

### Ping-Pong Target Practice

Tommy Tran, Matteo Caporuscio, Maxwell Kenny, Sara Haycox  
 {ttrann, mjcapo, maxkenny, shaycox}@umich.edu

#### Abstract: Ping-Pong Target Practice

##### Idea

- Design a robot that is capable of playing target practice
- Control robot to function either automatically, or with a controller (PS2 or Wiimote) to set a specific position

##### Implementation

- Build a robot that moves a ping-pong paddle to the location specified
- Use stepper motors to move the paddle
- Use servos to swing the paddle

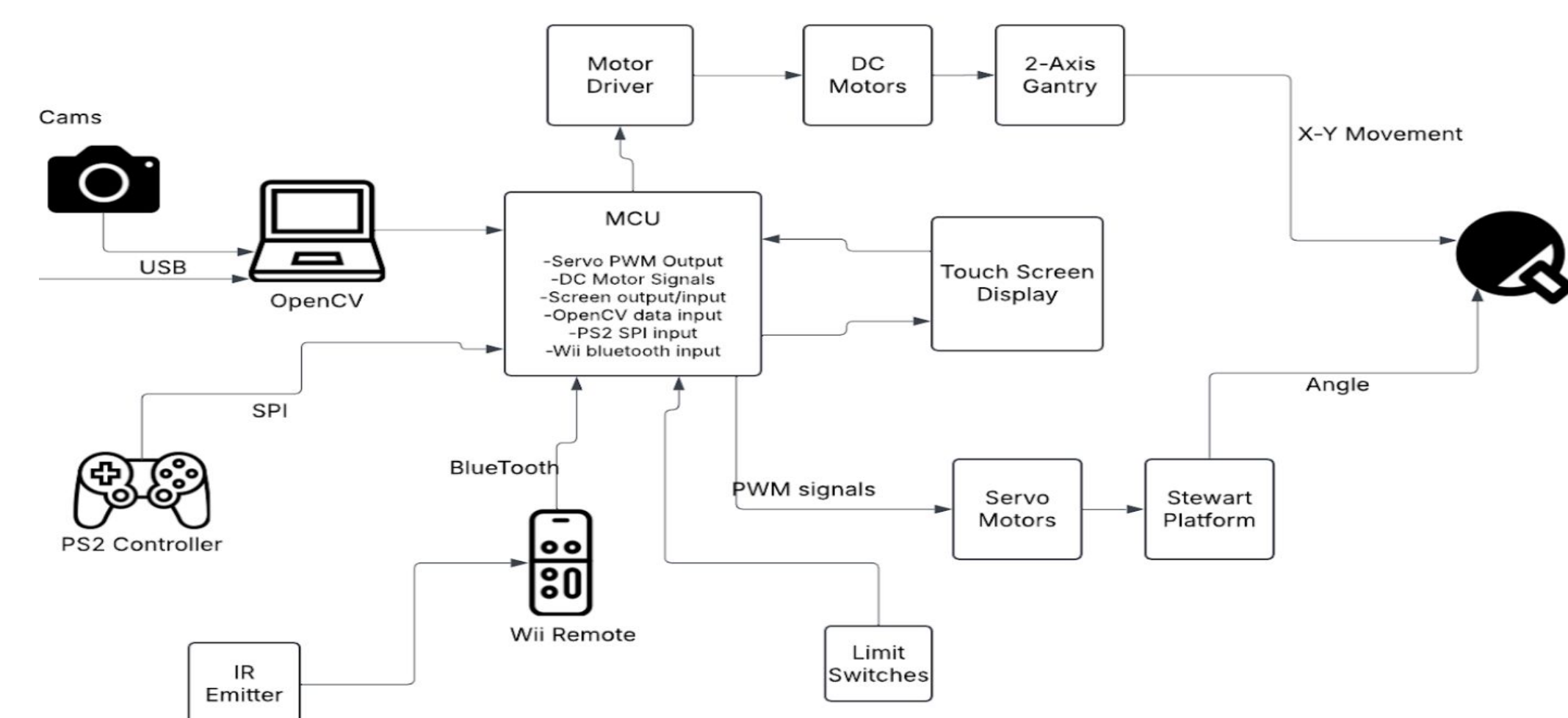


Figure 5. Component Diagram of system

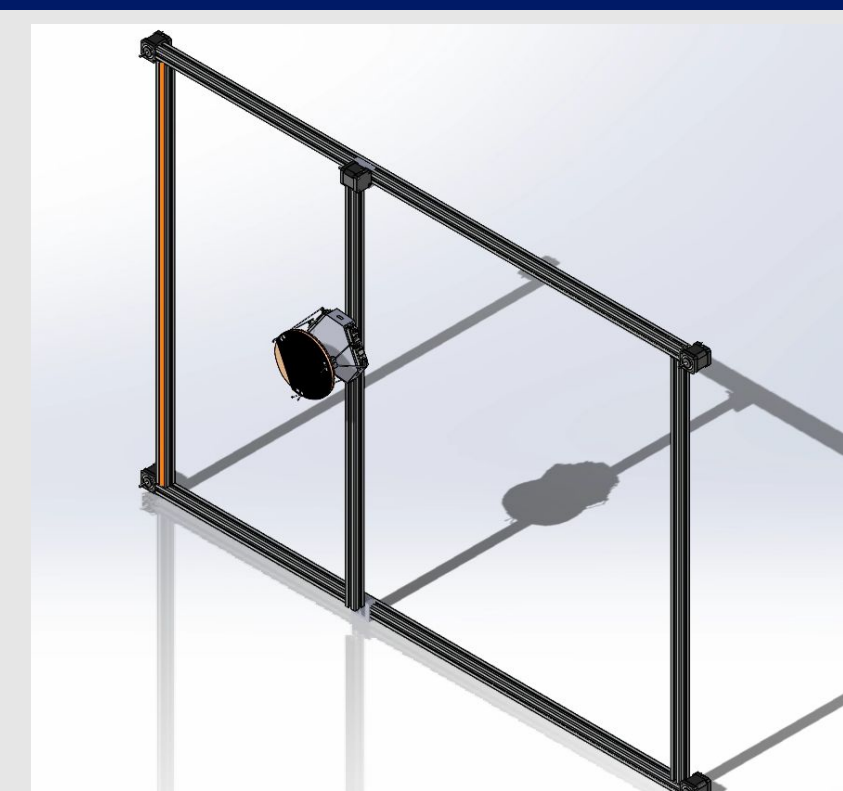
#### Purpose: Play Target Practice With Camera or with a Controller

##### Robotic Target Practice

- We wanted to design a system that is capable of moving a target to be hit by a human player
- The system can either be controlled by a PS2 controller, Wii camera, or it can serve as the second player by functioning independently

