RoboLamp Gesture Controlled Lamp
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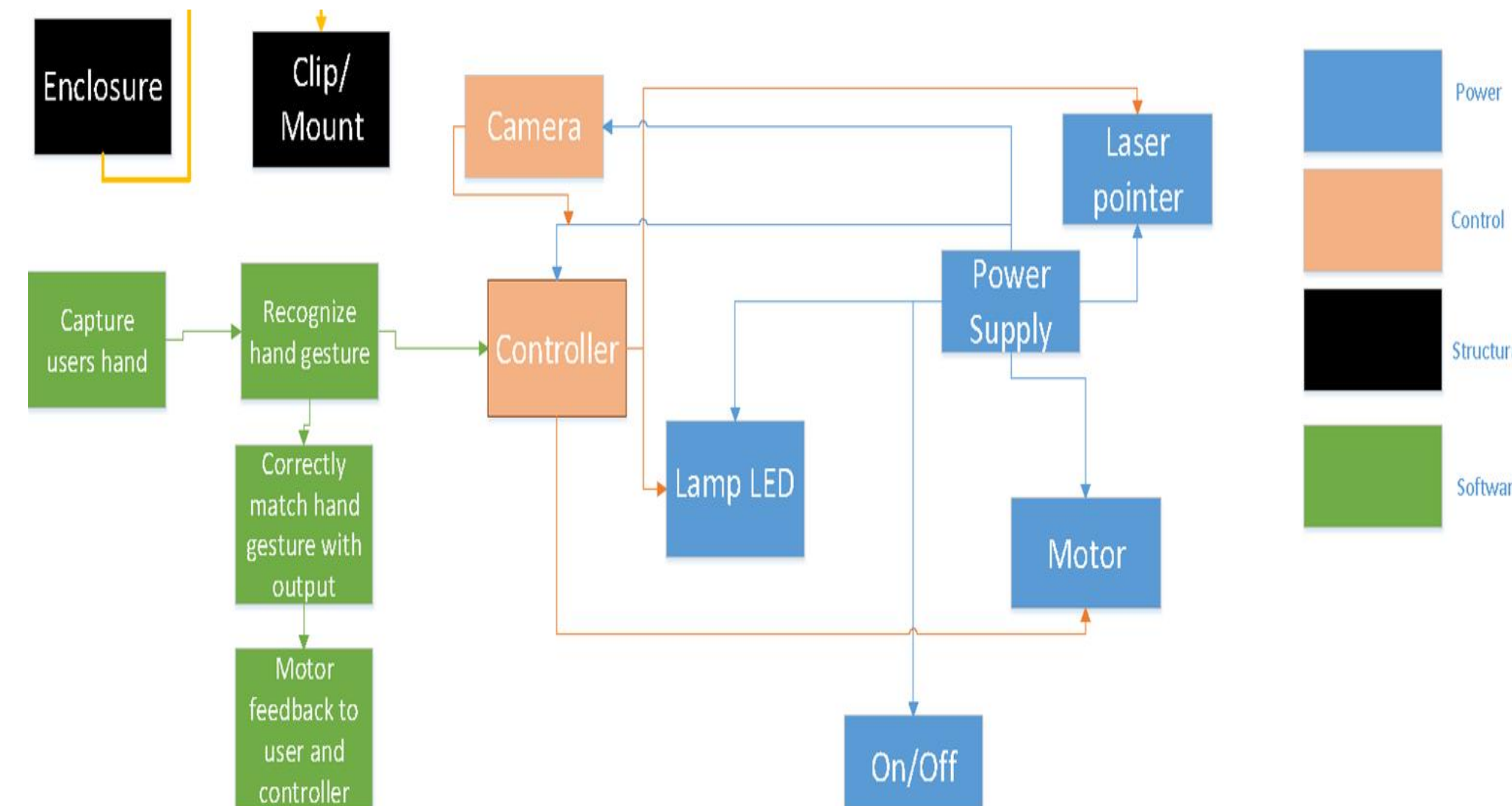