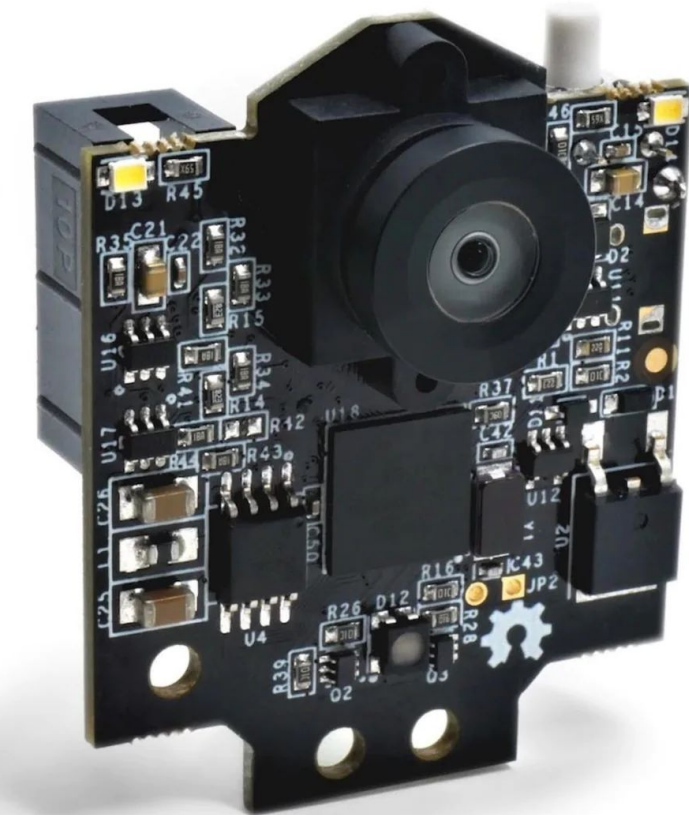## Human vs. Tic-Tac-Toe Robot

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Introduction:

Play tic-tac-toe on a physical board against a computer!

Implementation
- Detect human moves with camera
- Perform computer moves with a XY-axis plotter
- Facilitate the game through audio & LCD screen
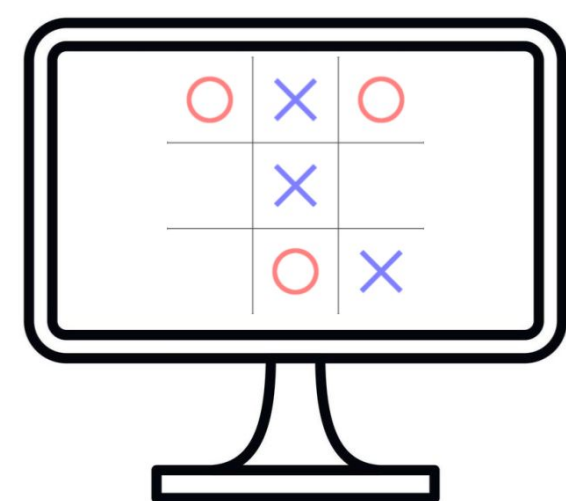
Fast color-based move detection

Surround sound for immersive experience

Easy and Fun physical interaction

Problem Description:

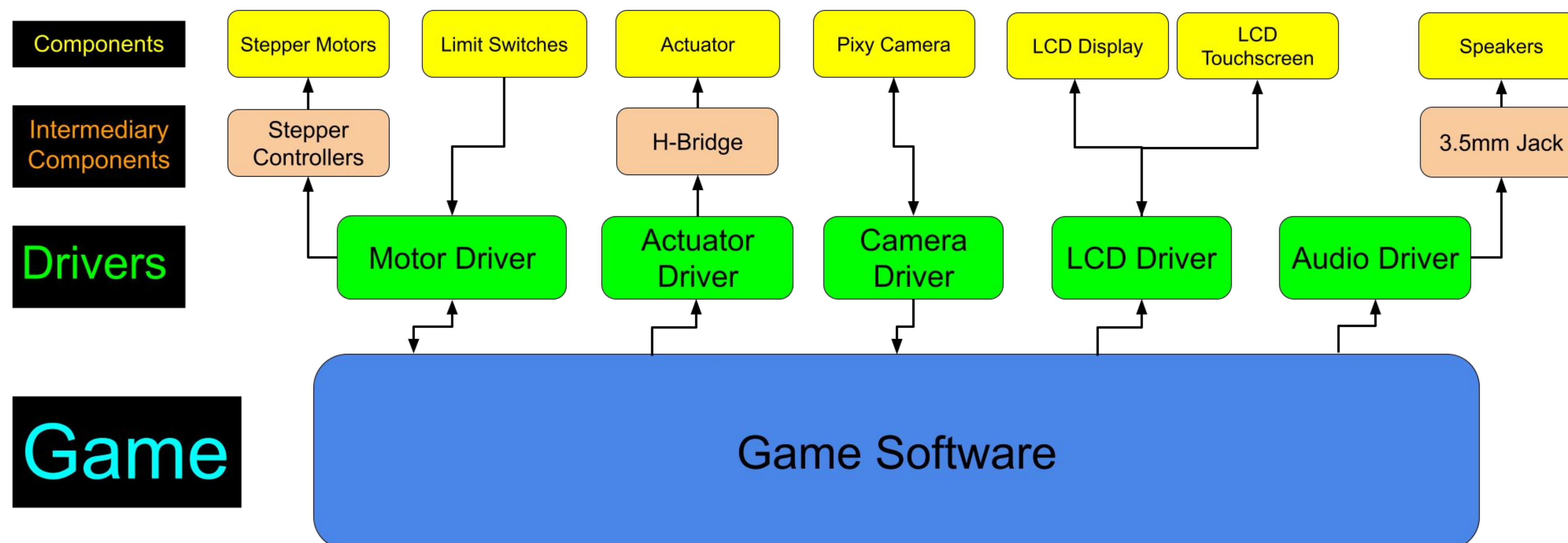We've all played board or card games on a computer monitor