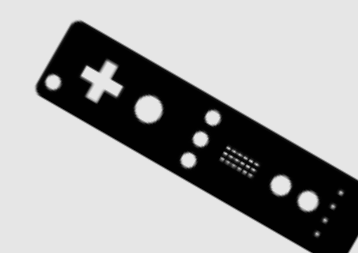


+



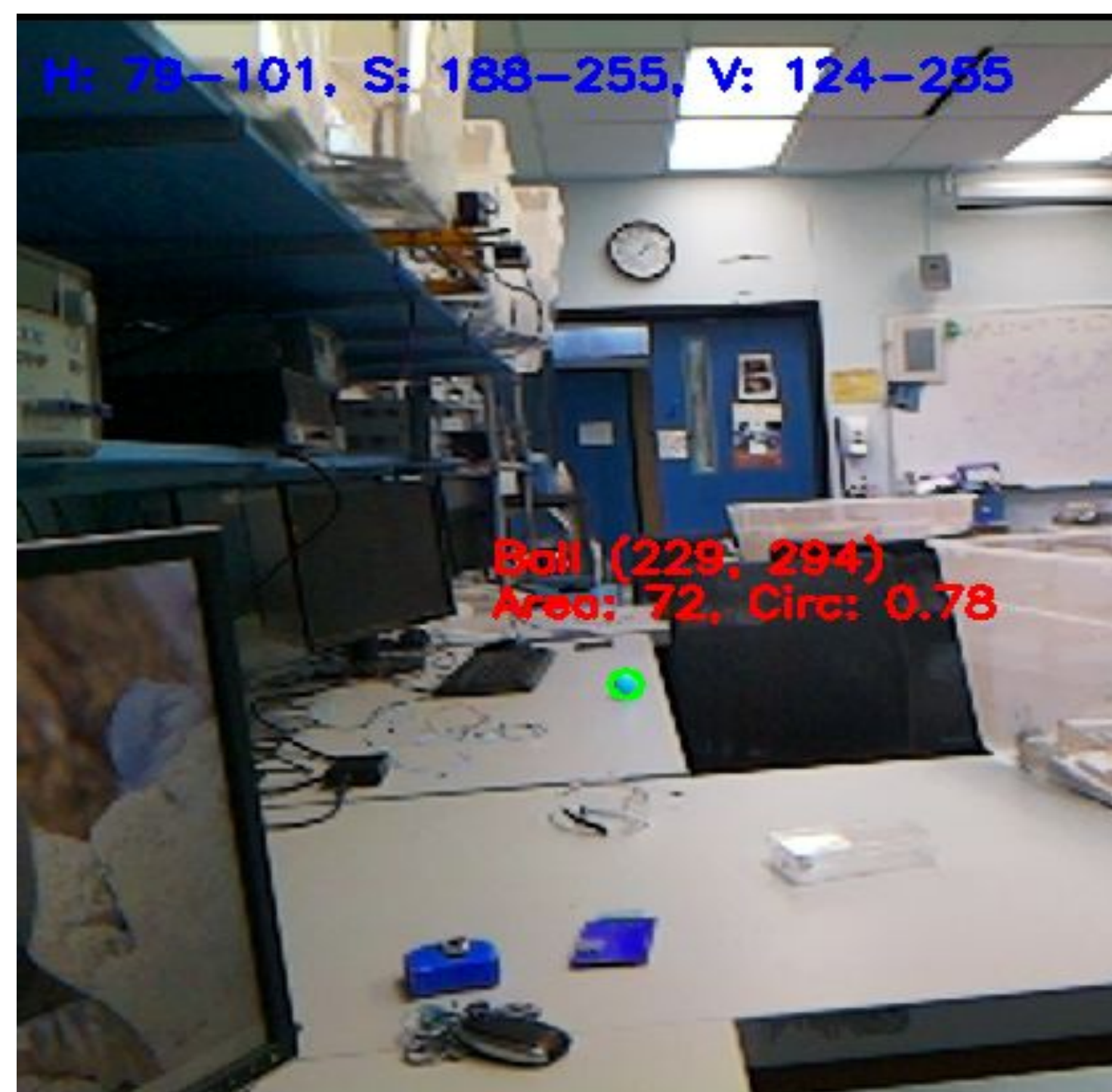
+

(Optional)



