

ECD Spring Final Appraisal Inputs: ECDME305: Robotic Arm for NES Power Glove

Student Name: Ragul Ganesh Anitha Palanivel

Faculty Advisor: Prof.Lee Jaeho

Student Department: Computer Engineering(CoE)

Role in the Project: Programming Lead

Self-Appraisal

Role & Responsibilities:

As the Programming Lead, I was primarily in charge of the servo control codebase, focusing on ensuring reliable and precise motor operation. I also handled the testing phases for each servo to verify alignment with the mechanical design requirements, along with the electrical components of the project.

Technical Contributions:

- Developed and debugged servo control algorithms to achieve smooth, accurate movement in response to control Glove inputs.
- Completed the design, fabrication, and testing of a custom PCB, which consolidated the wiring and significantly improved both durability and system efficiency. The PCB functioned as intended, passing all tests under integrated conditions.
- Verified full system functionality by integrating and testing all subsystems together, ensuring seamless interaction between hardware and software components.
- Wrote and refined the integration code to unify the mechanical design with electrical control logic, enabling synchronized operation between the glove inputs and robotic arm movements.
- Actively supported system integration across multiple team responsibilities, helping to align the mechanical, electrical, and control systems.
- Ensured stable and reliable power delivery by accurately calculating voltage and current requirements, selecting components to eliminate delay, prevent servo wobble, and ensure consistent performance.

Reflection and Lessons Learned:

Working on this senior design project has been a highly rewarding experience that pushed me to grow both technically and as a collaborator. I gained valuable hands-on experience in integrating hardware and software systems, especially through tasks like servo programming, PCB design, and system-level troubleshooting. Designing a PCB from scratch, debugging servo responses, and aligning hardware with glove inputs challenged me to apply both theoretical and practical skills in real-time.

Beyond technical growth, I developed stronger project planning, communication, and documentation skills—balancing coding with hardware tasks and ensuring progress updates were shared clearly with the team. I also learned the importance of interdisciplinary collaboration, as working with mechanical engineering teammates taught me how to align

control logic with physical design limitations. Overall, the project solidified my interest in embedded systems and system integration and prepared me for future roles in hardware development.

Ongoing Tasks:

I am currently focused on writing the final Senior Project Report, which involves compiling our design process, technical challenges, implementation steps, and testing results into a clear and comprehensive document. This task is helping me strengthen my technical writing and project documentation skills while ensuring the work we've accomplished is communicated professionally and effectively.

Performance Reflection:

I have remained consistent and focused in delivering technical milestones on time. My efforts in testing and debugging directly improved the servo's responsiveness and the PCB design with the appropriate circuit. I balanced both development and documentation work, helping the team stay organized and on track for submissions.

Team Engagement:

I regularly coordinate with teammates to resolve technical roadblocks, especially related to servo tuning, wiring errors, and the circuit for the PCB. I strive to maintain a collaborative and supportive environment by actively sharing knowledge and providing solutions when challenges arise.

Team Member Appraisals

Maxine Kruger (Mechanical Engineering)

Role: Team Lead

Key Contributions: Designed and fabricated the forearm CAD assembly, managed 3D printing, and embedded servos with precise alignment. Successfully integrated components despite issues with servo fit and cover design.

Collaboration: Maxine demonstrates strong leadership and organizational skills, maintaining project timelines and delegating responsibilities effectively.

Nicholas Marzan (Mechanical Engineering)

Role: Financial Lead

Key Contributions: Developed CAD models for the fingers, managed 3D printing and assembly, and handled budgeting, sourcing, and purchasing. Also took charge of all documentation and ordering for purchases.

Performance: Nicholas maintained detailed financial tracking while contributing to hardware builds. His dual focus on budget management and mechanical work was crucial.

Collaboration: Always dependable, Nicholas contributed significantly to documentation and team planning sessions, ensuring we met all deliverables.

John Milham (Mechanical Engineering)

Role: Communication Lead

Key Contributions: Designed and assembled the shoulder joint using CAD and 3D printing techniques, and provided additional support in wiring and soldering tasks.

Performance: John delivered a robust and functional shoulder structure, meeting both aesthetic and mechanical requirements. He was the most helpful during integration and testing, actively supporting all stages of system assembly.

Collaboration: John was a go-to team member for support during crunch times. His flexibility and teamwork made him essential in addressing technical and scheduling challenges.

Faculty advisor's (Professor Jaeho Lee) feedback:

He demonstrated outstanding initiative and technical skill in leading the development of motion control systems and embedded electronics for the project. His work on custom hardware and software integration significantly enhanced the system's real-time responsiveness and reliability. He was instrumental in aligning the structural, electrical, and computational elements to ensure smooth and cohesive operation. Alongside these efforts, he took charge of maintaining thorough and well-organized design documentation, reflecting strong communication and attention to detail. His proactive troubleshooting and readiness to support teammates helped create a collaborative environment that encouraged steady progress throughout the project.