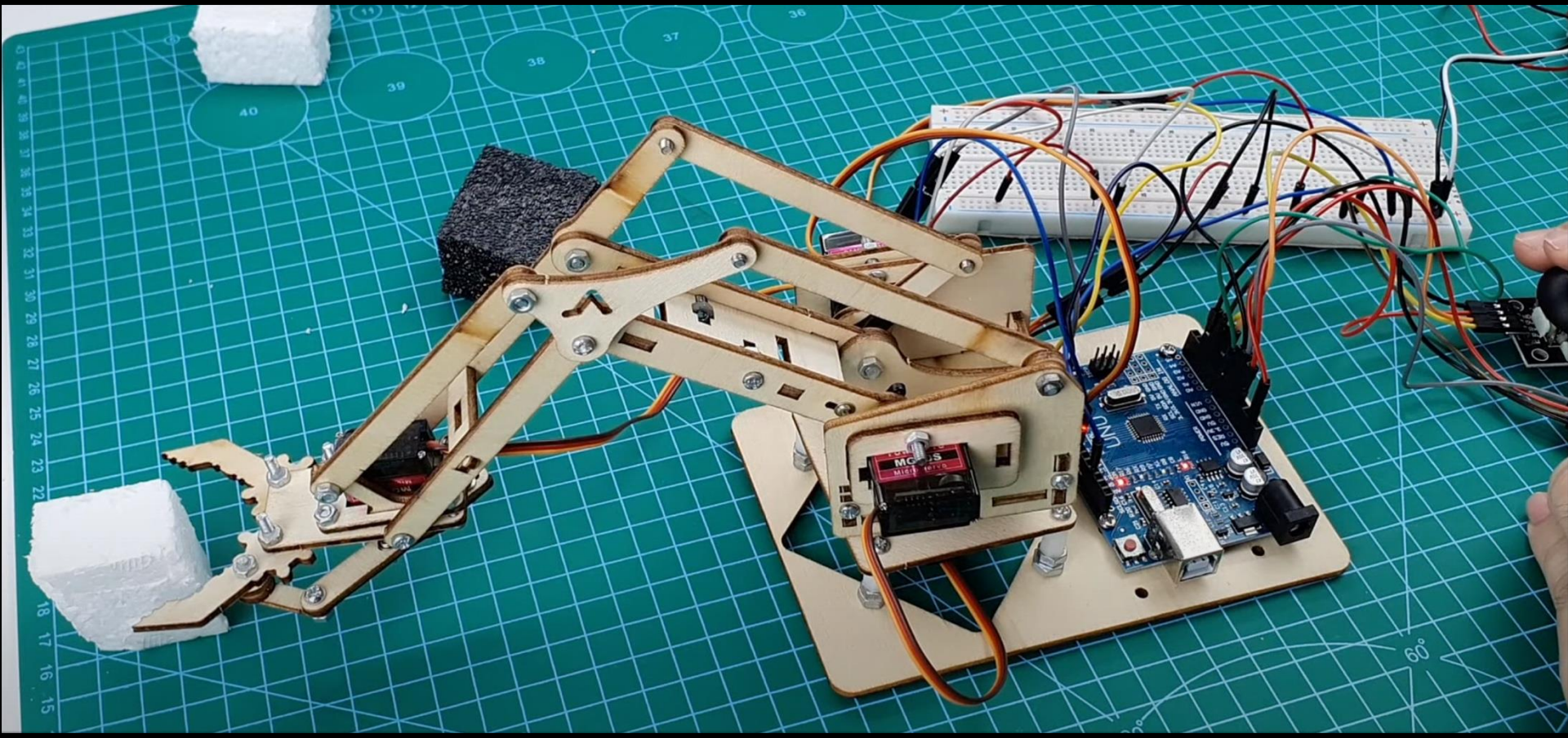


Low-cost Gesture-Controlled Arm for Assembly and Education

Aidan Henderson

Introduction

- The arm is going to be using:
  - An Arduino microcontroller (Arduino UNO R3)
  - A joystick module
  - Servo motors
- Integrating visual feedback using RGB LEDs
- Other components include
  - Breadboard
  - Jumper Wires (M-M, M-F)
  - RGB LED
  - Power Supply