#### Implementation: Functionality Details

##### Raspberry Pi & OpenCV



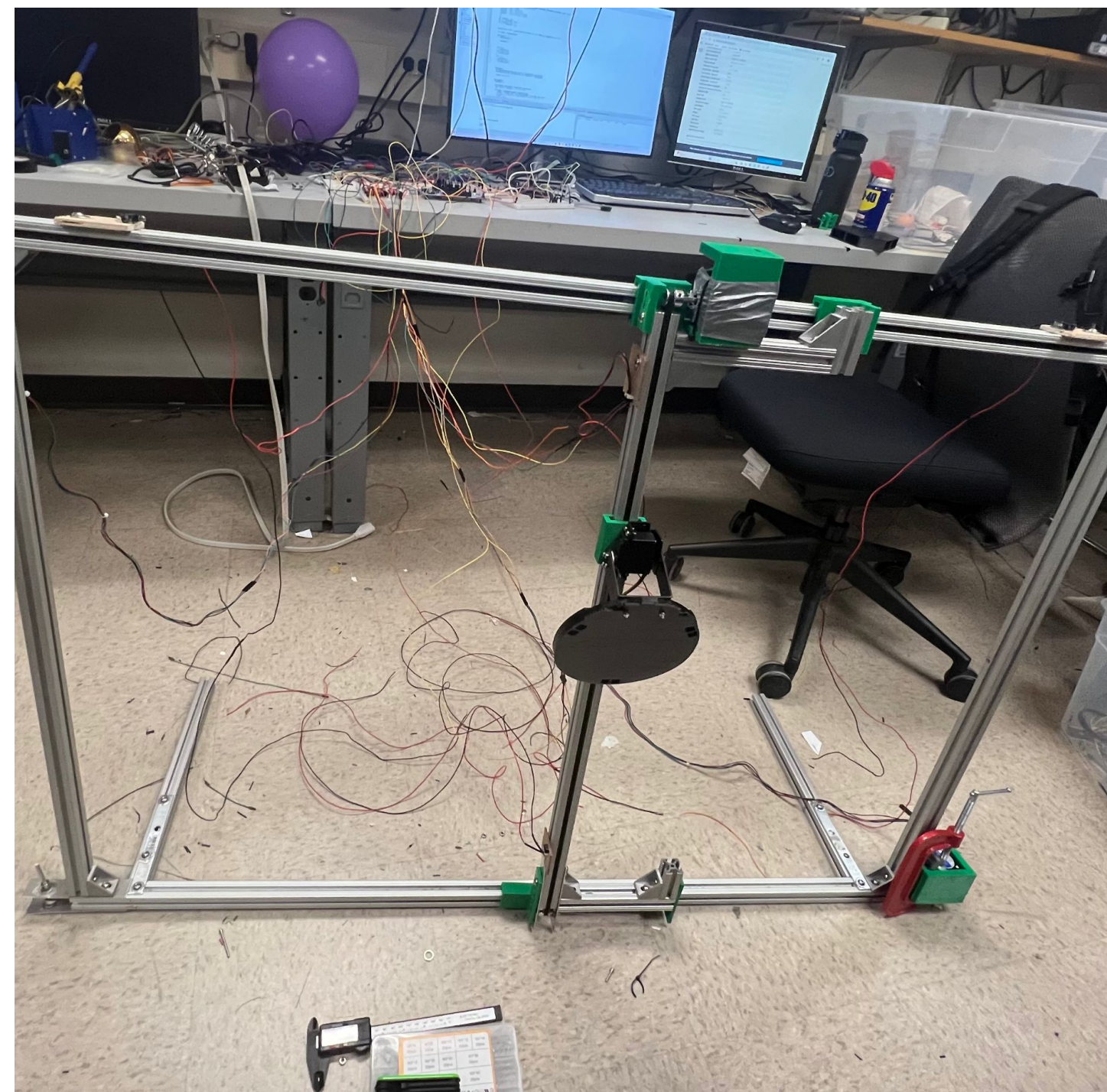
##### Ball Detection & Tracking

- Raspberry Pi Camera continuously captures playing field
- Process video feed with openCV
- Kalman filter to smooth tracked position

##### Communication

- Raspberry Pi acts as SPI master, STM32 Nucleo L4R5ZI-P as slave
- GPIO Handshake mechanism to ensure reliable communication by having the STM32 signal readiness to receive data
- Scaled X/Y coordinates are sent from PI to STM32 via SPI

##### Microcontroller & Gantry



##### Microcontroller

- LCD Touchscreen is connected to the STM32 Nucleo L4R5ZI-P and used to display the current game mode
- The button on the STM32 is used to switch between game modes
- The inputs from each game mode are used to control the gantry

##### Gantry

- Uses 3 stepper motors that are connected to the main STM32 – 2 for the x-axis and 1 for the y-axis
- Switches are used to stop motion at the edges of the gantry

##### PS2 Controller & Wiimote



##### PS2 Controller

- Connected to the main STM32
- Communicates the left joysticks input with the main STM32 using SPI

##### Wiimote

- Bluetooth module is connected to an STM32 Nucleo L432KC on the remote, which communicates with another module connected to the STM32 Nucleo L4R5ZI-P
- Powered by a battery pack
- Infrared camera captures coordinates of infrared LEDs which are processed by STM32 Nucleo L432KC using I2C