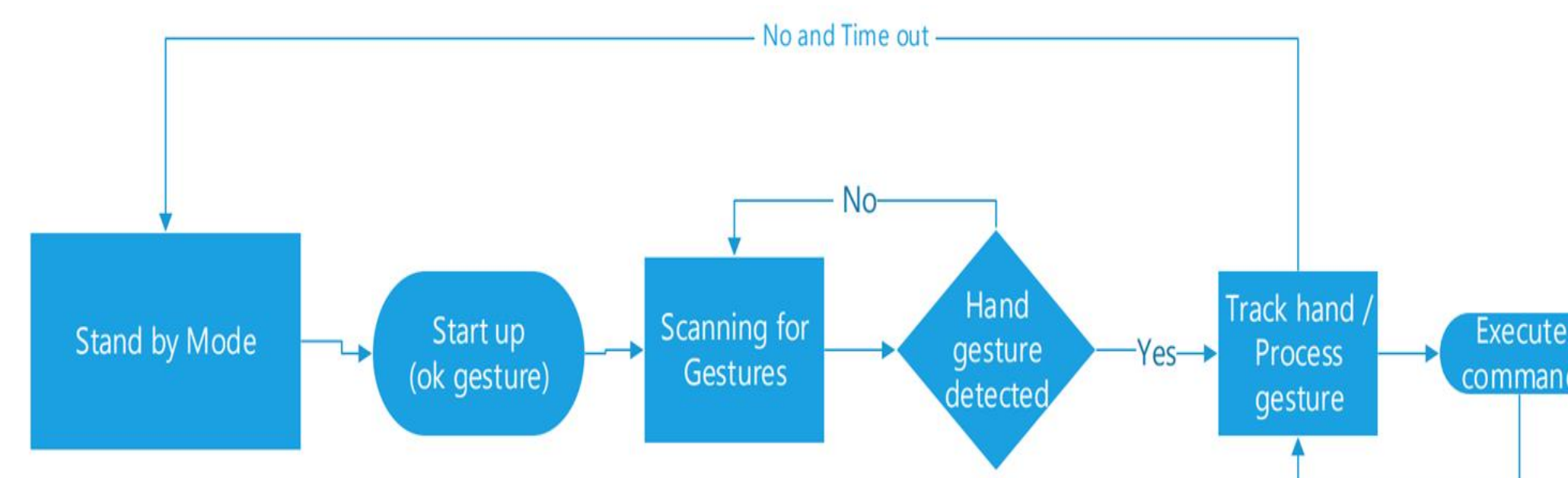
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Project Overview

