

# DUCK

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# HUNT

GAME A	1 DUCK
GAME B	2 DUCKS
GAME C	CLAY SHOOTING
GAME D	DOGS

INSTRUCTIONS SHOW MOUSE

TOP SCORE = 10500

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REMADE BY PSHYKOH <http://pshykohtech.cjb.net>

# Laser Shot

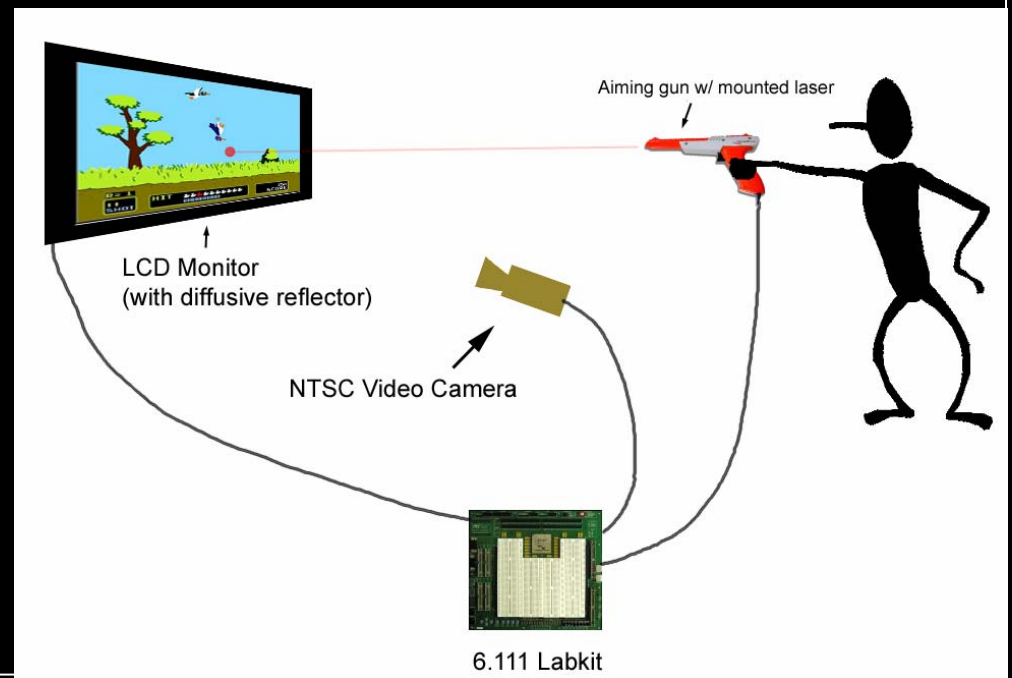
A Video-based Alternative  
to Arcade Light Guns

