Cameye

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Basic Idea

- Mechatronics solution for assisting visually impaired
- Computer vision and Deep learning techniques
- Minimalistic use of additional hardware
- Commonly used hardware like smartphone and headphones.

Features

- Object is detected when a finger is pointed at it.
- Distance from the camera is obtained.
- Name of the object and distance are listened through headphones.
- The person is warned is they are about to run into anything.

Work Flow

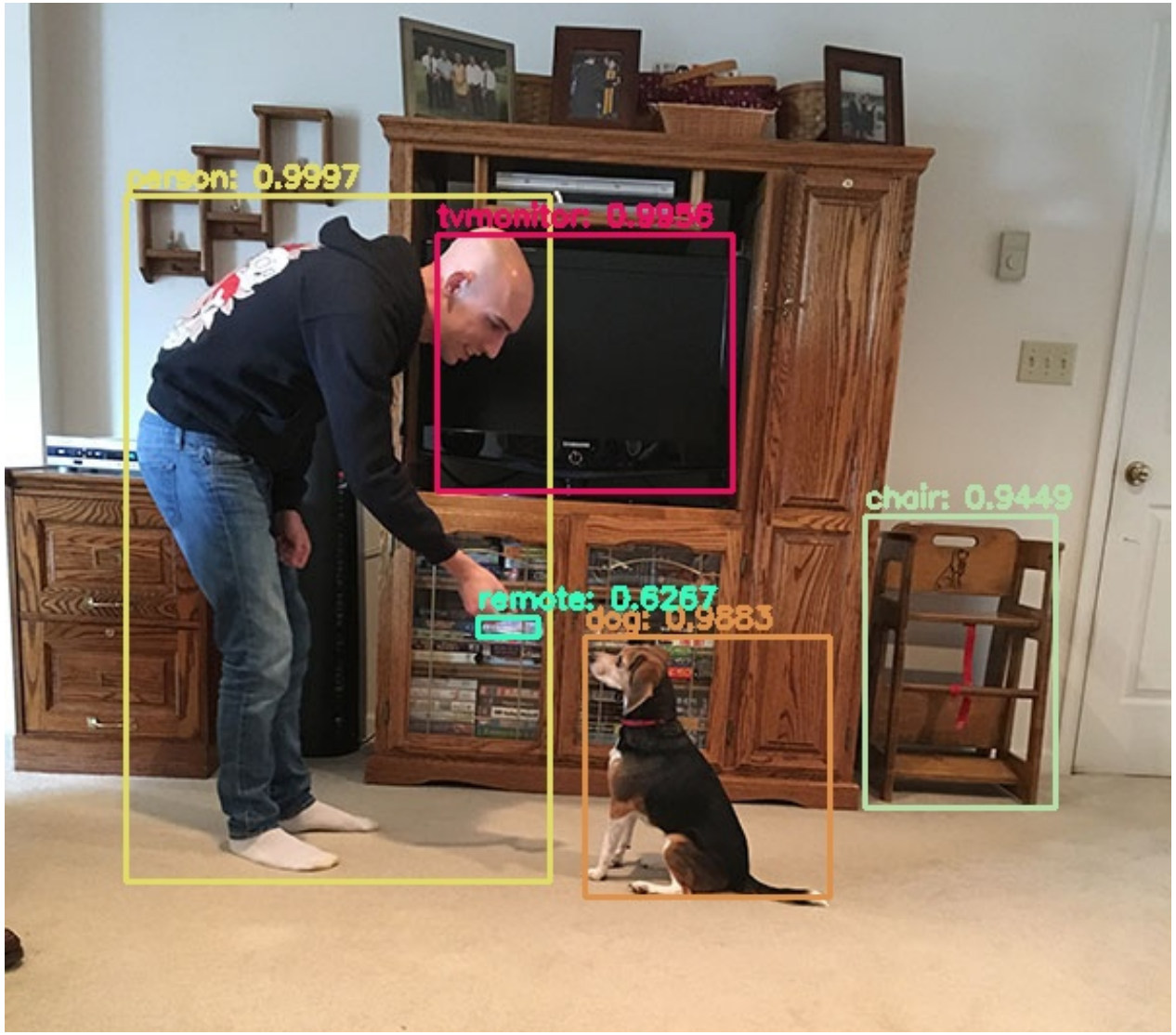
- Stream live feed from phone camera to raspberry pi
- Object detection using OpenCV and Neural Networks
- Finger tracking using contour detection
- Focal length based distance measurement
- Ultrasonic for proximity monitoring
- Serial communication between ardunio and raspberry pi

Components

- Raspberry Pi 3b+
- Arduino Uno
- Ping Sensor
- Smartphone (Preferably with stereo camera)
- Headphones with Bluetooth

Streaming and Detection

- IP Web cam is used to convert smartphone camera into an IP camera.
- Streaming is achieved through Wi-Fi using Urllib and Opencv.
- You Only look Once(Yolov3-tiny) model is used for detection.
- It can detect up to 79 different objects.
- Bounding boxes are obtained around the object.


person: 0.9997
tvmonitor: 0.9956
chair: 0.9449
remote: 0.6267
dog: 0.9883

Finger Tracking

- HSV histogram for skin color is calculated.
- Parts of image with skin color are isolated using histogram black projection.
- The boundary of wrist is recognized using contour detection.
- The finger tip is considered as farthest point from the mean of the obtained points in contour.
- Limitation is the background having similar color as skin.

