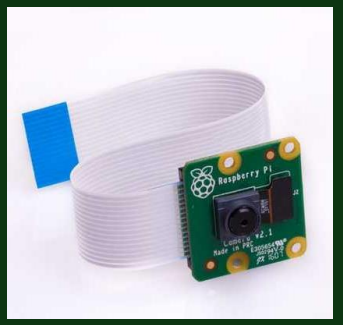
Holiday Light Projection Mapping

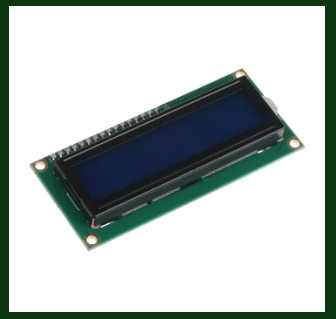
AIPI 590
Final Project

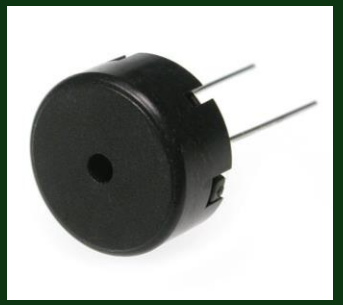
Background: Time, Cost, & Safety

Sensors, Inputs, & Peripherals

- RPi Camera Module 2
- Push Button x2
- DS3231 Real Time Clock Module
- LCD 16x2 Display
- Passive Buzzer
- FS90R Continuous Servo Motor
- Mini Projector







Dataset + Model Prediction

Model

- Instance segmentation
- Ultralytics YOLOv8n
- Roboflow
- 298 images
- Epochs: 50