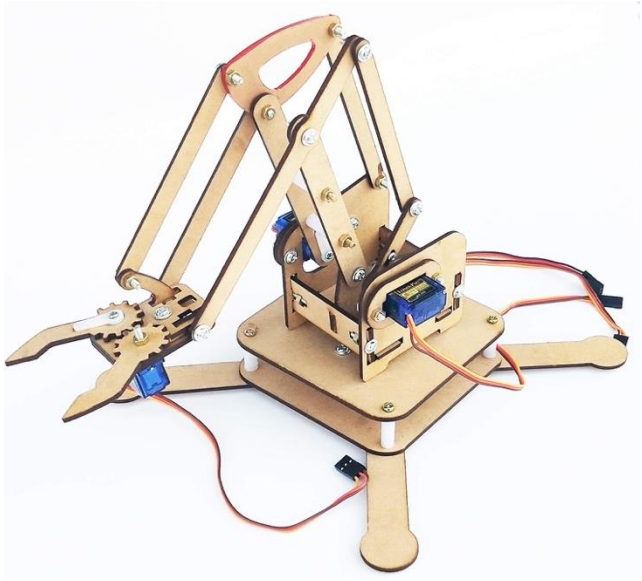
Challenge: Manual Assembly Limitations

- Reliance on manual pick-and-place leads to high labor costs (≈25% of operational expenses).
- Average cycle time of 15 seconds per pick-and-place, limiting output to ~240 units/hour.
- Human error rate could affect repetitive tasks, causing quality issues