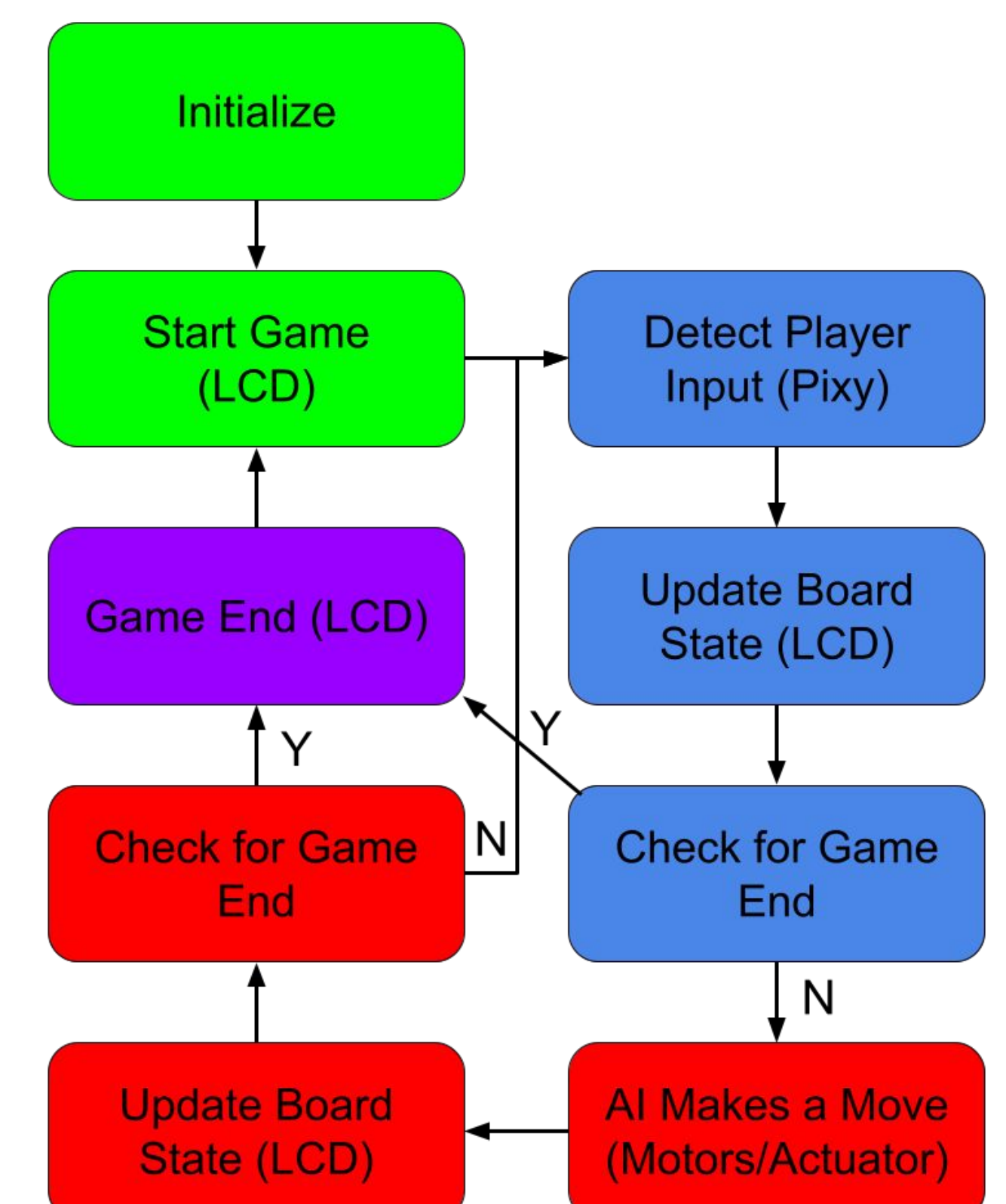→ **Lacks the tactile & sensory experiences of playing in the real world with a friend.**

→ **How can we keep the depth and dynamism of real world games while playing with machines?**

Solution:

Hardware

| Components | Stepper Motors | Limit Switches | Actuator | Pixy Camera | LCD Display | LCD Touchscreen | Speakers |

Intermediary Components: Stepper Controllers, H-Bridge, 3.5mm Jack

Drivers: Motor Driver, Actuator Driver, Camera Driver, LCD Driver, Audio Driver

Game: Game Software

Software

Initialize → Start Game (LCD) → Detect Player Input (Pixy) → Update Board State (LCD) → Check for Game End → N → AI Makes a Move (Motors/Actuator) → Update Board State (LCD) → Check for Game End → Y → Game End (LCD)

LCD:
- Display with current board state over SPI
- Touchscreen to control game flow over SPI

Sound:
- Timer interrupts to set DAC values to play audio

Camera:
- Detect played squares and send them over UART

Stepper Motors:
- X and Y controlled by PWM and direction pins over stepper controllers

Limit Switches:
- Polled by timer interrupts every millisecond

Actuator:
- Reverse polarity through H-bridge

XY Plotter:
- Frame sourced from Makeblock

STM32L4R5 Board:
- Board handles all inter-component communication and game logic