By Tiffany Chen, Spencer Sugimoto, and Paul Yang

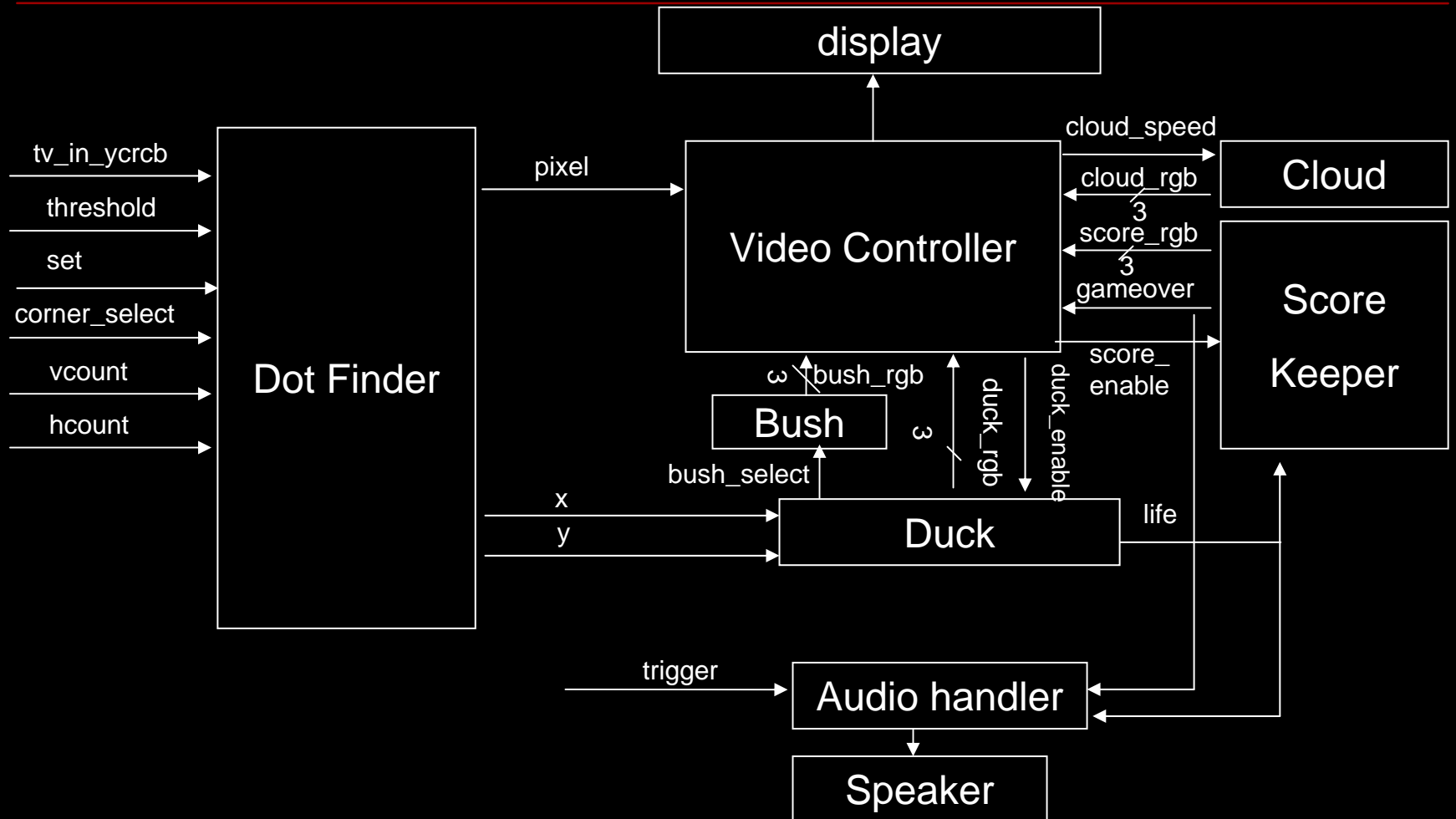
# Introduction

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- Dot Finder
- Duck Hunt System
- Potential Issues
- Materials Needed



# Block Diagram

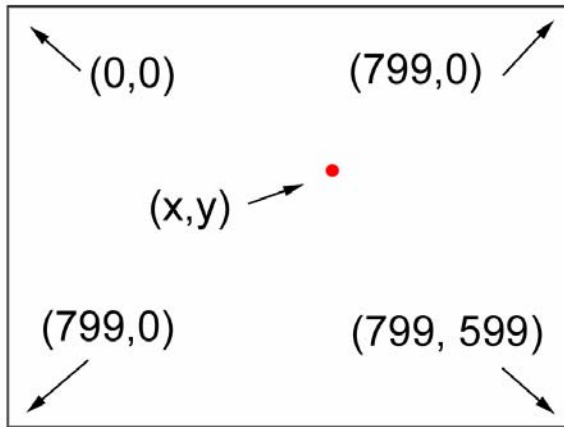


# Dot Finder

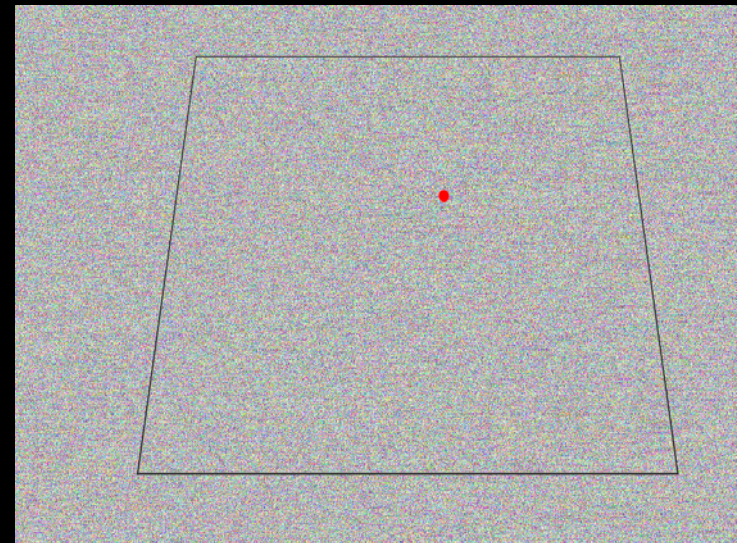
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- Goal: Given an camera view of the screen with the laser dot, find the coordinates of the dot on the screen.