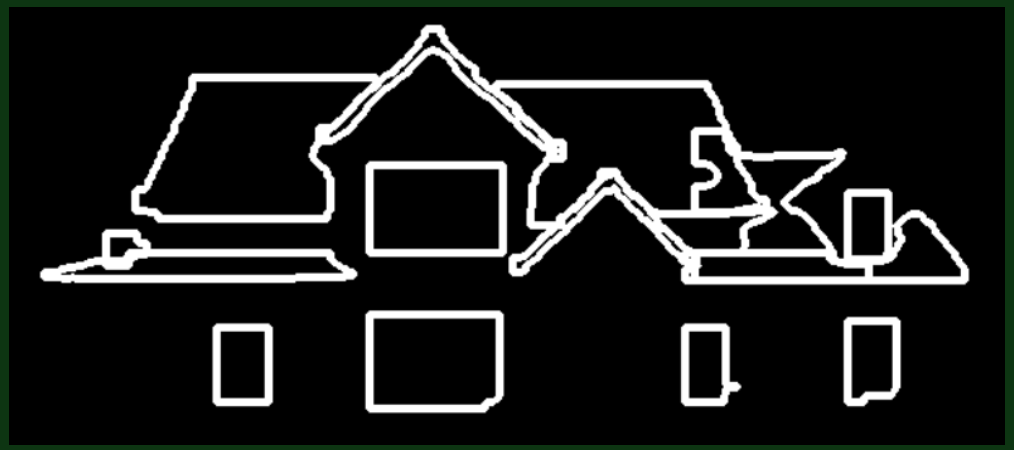
Postprocessing

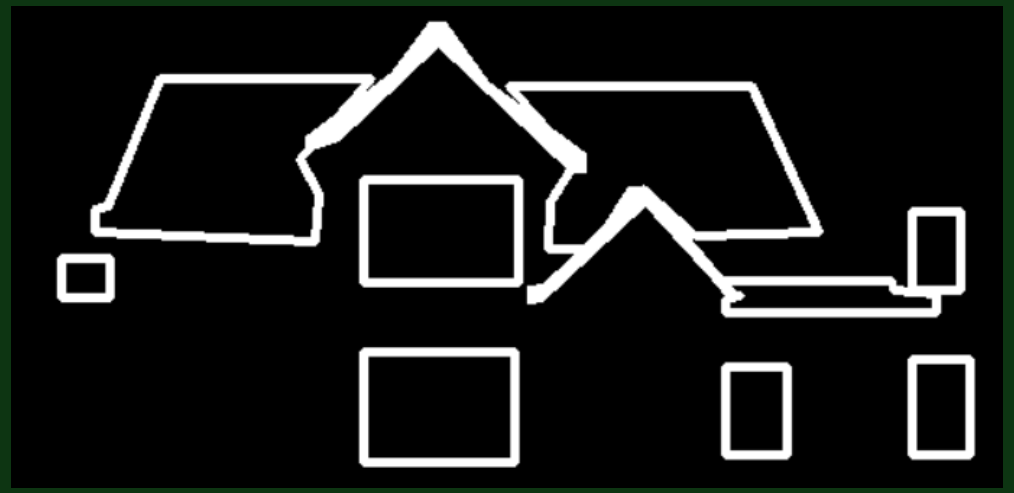
- Extract external contours via OpenCV
- Apply class-specific filtering:
  - Window: convert to bounding rectangle
  - Trim: Keep as polyline, no mask fill
  - Roof: smooth shape, remove jittery edges

Model Performance

Class	Precision	Recall	mAP@0.5	mAP@0.5:0.95
Roof	0.678	0.812	0.828	0.704
Trim	0.772	0.640	0.774	0.550
Window	0.884	0.822	0.930	0.772

Postprocessing Example





Process

Control Module

- Servo control
- LCD screen feedback
- Sound effects
- RTC time tracking
- Demo button