Lite
ROYAL

Object and distance

- The only object whose bounding box is surrounding finger tip is chosen.
- The focal length of the camera is calibrated.
- Distance from the camera is estimated using the technique:
  - Distance = Focal length * known width/pixel width
- Widths of few objects are calculated and hardcoded.
- Limitation is to know the actual width of the object.

refrigerator at 68.0in

Sound transmission

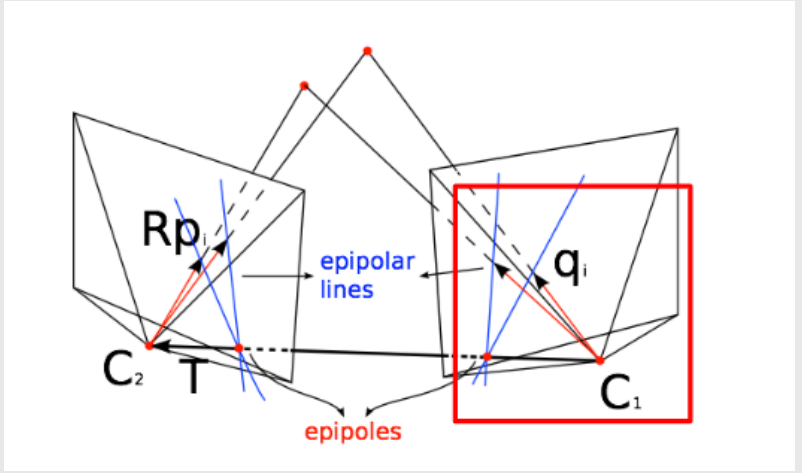
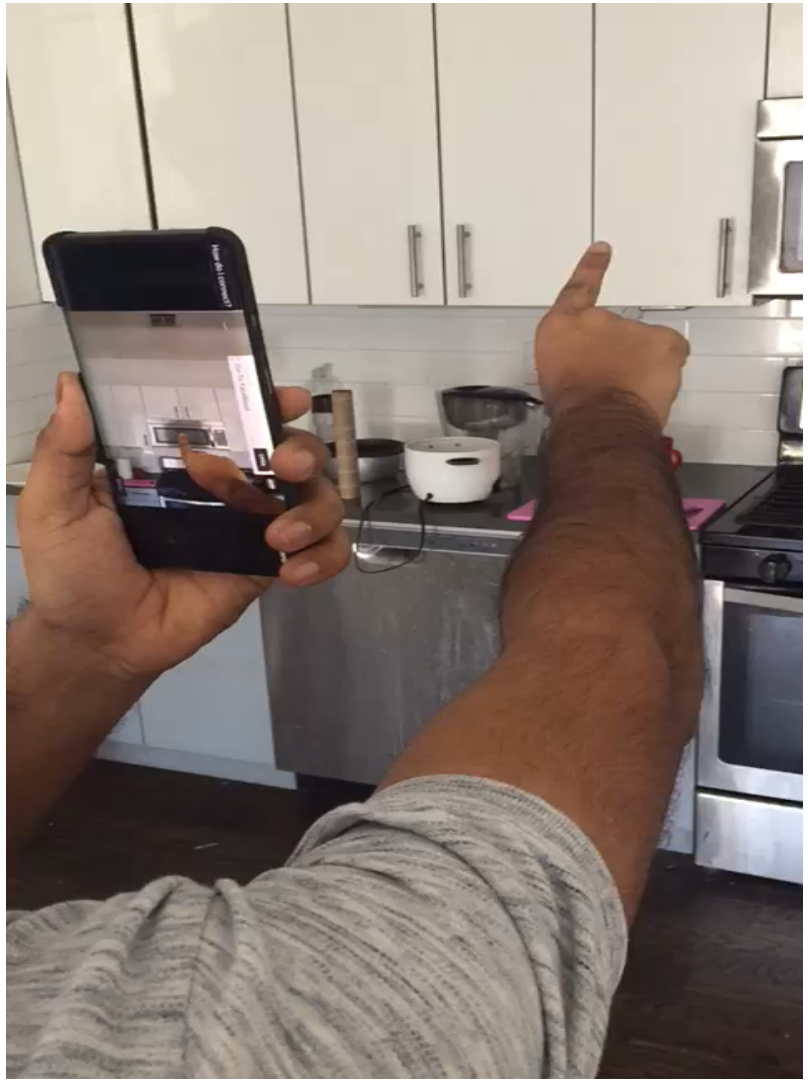
- A sentence is made based on the name and distance of object.
- NLP based gTTS package in python is used to convert this sentence to speech and stored as an mp3 file.
- Pygame is used to play this file when needed.
- Headphones are connected to Raspi through Bluetooth to hear this sentence.

Proximity

- Ultrasonic sensor along is Arduino is used to estimate the proximity of nearby obstacles.
- USART serial communication is used to transmit data to Pi.
- Whole data from previous read need to be grabbed due to serial communication.
- The last line indicates the current proximity.
- A warning message is played on headphones if the distance is less a certain threshold.

Future Scope

- Accurate distance can be measured using epipolar geometry with stereo camera data.
- Using motion sensors data from smartphone for localization.
- Better processing to run bigger yolo models.
- Multiple proximity sensors to detect obstacles around.



Demo