Screen Location of Dot



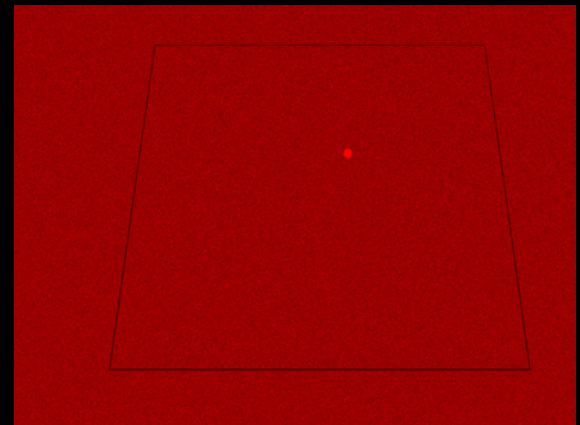
What the Camera Sees



# Dot Finder Algorithm

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- Remove blue, green



- Apply a threshold



# Dot Finder Algorithm

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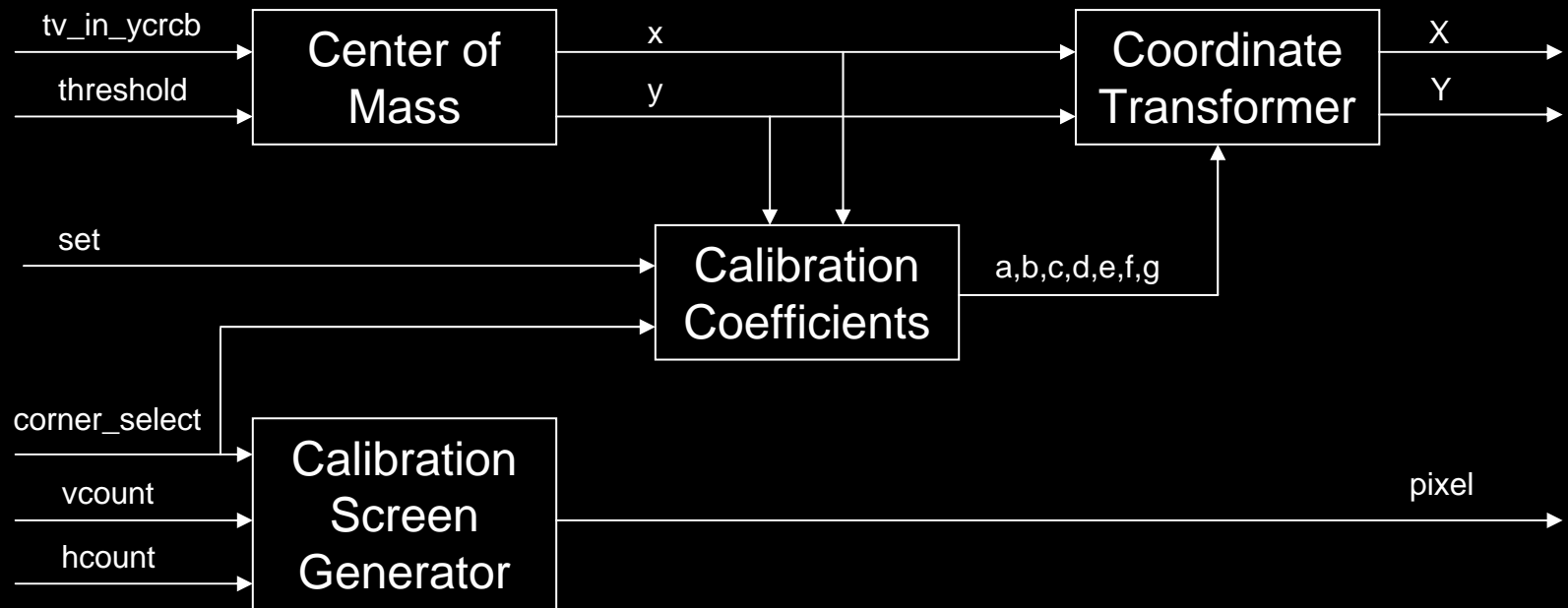
- Find the center of mass of resulting dot
- Apply a perspective transformation of the form

$$\begin{aligned} X &= \frac{ax + by + c}{gx + hy + 1} \\ Y &= \frac{dx + ey + f}{gx + hy + 1} \end{aligned} \quad ^1$$

