

Elsabot

Hobby Robot by Scott Horton



Motivations

- Continuation of a previous project that used iRobot base and object detection for ball picker (Jetson Nano + Realsense D435i Camera)
- Platform for trying-out the OpenCV/Luxonis OAK-D camera
- Playground for involving 3-year old granddaughter

Project Documentation and Source on GitHub

- Top-level project repo containing project report
 - <https://github.com/rshorton/elsabot>
 - Report: https://github.com/rshorton/elsabot/raw/main/Team_Grandplay_Report.pdf
- Robot Head (vision, camera tracking, UI LEDs) repo
 - https://github.com/rshorton/robot_head
- Control (behavior tree action nodes and trees) repo
 - https://github.com/rshorton/elsabot_bt
- Speech (synthesis, recognition, wake word detection) repos
 - https://github.com/rshorton/speech_output_server
 - https://github.com/rshorton/speech_input_server
- Other repos (see project report appendix)

Key Components

[**Platform** section of project report]

Demo Video

OpenCV AI Competition video submission:

<https://youtu.be/WZ-JJvT5fn8>

Software Architecture

[**Software Architecture** section of project report]

Code Walkthrough

- Vision Node - https://github.com/rshorton/robot_head/blob/main/robot_head/vision.py
 - Pipeline Setup - (Vision Node section of doc and <https://docs.luxonis.com/projects/api/en/latest/>)
 - MobileNet SSD object detection (21 classes including human)
 - Google MediaPipe Blazepose
 - Processing Loop
- Behavior Tree node - <https://www.behaviortree.dev/>
 - Initialization - https://github.com/rshorton/elsabot_bt/tree/main/src/bt_ros2.cpp
 - Custom tree node examples
 - https://github.com/rshorton/elsabot_bt/blob/main/src/human_pose_detect.hpp
 - https://github.com/rshorton/elsabot_bt/blob/main/src/nav2_client.hpp
 - Trees
 - Pose Test - https://github.com/rshorton/elsabot_bt/blob/main/bt_xml/bt_pose1.xml
 - Elsabot games - https://github.com/rshorton/elsabot_bt/blob/main/bt_xml/bt_game_top.xml
 - Debugging/logging

Project Next Steps

- Replace RPi4s with a more powerful Celeron-based SBC (finished)
 - Seeed Odyssey X86 Blue J4125
 - 50% CPU headroom (for existing Elsabot functionality)
 - Quad-Core CPU (CPU freq 2.0-2.7GHz)
 - 2 x M.2 PCIe slots (one slot used for 128 GB SSD)
 - SATA III interface, 4 x USB Ports, 40-pin Raspberry Pi compatible header, 28-pin Arduino compatible header
 - Onboard ATSAMD21 32-bit ARM Cortex-M0 (Arduino) coprocessor
 - DC power: 12-19V DC
- Add 5 DOF Arm for pick and place and new BT action nodes
- New games/tasks leveraging Arm

Questions