

Automated Chess Board: 3-Axis Gantry

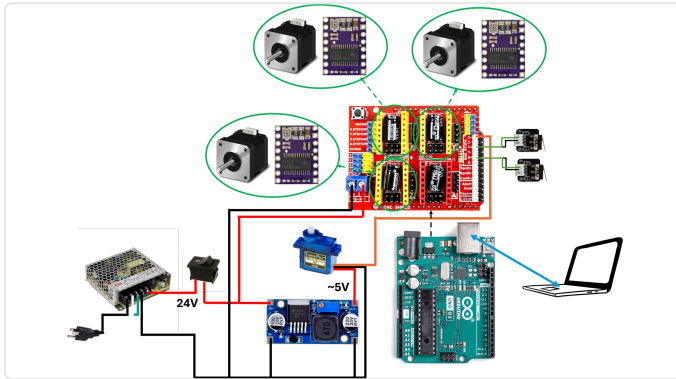
University of Toronto, MIE438 (Microprocessors and Embedded Microcontrollers) · Group of three, design and firmware

Embedded systems

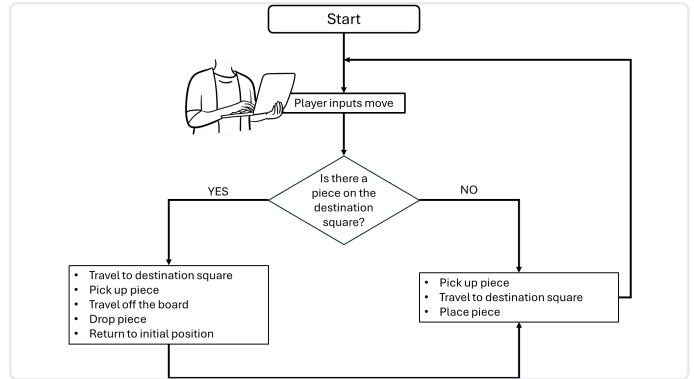
Mechatronics

A 3-axis gantry that executes online chess moves by gripping and relocating pieces.

This MIE438 project receives chess moves over a serial link and drives a three-axis gantry with a 3D-printed gripper to pick up, relocate, and place pieces, handling captures by removing a piece off-board first. The team scoped out on-board piece detection and any chess engine to keep the build feasible in a term. It is a design-and-firmware deliverable: a proposal, working control code, and a costed bill of materials.



Electronics architecture: Arduino and CNC shield, three NEMA 17 steppers with DRV8825 drivers, servo gripper, 24V supply.



Move-execution logic, branching on whether the destination square is occupied (capture versus simple move).

Electronics and motion

An Arduino UNO on a CNC Shield V3 drives three NEMA 17 stepper motors through DRV8825 drivers, with a micro-servo gripper, limit switches for homing, and a 24V supply stepped down through a DC-DC converter. Commands arrive over UART from a laptop.

Firmware

The Arduino sketch uses the AccelStepper library for acceleration-controlled multi-axis motion and parses serial text commands for axis moves, grab, and release. Gripper closure is coupled to the Z-axis descent.

Scope

The proposal reasons through the GPIO budget, motor current against driver and supply ratings, and a closed-loop encoder fallback if the steppers lose steps. It is a proposal-stage design rather than a validated working machine.

SELECTED REFERENCES

- Firgelli Automations, "CoreXY Mechanism Explained," 2023 (Cartesian gantry kinematics).
- Maker.io / DigiKey, "CoreXY Chessboard: Where Electronics Meet Classic Chess."
- M. McCauley, AccelStepper library documentation.

Engineering portfolio brief. Course and team project; contribution as noted above.