

# Project Checklist 6.111 Final Project

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## Commitment:

### Machine Vision (Alex):

- Output camera view to screen
  - Black and white video
  - Color video
- Identify objects of certain hue
  - YCrCb -> RGB -> HSV conversion
- Determine pixel position of objects
  - Basic filtering to eliminate noise
  - Centroid calculation
    - Keep track of top left and bottom right most pixel positions of object

### AI (Kathy):

- Velocity detection module
  - Track past movement
  - Calculate current velocity
  - Ignore steps when bounces off of wall
- Trajectory prediction module
  - Output where puck will be in fixed time
  - Approximate tangent calculation
- AI Strategy module
  - Move paddle in y direction only to block puck from scoring
  - Control whether to move based on the puck moving towards/away

### Motion Control (Xavier):

- Run Stepper motor tests for functionality
  - Pulse motors for 1 full step and measure how far they move
  - Connect Stepper motors with stepper driver
- Rest Module
- FSM Module
  - Be able to store the present location and find out how to move on to the next location as soon as possible
  - Create corresponding sequence of step signals to accelerate stepper motor without stalling or damaging the motor
- Boundary checking module

- Pulse Generator Module
- 1 microsecond timer

## Goal:

### Machine Vision (Alex):

- Annotate output camera view to screen
  - Pixel location using font ROM
- Determine pixel position of objects
  - Advanced temporal filtering to completely eliminated noise
  - Expected object model to help with physics prediction

### AI (Kathy):

- Velocity detection module
  - Calculate velocity on timesteps where the puck bounces off of walls
- Trajectory prediction module
  - Accurate tangent calculation
  - Output array of positions and timesteps
- AI Strategy module
  - Include basic offensive strategy that "hits" the puck when close enough

### Motion Control (Xavier):

- Be able to move in the Y direction as effectively as possible to defend the puck goal
- State Machine Module
- Accelerator Functionality
- Mechanical and Electrical Assembly integration

## Stretch:

### Machine Vision (Alex):

- Match multiple pucks on the board
- Use edge detection to match geometry to model
- Be able to operate regardless of lighting conditions

### AI (Kathy):

- AI Strategy module
  - Decide which direction to hit the puck
  - More complex and aggressive strategy

## Motion Control(Xavier):

- ❑ Expand functionality to beyond the Y axis and move on to X axis
- ❑ Expand the FSM to account for best attack methods
  - ❑ Send the puck and the best angle and velocity in order to score
- ❑ Be able to do repeated motions with the same result
  - ❑ I.e. Make a goal every time you hit the puck at 5cm from wall at an angle of 45 degrees