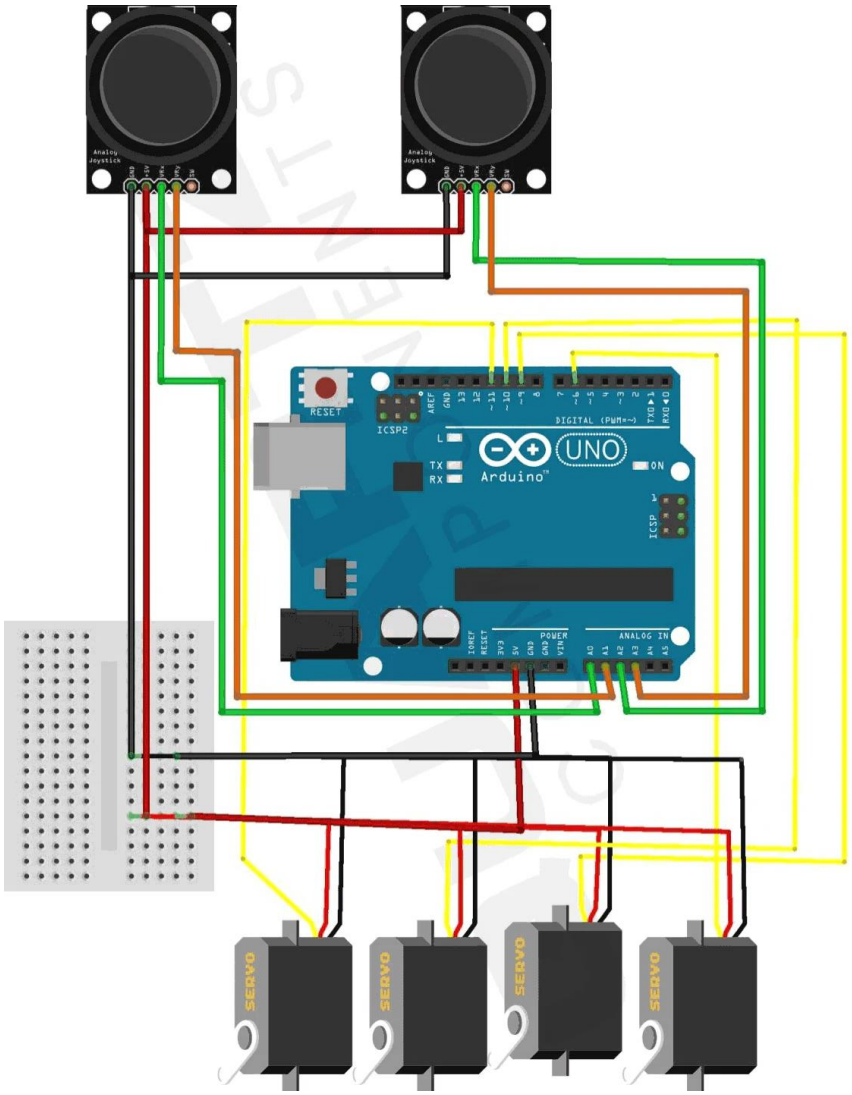
Systems Overview

- Joystick module outputs analog signals in the X and Y axes
  - Signals are read via Arduino's analog input and mapped to servo angle ranges

- Each servo representing a joint in the robotic arm



Circuit Diagram



Timeline & Milestones

- June 12–14 Hardware assembly and wiring
- June 15–17 Initial control logic development
- June 18–20 Servo tuning and gesture response mapping
- June 25–26 Testing, documentation, and final adjustments