$(x,y)$  – coordinates of dot in camera image  
 $(X,Y)$  – coordinates of the dot on the screen  
 $a,b,c,d,e,f,g,h$  – calibration coefficients

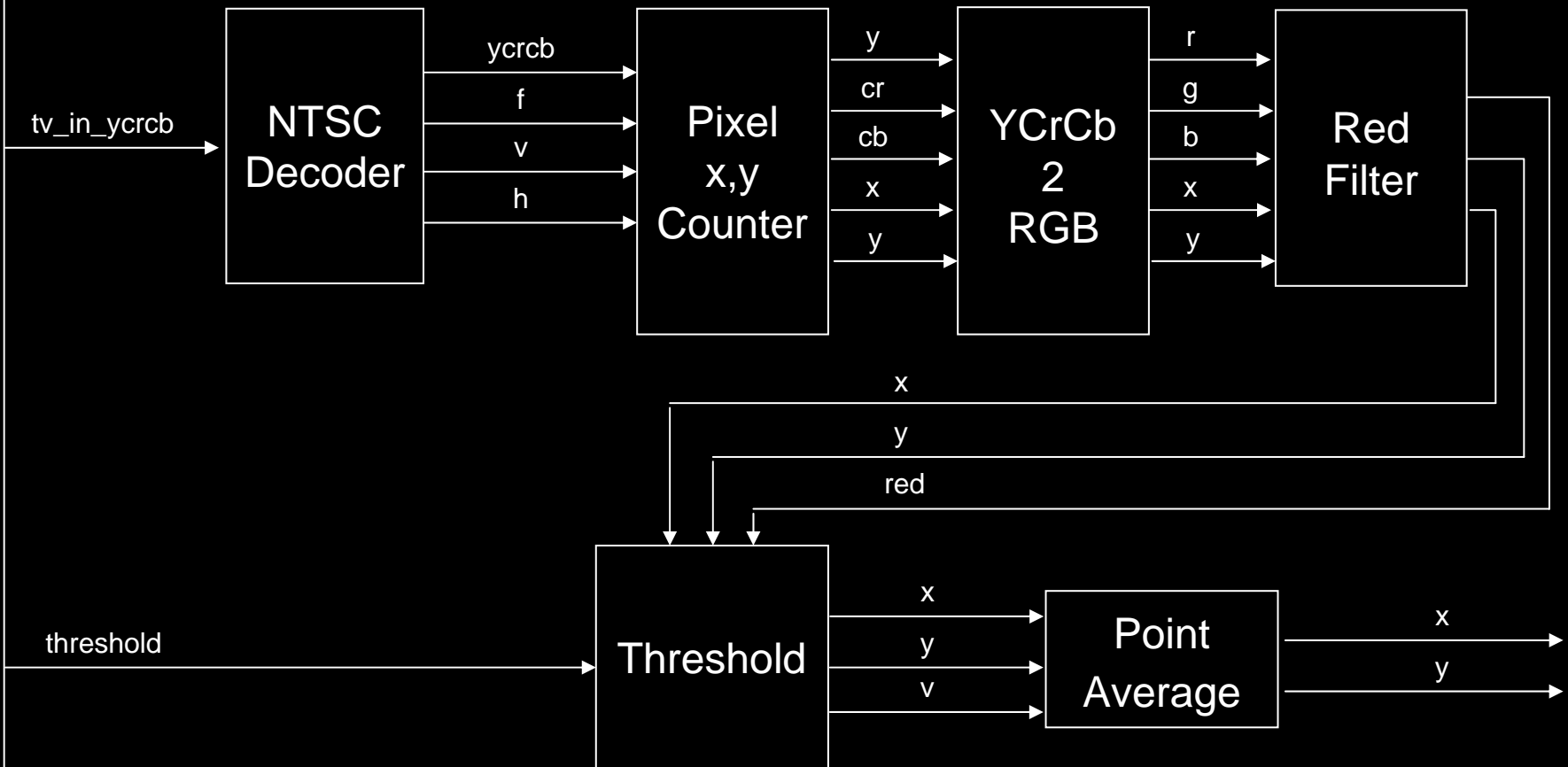
# Dot Finder Block Diagram

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# Dot Finder – Center of Mass



