Duckhunter Checkoff List

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- **Servomechanisms:** Drive the servos with a signal from the labkit: point servos at four different positions based on switch inputs.

  Test: output motor pulse width values to LED display. Control movement of motors using up/down and right/left buttons and watch display correspond to motor position. [tbarton]

- **Light Gun:** Trigger the light gun electrically using an output signal from the labkit.

  Test: Input NES signal to TV, playing game by hand. Control trigger through pushbutton on labkit. [tbarton]

- **Calibration video:** (1) color screen black, then white for locating point of aim of light gun, and (2) display white target on black screen to verify aim.

  Test: Watch screen turn black and white, and watch target displayed on a black screen. [tbarton]

- **Hit Detection:** Use ouput from circuit on light gun to determine when the gun is aimed at the target.

  Test: Illumiate LED on labkit when light gun points at white signal. If time allows, combine with trigger to light LED for one second after trigger pull if gun was pointed at white target when trigger is pulled. NES signal can be used to demonstrate this function. [tbarton]

- **Coordinate conversion:** Convert from (x, y) coordinate input to angle outputs used to drive the servomechanisms taking into account the distance of the gun from the TV and offset inputs from the calibrator.

  Test: Generate coordinates (eg, moving target across the screen), display target at these coordinates and aim gun at coordinates. Using laser pointer, watch gun track target. Another test would be to use the pong game from lab 4 to generate the target. [tbarton]

- **Calibration FSM:** Control the various calibration modules and have them coordinate with the aiming.

  Test: capture the state value on the logic analyzer and compare to transition diagrams. [tbarton]

- **Wait FSM:** Demonstrate four modes of FSM: no disc detected (no coordinate output), tracking disc one coordinates, tracking disc two coordinates, calibrate routine. [alisy]

- **Wait FSM:** Show working disc detection. Overlay two colored boxes on portion of screen where the discs first appear. [alisy]

- **Physics Engine:** Disc coordinates tracking disc 1 appear on 16hex[0:7] display. May be tested by freezing initial disc coordinates on display f or comparison with colored boxes on screen. [alisy]

- **Physics Engine:** Disc coordinates tracking disc 2 appear on 16hex[8:15] display. [alisy]

- **Main FSM:** Drives servomechanism – FSM sends coordinates from physics engines as output and they are used to aim the gun. [joint]

- **Main FSM:** Integrate calibration system with main system: based on *switch[0]* input, switch between video from NES and calibrator, and switch between FSM aiming gun and calibrator module aiming gun. [joint]

If time allows,

- **Crosshairs:** Superimpose crosshairs where the gun is (in theory) aiming on the video output, and determine accuracy of aim using laser pointer on light gun to show actual point of aim. [tbarton]
- **Continuous calibration:** If we can obtain a ROM using the white screen method of hit detection, recalibrate aiming after each shot. [tbarton]
- Physics equation and disc coordinates superimposed at bottom of screen. [alisy]
- "Tracer" line overlayed on screen corresponding to path the disc has followed so far, updated as disc moves.
- Detect a failed hit and retrack disc on hex16. [alisy]
- Recalibrate on-the-fly during game. [alisy]
- Play duck mode of *Duck Hunt*. ***Note:** it is much more difficult to track objects in later rounds of duck mode because flight path equations are non-constant. Therefore, we will attempt to play the first round only. [alisy]