Vision Module

- capture_utils
- yolo_utils
- ui_utils
- edit_utils

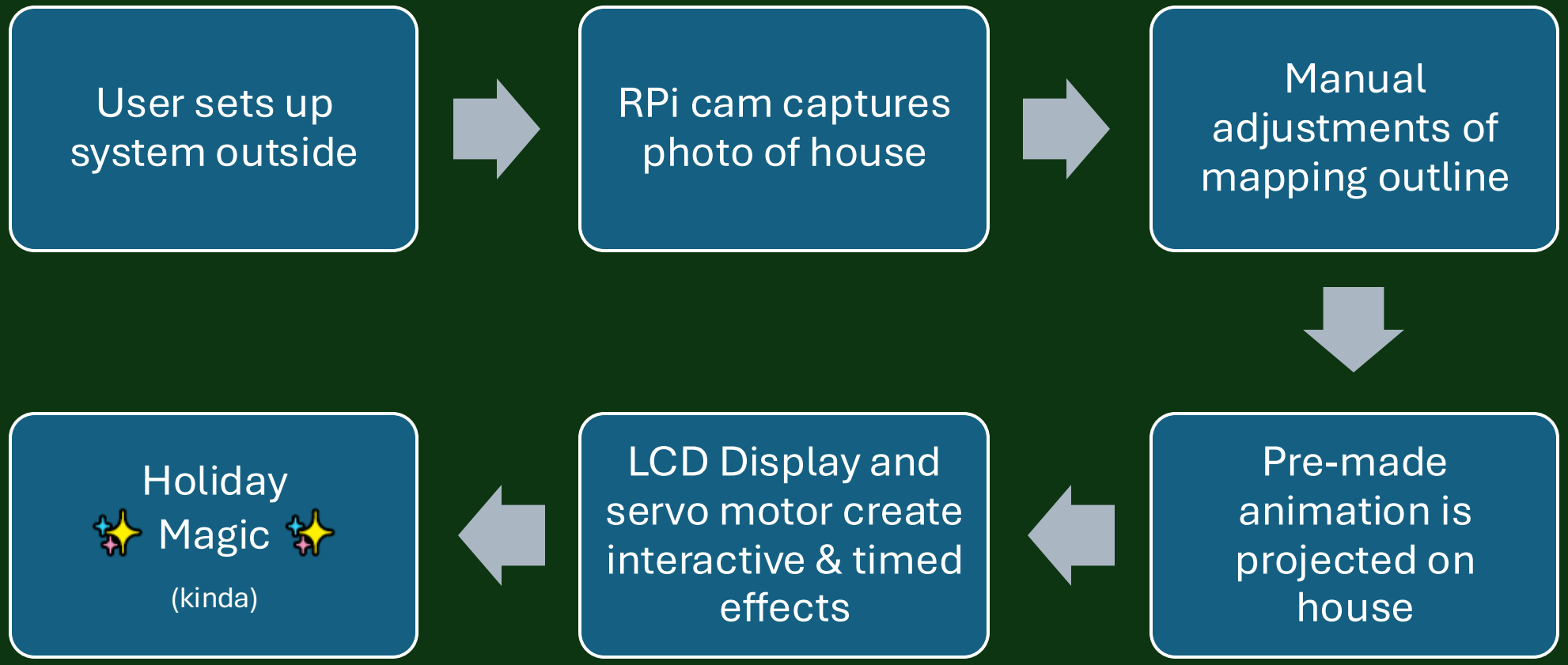
Projection Module

- Overlay GIFs
- Sends to projector

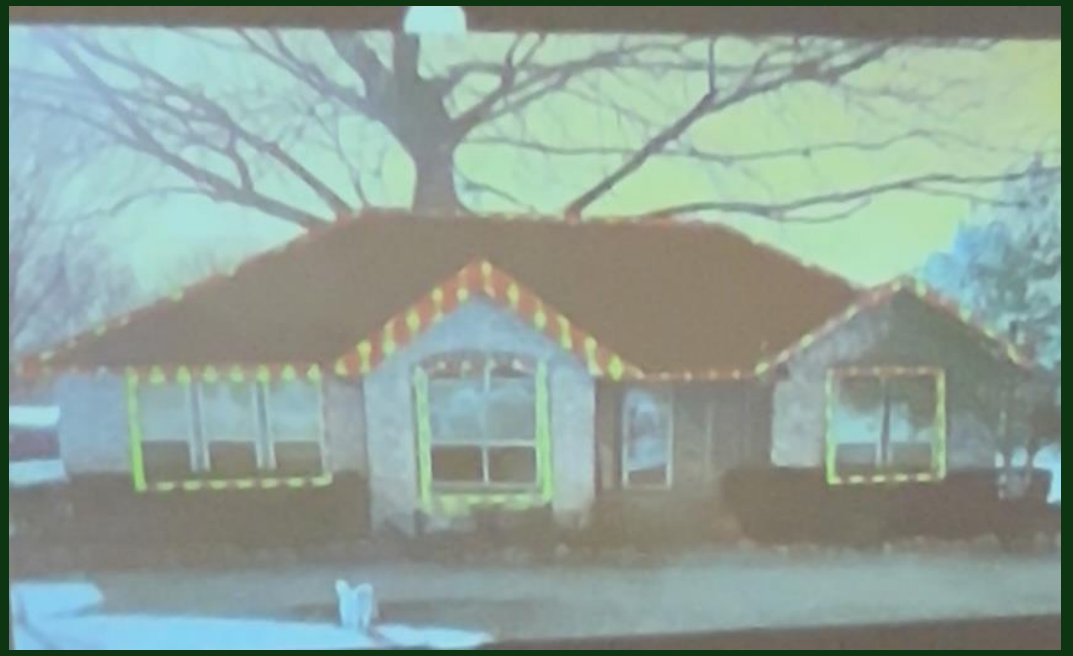
Challenges

- IR blaster integration
- Designing the container
- Servo motor precision
- Projection mapping accuracy

How it Works


User sets up system outside
RPi cam captures photo of house
Manual adjustments of mapping outline
Pre-made animation is projected on house
LCD Display and servo motor create interactive & timed effects
Holiday ✨ Magic ✨
(kinda)

Demo



Next Steps

Improve model prediction

Simplify user interface

Try out on actual house ☺