# Duck Hunt System

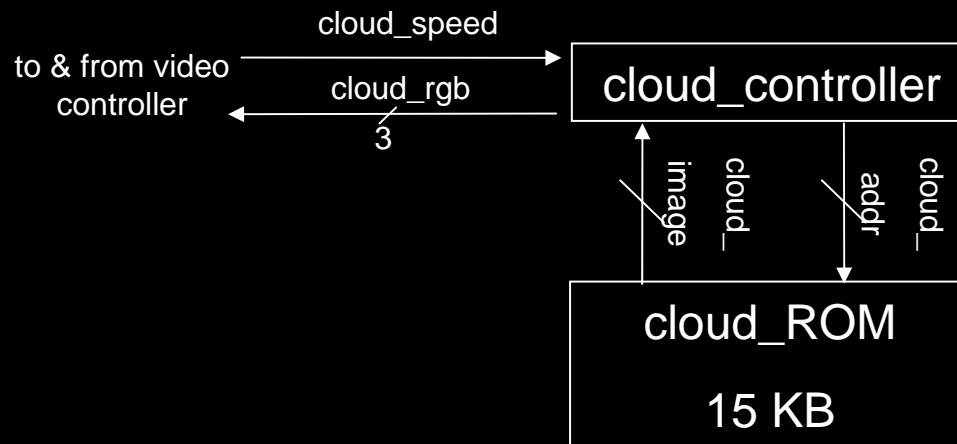
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- 800 x 600, 60 Hz display
- Shoot ducks before time runs out
- Features
  - Animated ducks and bushes
  - Sound effects
  - Score keeping & timing

# Duck Hunt System - Cloud Generator

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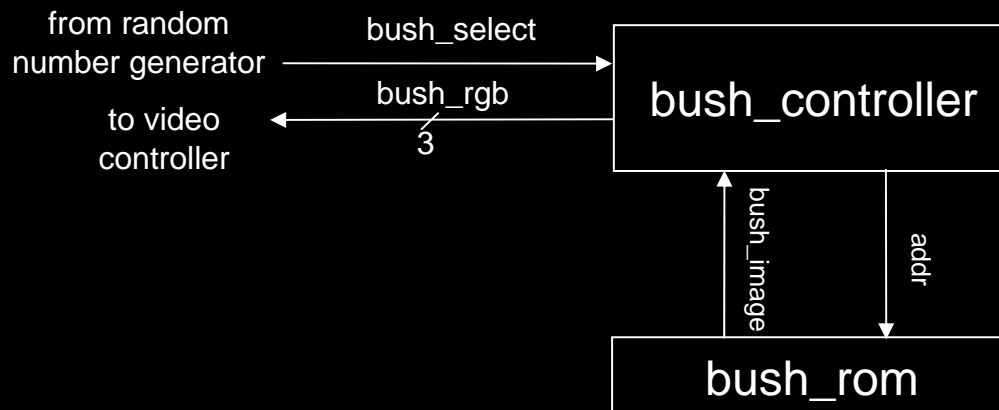
- Clouds move at constant speed across the sky



# Duck Hunt System - Bush Generator

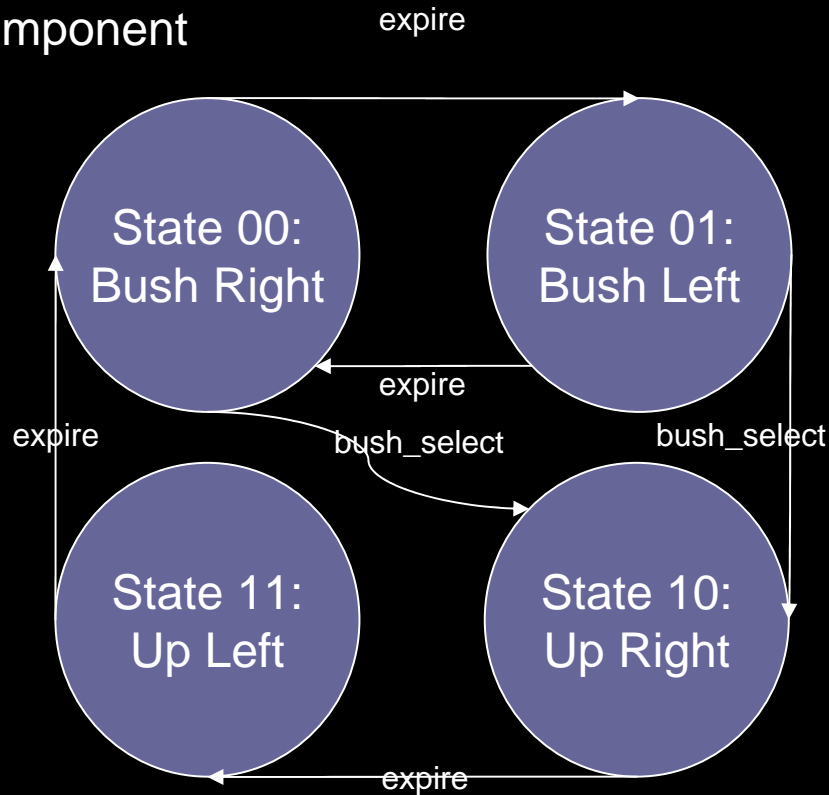
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- Bushes are hard coded onto the screen
- Bushes sway left and right each second
- If a bush is selected, bush shudders



