

FlexyBoard

Design
Presentation

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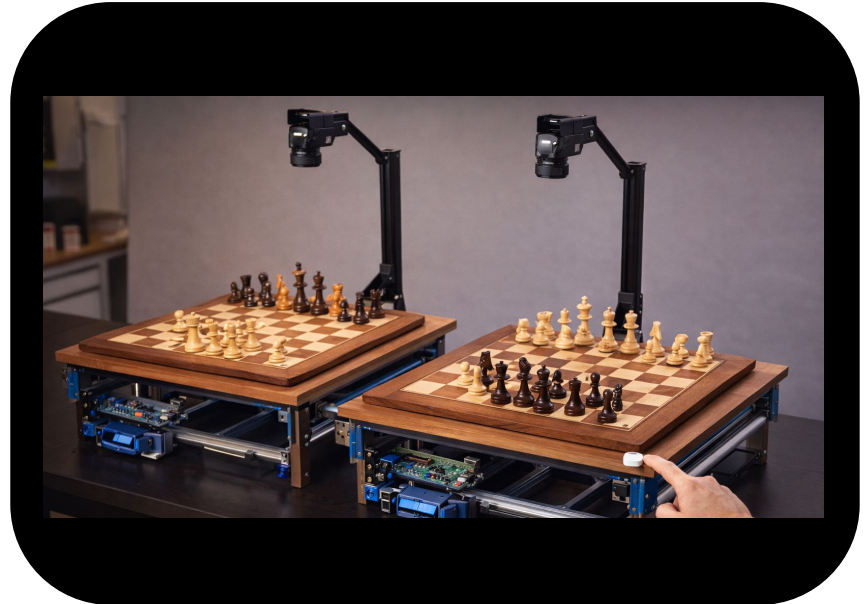
Use Case

Application: Remote way to play board games

Solution to Problem: Allows for tactile interaction with remote game play

Scope: Will only build one board.

Areas: Software/Circuits



Form & Function

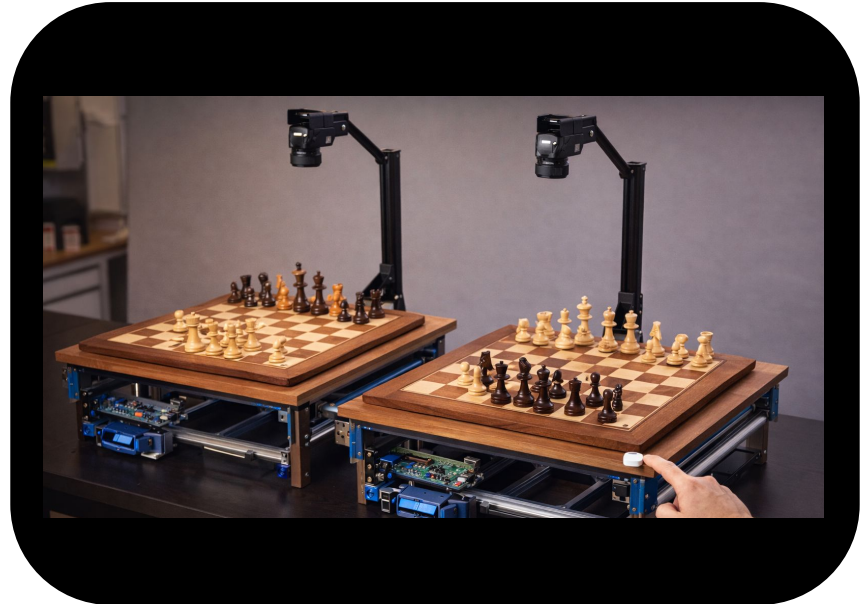
Form

Dimensions : 500x500mm

Plywood Enclosure

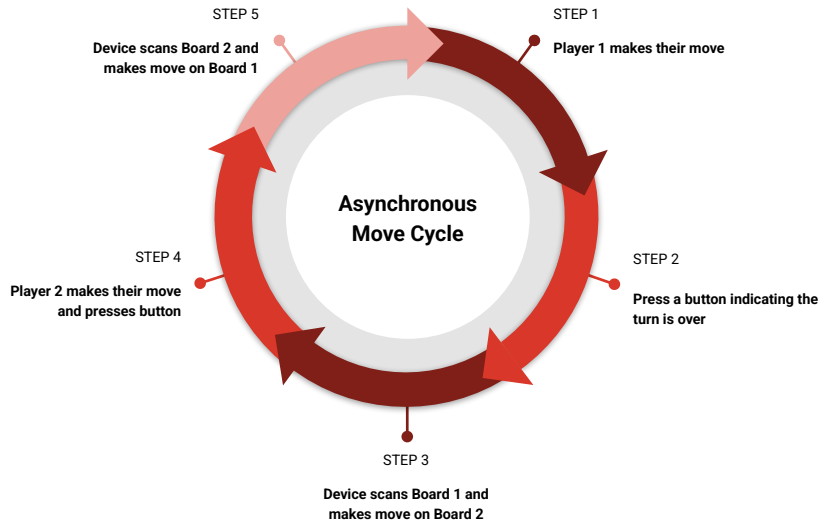
Function

- Execute move in 3 seconds
- Pieces placed w/in 2mm of intended center
- 95% correct piece detection
- Supports chess, checkers, sorry