Use Cases & Potential Applications

Industrial Automation

- Efficient pick-and-place tasks in manufacturing and assembly lines

Educational Tool

- Hands-on learning for robotics and embedded systems courses

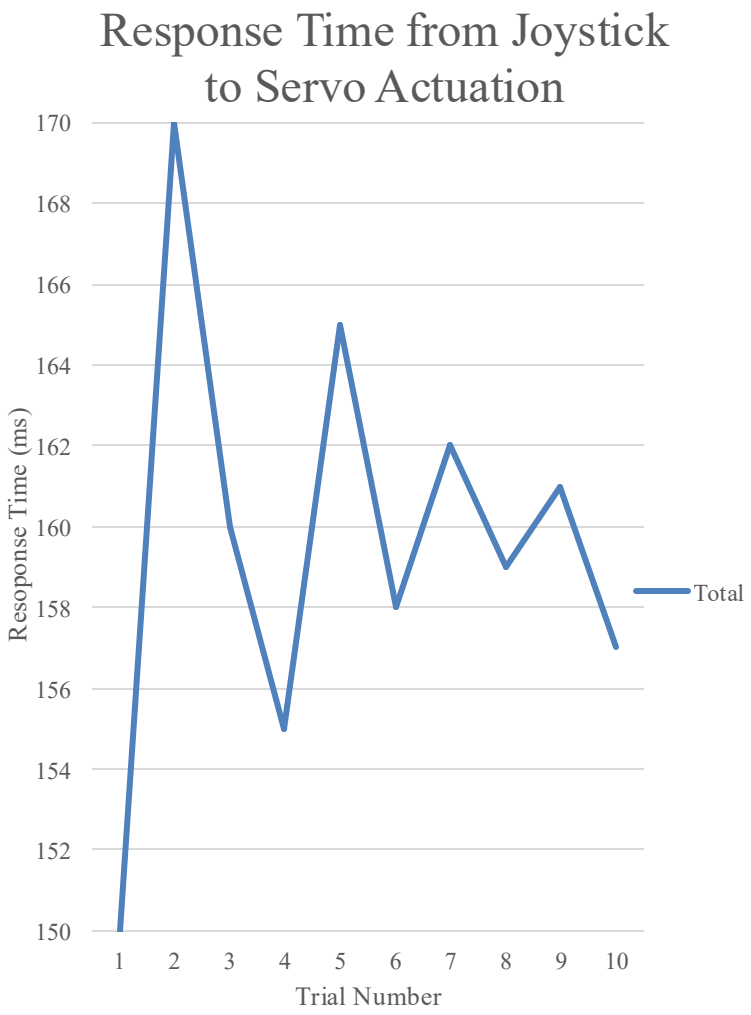
Human-Machine Interface Research

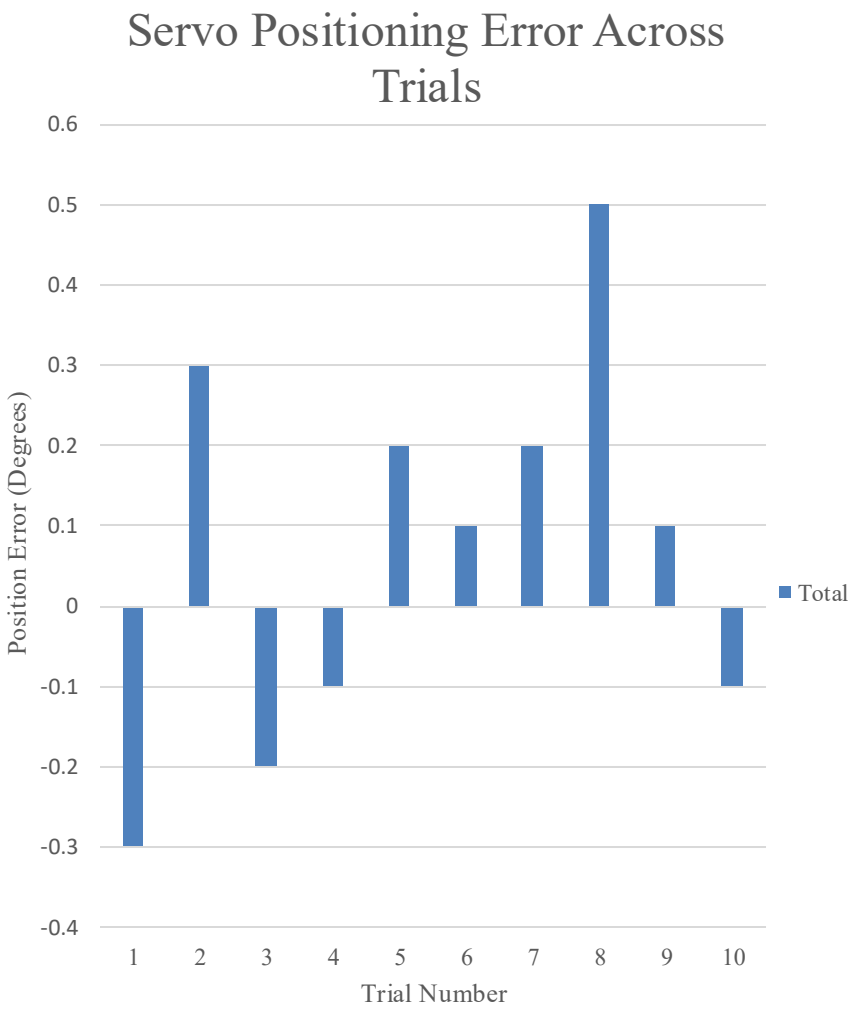
- Platform for developing and testing gesture-based controls

Prototype Platform

- Rapid development of gesture-controlled robotic devices and applications

Performance Data





Competitive Advantages

Cost Efficiency

- Built with low-cost, readily available components

Simplicity & Effectiveness

- Intuitive control scheme using joystick gestures

Scalability

- Easily expandable with additional sensors or control methods

User-Friendly Design

- Straightforward assembly and customization for diverse needs

Conclusion

- Demonstrates that low-cost components can be used to build effective control systems
- Prototype for control systems and embedded experimentation