# Duck Hunt System - Bush FSM

FSM Component



- Default progression-bushes sway left and right
- If bush\_select ever goes high, bush shudders

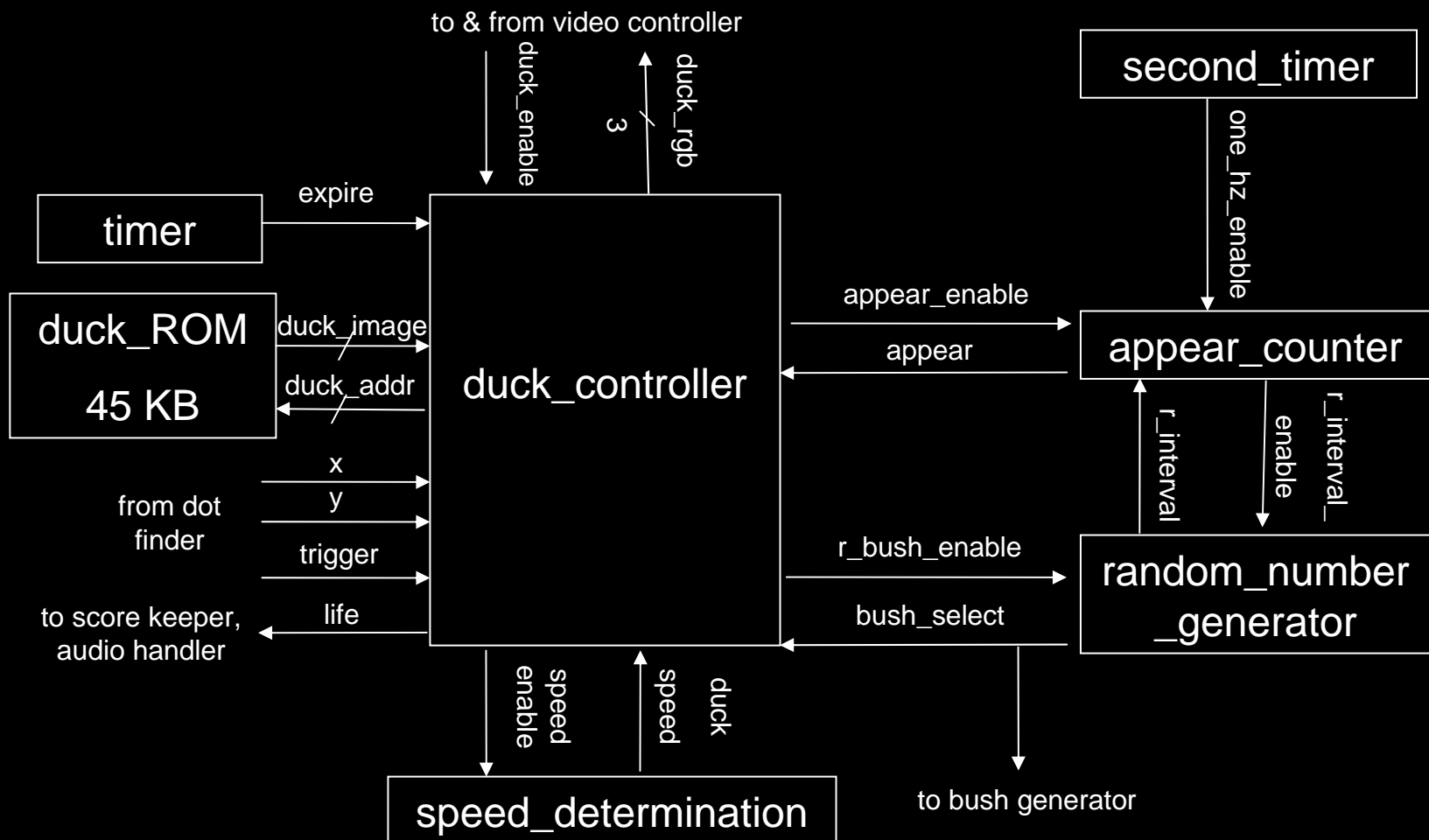
# Duck Hunt System – Score Keeper

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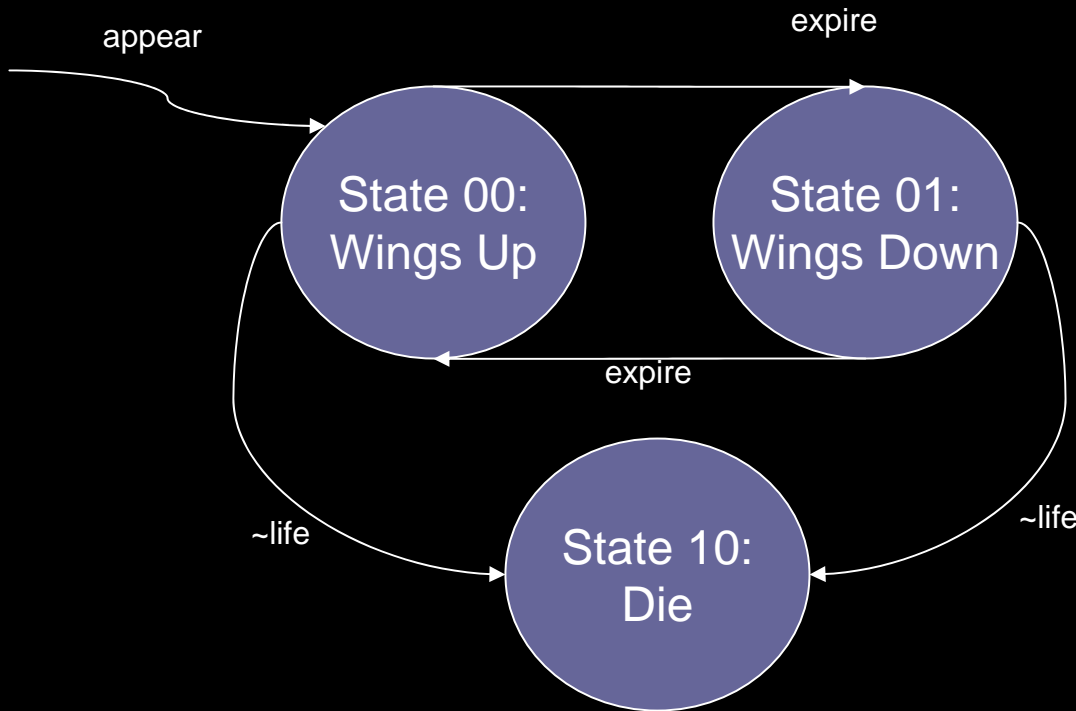
- Increments score whenever a duck is shot
- Displays current score
- Counts down time
- Indicates a game over



# Duck Hunt System - Duck Modules



# Duck Hunt System - Duck Controller



FSM Component

- Compares  $x$  &  $y$  coordinates of laser dot to duck coordinates
- Takes 3 shots to kill duck