The goal of this project was to create a hand gesture controlled desk lamp to be used in a cubicle. The user input consists of recognizing five distinct hand gestures that perform a corresponding task. These tasks include: initializing the program, changing brightness, spot size, pointing angle, and turning the light on/off.

Requirements

- The RoboLamp SHALL illuminate a surface 6' away
- The RoboLamp SHALL provide a minimum of 1200 lumens
- The RoboLamp SHALL implement Vision-based gesture control
- The RoboLamp SHALL recognize at least 5 gestures
- The RoboLamp SHALL control the following functions:
  - Brightness
  - Spot-size
  - Light Color
  - Laser pointer
  - Pointing angle
- The RoboLamp's Hardware controller SHALL have a 2.0 USB connection type A.
- The RoboLamp SHALL mount on the wall of a standard cubicle.
- The RoboLamp SHALL weigh no more than 5 lbs.
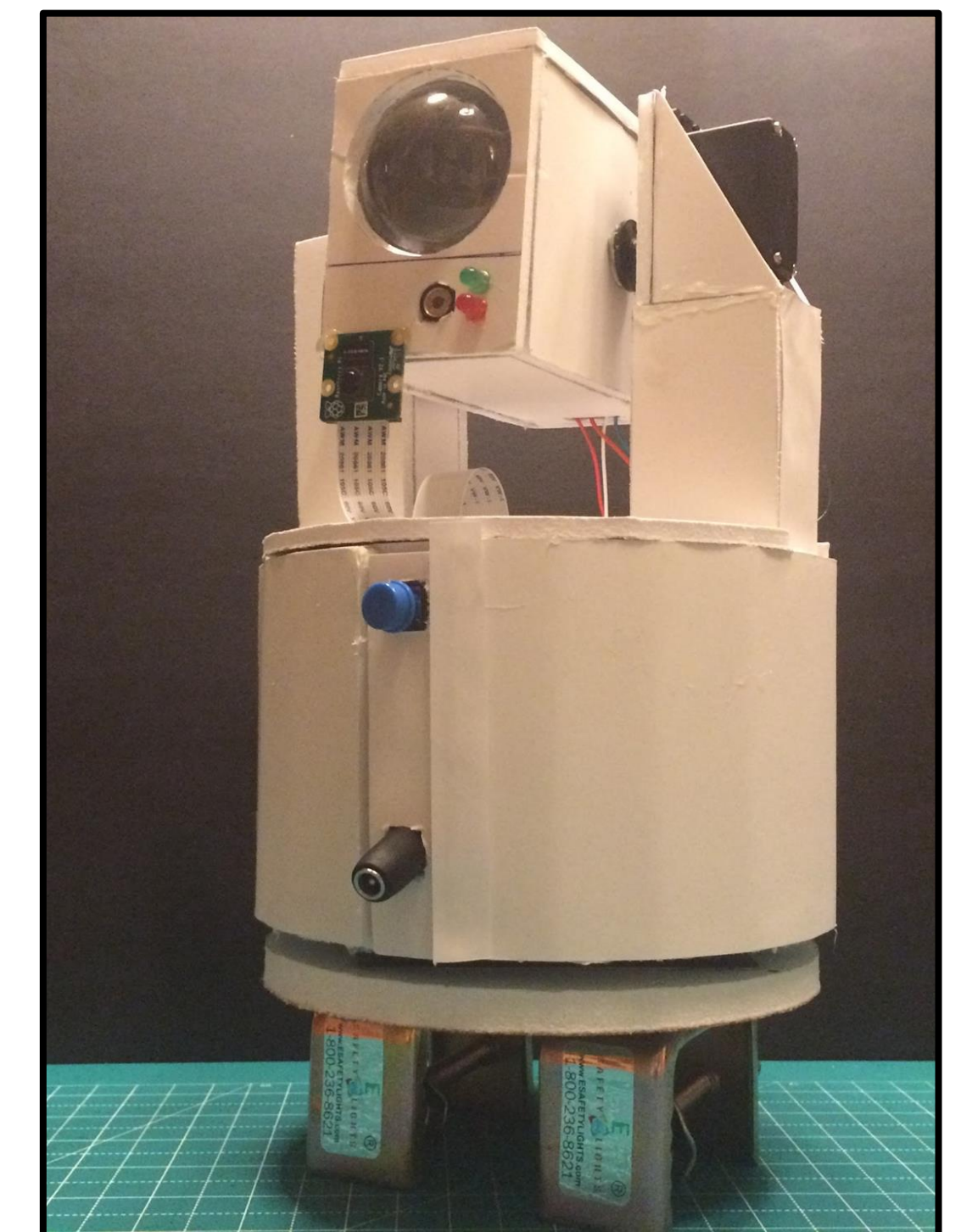- The RoboLamp SHALL operate from standard 110 VAC.

Software

The software, programmed onto the Raspberry Pi 3, captures the user input from the camera and decides the appropriate task. The development of the image processing algorithm used the OpenCV library. The specific program used to train each classifier was HaarCascade. It allowed us to create a custom classifier for each hand gesture. Then the specific classifier was used to detect hand gesture without any further image processing.

Hardware

Raspberry Pi 3 & Camera v2 **Raspberry Pi Servo Hat** **Convex Lens**

Servo Motors (3) **High Powered LED**

Additional Resources::
- Screw Clamps (2)
- Lazy Susan
- 5V Wall Adapter
- Jack to Alligator Clip Cable
- NPN Bipolar Junction Transistor

Laser Pointer **Red and Green LED**

Hand Gestures

Results/Conclusion

Our group successfully fulfilled the main project requirements. We implemented a working vision-based gesture control using HaarCascade. We also implemented the controllable features being brightness, spot-size, pointing angle, light color and laser pointer using our distinct hand gestures. The device can successfully clamp to the top of a cubicle wall, run off 110 VAC, and weighs less than 5 lbs.

Given more time, we could improve the hand recognition software. Currently the hand gesture recognition captures some false positive hand gestures and is most effective when used with a background that provides a high amount of contrast with the hand.

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