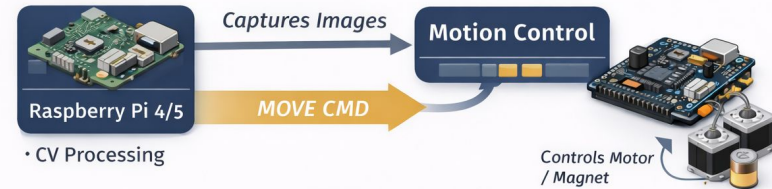
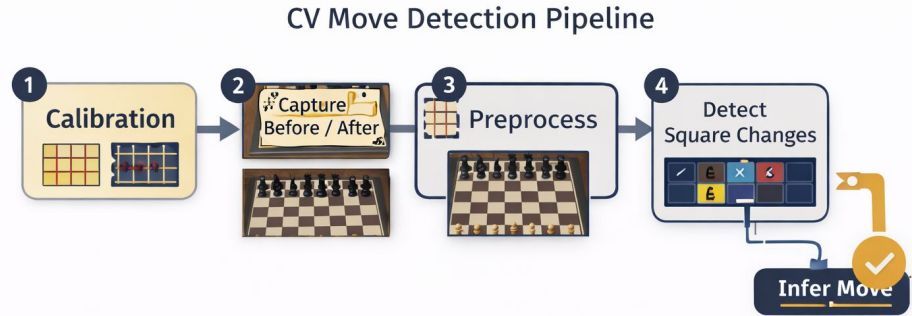
Gameplay

- Player 1 makes a move (regular game board)
- Take a photo
- Process using CV
- Update game state on FlexyBoard



Camera/CV

- Camera: Top down view (Overhead USB Camera)
- Raspberry Pi for CV connected to Camera
- User will press a button when start and end of turn, this will trigger CV algorithm
- Diff between start and end images to see which pieces moved
- The output of the CV will then be connected to an STM32 for the stepper motors



Perception & Control System

• Raspberry Pi 4/5

• STM32 Microcontroller

Gantry



Belt and gear system



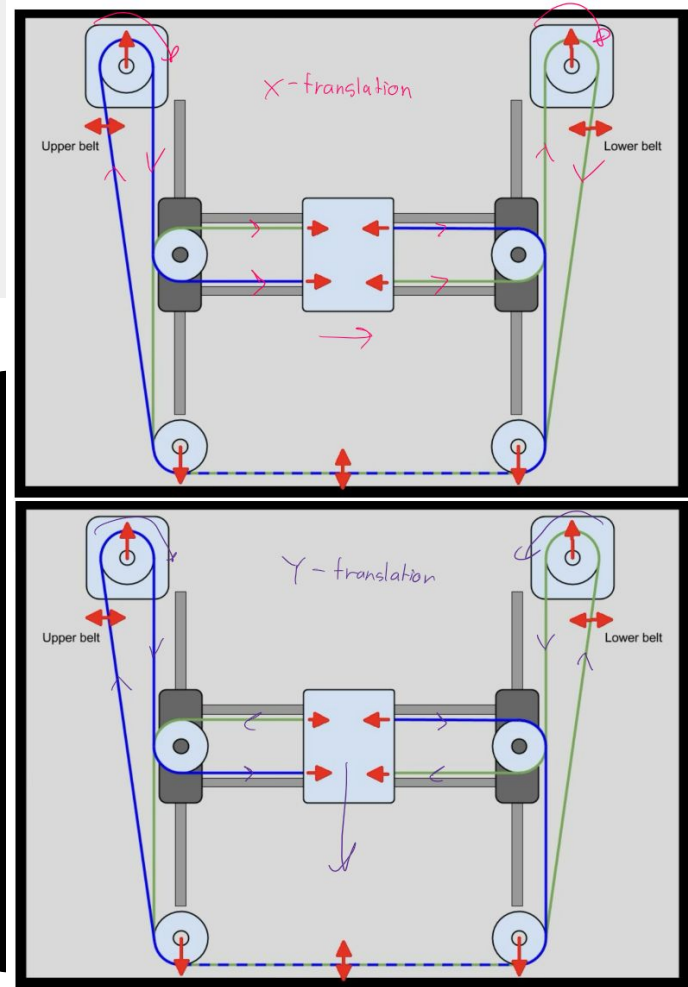
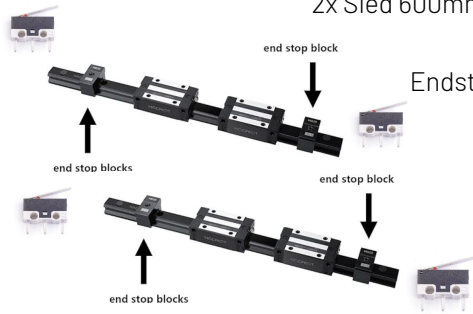
Electromagnet