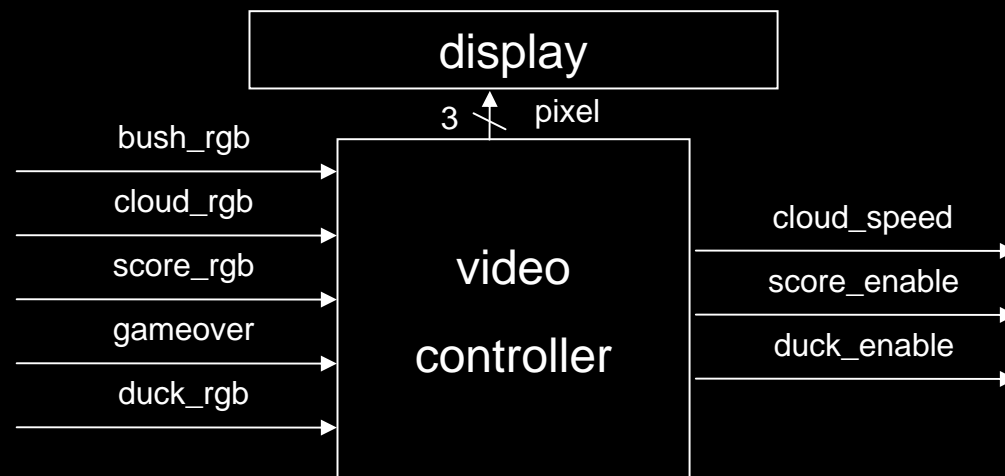


# Duck Hunt System - Video Controller

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## ■ Priority encoder

- Ensures ducks hide behind bushes & clouds
- Outputs pixel RGBs
- Controls image transparency

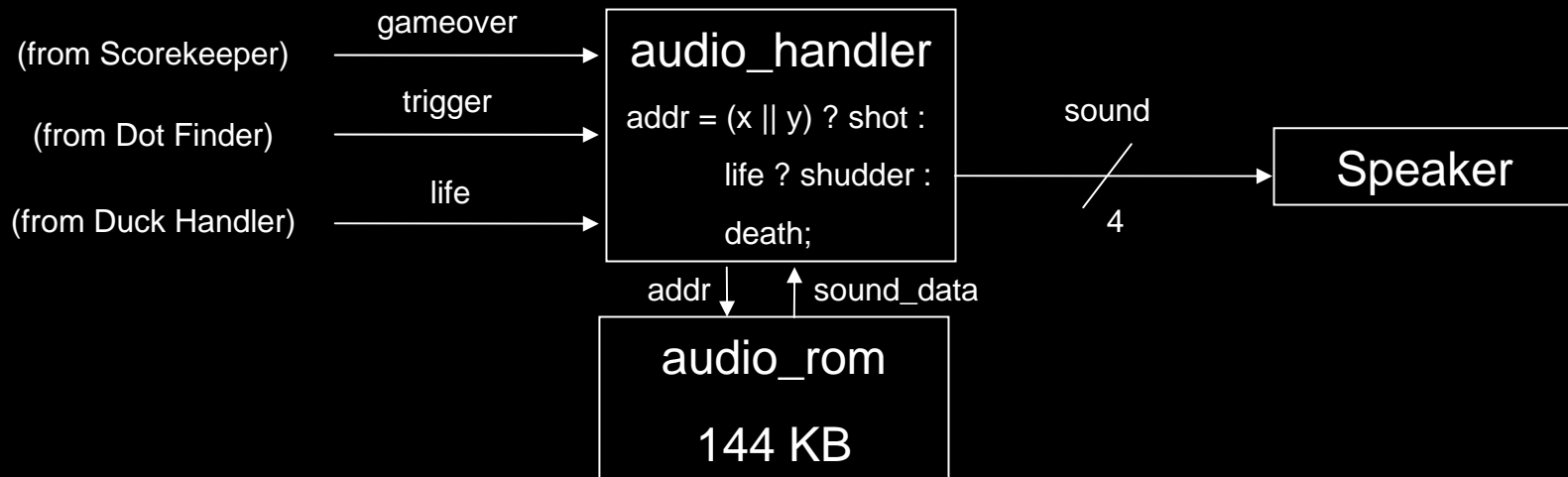


# Duck Hunt System - Audio Controller

## ■ Sound Selector

### ■ Chooses sound to output to speaker

- Duck death, Laser shot, Bush rustle, Gameover, Duck Flapping



# Timeline

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- 11/22 Center of Mass Module fully functional, Duck module basic functionality
- 11/29 Dot Finder fully functional; Duck and Video Controller fully functional; Bush module, scorekeeping, and Audio fully functional
- 12/4 Initial integration of dot finder & duck hunt system
- 12/11 finish debugging & final checkoff

# Materials Needed

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- NES Light “Zapper” Gun
- 5mW Red Laser Pointer
- 10mW Green Laser Pointer
- Plastic Sheet
- Fine-Grit Sandpaper



# Dot Finder – Potential Issues

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- **Reflectivity** - Dot must be brightest object on screen
  - LCD reflectivity may not reflect laser strongly enough
  - Use a diffusive reflector overlay or brighter laser
- **Noise** - Assumed noise was low enough such that the threshold filter would be sufficient
  - If not, and mean or median filter will be necessary
- **Other**
  - Over saturation of image
  - Difficult perspective transform
  - Accuracy
  - Blurring of dot due to exposure times