LIMB

Leveraging Intelligent Mechatronics for Bionics

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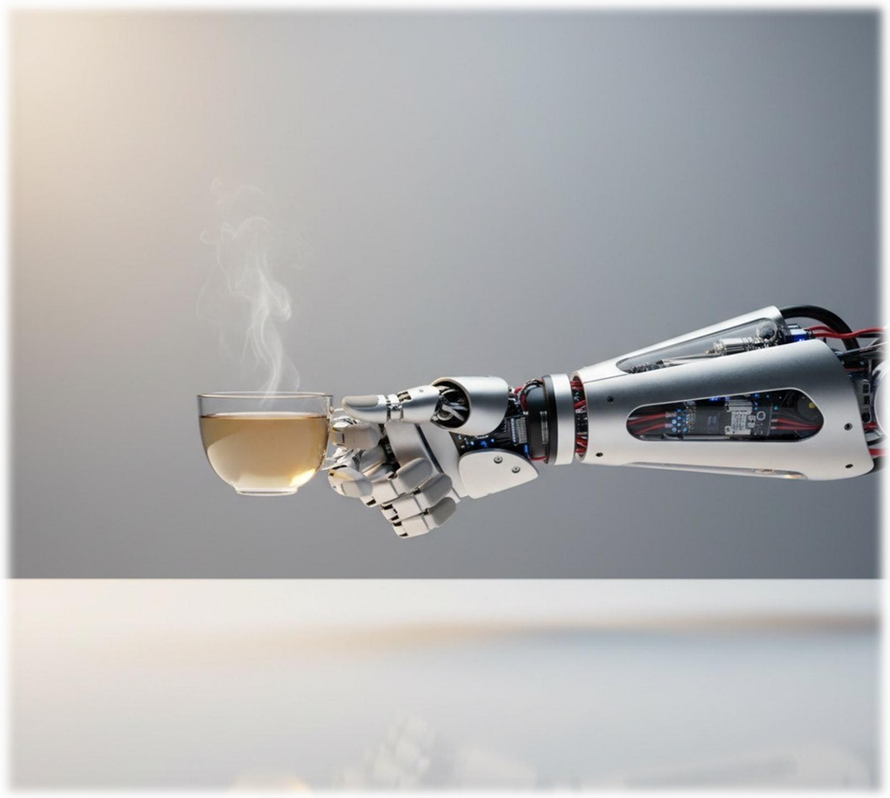
Purpose and Vision

The goal of this project is to produce a bionic arm that bridges the gap between human intent and robotic precision to aid stroke patients in their rehabilitation journey.