NEMA 17 Motor

2x Sled 600mm

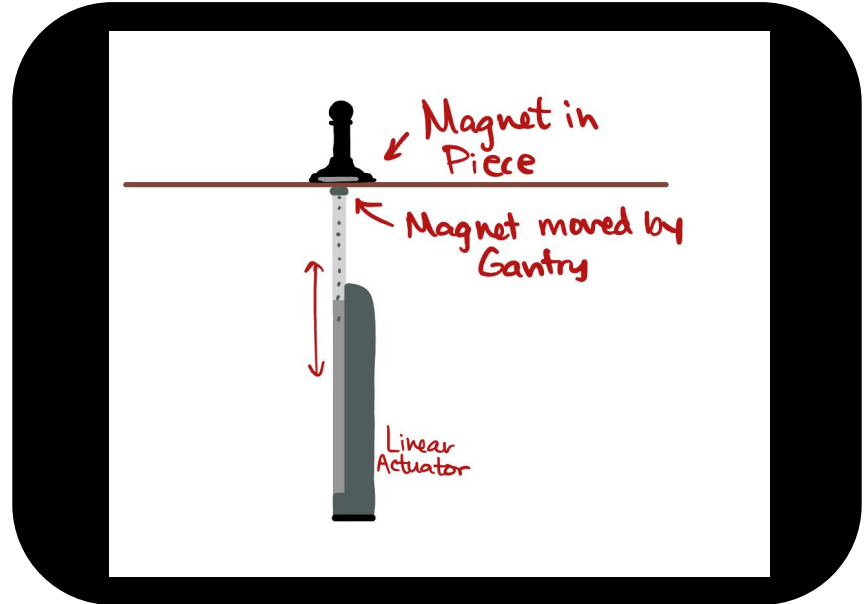
Endstops



Magnet/Control

Parts:

- Neodymium disc magnets
- Linear actuator
 - Commands sent by Raspberry pi to STM32 which controls motors



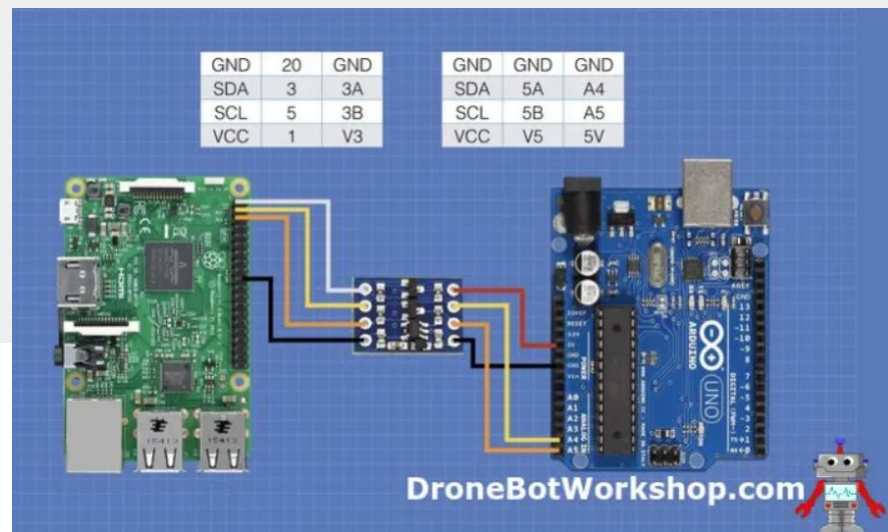
Technical Challenges

Hardware:

- Laying gantry into table
- Building frame for gantry

Software Integration:

- Linking Raspberry Pi to Arduino
- Translate CV output from Raspberry into coordinates for Arduino



Testing, Verification, and Validation

Requirement	Method	Target
Latency (from button to completed move)	Timer (can be outside of software)	Less than 5 Seconds
Move Accuracy across all games	Play full real games	>95% overall
Works consistently across games	Test on full games (Chess, Checkers, Sorry)	>95% in each game, shouldn't be lower for one
User Enjoyment	Student Survey	80% of Users say it's more enjoyable than online play

Gantt Chart

Iniyaa	Order Electronics		Wire Arduino/Rasbperry Pi		
		Asseble Claw/Magnets		Latency Testing	
Harrsion	Order Gantry Components		X/Y Motor Testing		
		Assemble Gantry		Accuracy Testing	
Chris	Finalize Software Design			Reliabilty Testing	
		Board Mapping/Callibration			
Team	Finalize Hardware Design		Hardware/Software Integration		Slack/Debug
		Program Computer Visison			

Social Factors

Cultural/Social Impact

- Allows people to connect even when they are physically far apart
- Provides an activity/platform to play games remotely
- Good option for people who are sick/contagious, in different locations

Economic Considerations

- More affordable than existing automatic chess boards
- Versatile - can play multiple games

Block Diagram

