328pb
PD6
PB5
PB3
PB2
PB0
PB1
5V
GND
PC1
PC2
SW1
BAT1
9 V
BAT2
9 V
Muscle Sensor v3
+Vs
GND
-Vs
SIG
GND

Project



SRS Validation

SRS 1 was achieved? The software detects EMG signals between 0 and 1024 by ADC, filters noise under, and classifies signal strength. This requirement was tested by displaying the data corrected by the EMG signals on the serial terminal. The values corrected were between 0 and 1024 by ADC.??? The data corrected is shown below as the proof of the work.

SRS 02, will measure time to test We measured the time between detecting an EMG signal and claw being opened and closed by displaying the time on the serial monitor. We tested 50 times and the average time is , max is , and min is All the data collected is shown below.

SRS 03 was not achieved because we did not include fail-safe controls to prevent accidental or unsafe activation of the claw. However, there is a button that can be used to stop the control of servo manually. SRS 04 was achieved and the system includes battery health calculation by ADC to show the percentage of the current battery on the LCD screen. We tested this requirement by showing battery percentage on the screen and compared it with the measured value by the multimeter. The image of the LCD screen is shown below as the proof of the work.

SRS 05 was achieved and the software outputs the PWM to control the servo degree. The servo can move the claw based on the input of the EMG signal. The screenshot of the code controlling the servo is shown below as the proof of the work and the video shows that the servo is controlled by the PWM can be found in our demo video. SRS 06 will measure time We measured the response time to handle the interrupt by the button by printing on the serial. We tested 50 times and data is shown below.

SRS 07 will measure time The time to update the LCD screen was measured and displayed on the serial monitor. Data is corrected 50 times and shown below.

SRS 08 was achieved and the LCD screen displays the data including EMG signal, battery health, and claw angle. The image of the LCD screen displaying the data is shown below.

	Points	Grade
STU1	50	F
STU2	70	C
STU3	90	A

HRS Validation

HRS 01 Achieved. ATmega328PB microcontroller operating at 16MHz is used for this project. The image is shown below as proof. HRS 02 Myoware Muscle Sensor is used, will have to measure voltage

HRS 03 Achieved. A 1.8" Color TFT LCD (ST7735R controller) to display data for users. The image is shown below.

HRS 04 Achieved. A servo motor with 270-degree rotation capability for mechanical actuation controlled by PWM is used for our project. Here is the link for the datasheet of the servo.

HRS 05 A 9V battery is used for power supply and converted to 5 volts by using a voltage regulator. We measured the voltage supplied to the ATmega328PB by using a multimeter. Will have to check voltage

	Points	Grade
STU1	50	F
STU2	70	C
STU3	90	A

Conclusion

In this project, we were able to design a smart robot system that demonstrated key principles of embedded systems: real-time control, efficient power management, and robust sensor integration. With the use of advanced microcontrollers and carefully chosen components, we were able to find a balance between performance and functionality. The robot performed its designed tasks efficiently, showing our understanding of embedded software design, hardware interfacing, and system optimization.

What Would You Have Done Differently?

Reflecting on the project, there are several aspects we would approach differently to further enhance the system:

Hardware Optimization:

We would have chosen more modular and scalable hardware components to allow for easier integration and future upgrades. Exploring alternative power sources or optimizing power consumption would have extended operational time.

Improved Testing and Debugging:

Incorporating more systematic testing at every development stage would have reduced debugging time. Adding diagnostic tools or logging mechanisms would have provided clearer insights into system behavior under different conditions.

Algorithm Refinement:

Implementing more advanced control algorithms, such as predictive or adaptive controls, could have improved the robot's efficiency and responsiveness. Exploring machine learning techniques could have added an element of autonomy and adaptability.