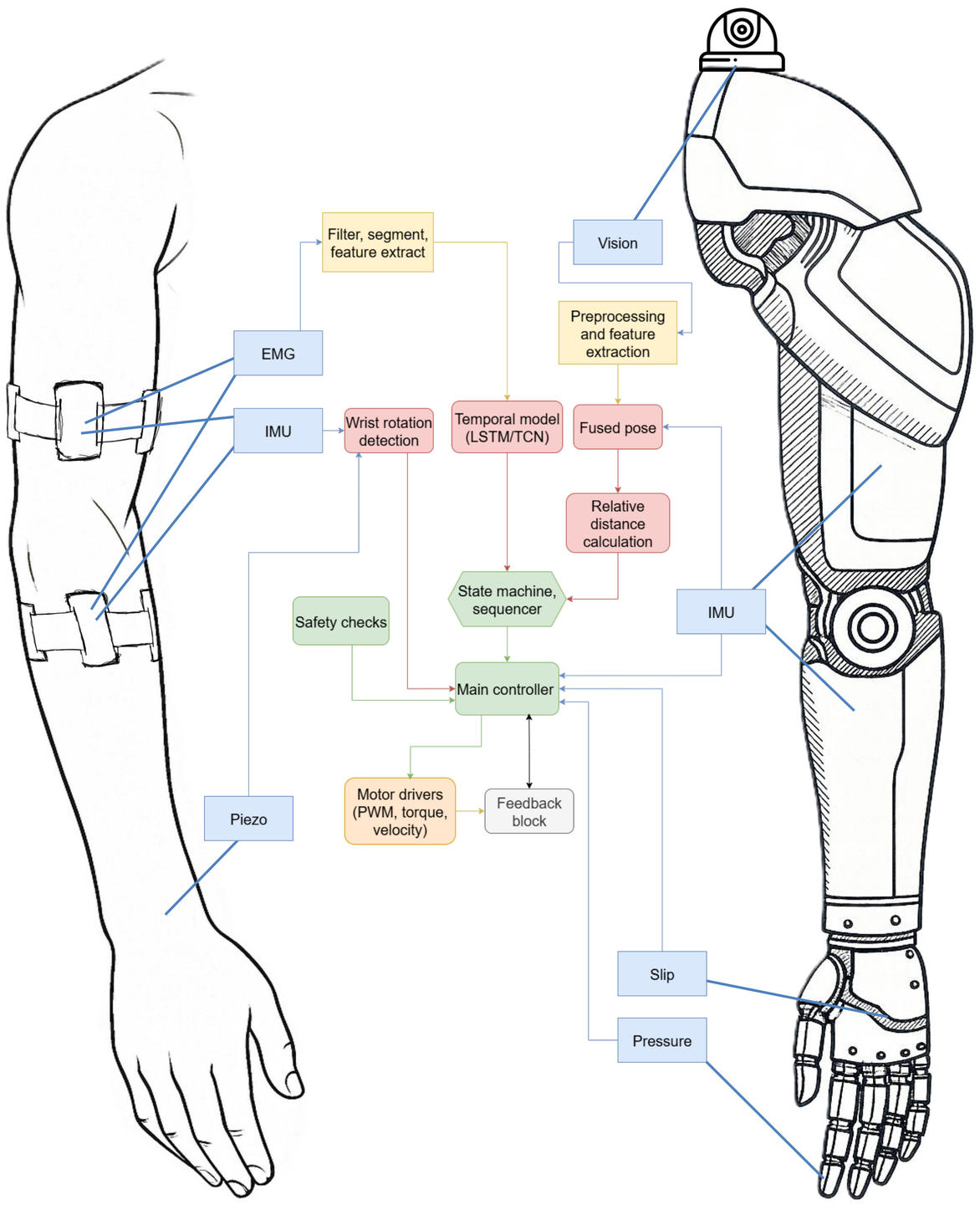
Key objectives:

- High dexterity and human-like control
- Adaptive grip and sensory feedback
- Lightweight and modular design
- Integration with neural interface systems

By incorporating advanced mechatronics, bio-signal interfaces, and adaptive control algorithms, we aim to develop a standalone robotic arm that moves and responds with human-like precision.



System Overview

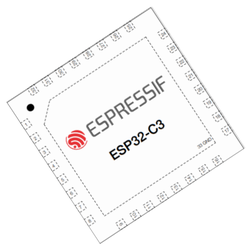


Hardware

Nvidia Jetson AGX Orin

The main processing unit for high-level AI control, adaptive response algorithms and sensor fusion.

ESP32-C3



Microcontroller handling local motor control, real-time sensor data acquisition and wireless communication.

OAK-D Lite

The camera module will accurately assess the orientation of the Robotic arm and its distance to an object.

Software

- **Primary Goal:** To interpret a user's intention and provide assistive control of a bionic arm for completing simple tasks, such as gripping and moving a cup.
- **Multi-Modal Perception:** A perception module fuses data from artificial vision, EMG and other sensors to decode the user's real-time intent.
- **State-Based Control:** The arm's behavior is governed by a state machine that transitions through distinct operational phases, such as **Idle**, **Reaching**, and **Gripping**.
- **Seamless Integration:** The user's decoded EMG signals combined with other sensory input directly trigger state transitions, allowing the arm to mirror the user's intent.

*Images are generated by AI and are meant for visualization purposes only.