Proactive framework for object detection and path navigation for visually impaired

Btech 4th sem minor project

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Introduction

- It’s a known fact that globally there are 43 million people living with blindness and 295 million people living with moderate-to-severe visual impairment. They suffer regular and constant challenges in Recognizing objects and Navigation especially when they are on their own They are mostly dependent on someone for even accessing their basic day-to-day needs.
- we propose an Integrated Machine Learning System which allows the Blind Victims to identify and classify Real Time Based Common day-to-day Objects and generate voice feedbacks and calculates distance which produces warnings whether he/she is very close or far away from the object.

- The same system can be used for Obstacle Detection Mechanism.

(Source:https://ind.orbis.org/en)

Issue addressed

- vision is one of the most important human sense that plays a major role in life , visually impaired people face many issues (later addressed) and have to depend on someone even for very simple tasks
- **Personal object detection -**
  recognizing personal daily objects such as bottles, chairs , bed, tv, sofa etc. even in distinguishing between objects is a tough task. eg. Ball and apple
- **Difficulty in Navigation -**
  for navigation blind people generally use a White cane or take help of others whenever walking through a pathway with obstacles such as roads, college corridors
- **Distance measure & Danger Alert -**
  Measures distance of object from the camera and alerts a danger message when the object is close enough

Existing Solutions

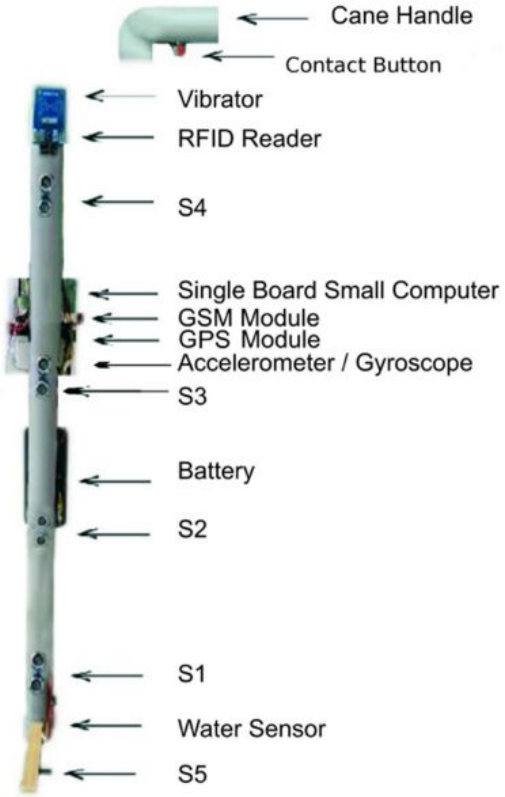
ReCog: app Supporting Blind People in Recognizing Personal Objects (CHI 2020 Paper)

Drawbacks

- Does not provide guided navigation.
- No obstacle detection

Existing Solutions

An Astute Assistive Device for Mobility and Object Recognition for Visually Impaired People (IEEE Transactions)



Advantages

- helps in navigation
- wet floor detection
- helpful for stairs

Drawbacks

- Does not provide guided navigation.
- no object detection

Existing Solutions

Mobile applications such as Microsoft Seeing AI are trained to recognize common objects (e.g., car, cup) or commercial products

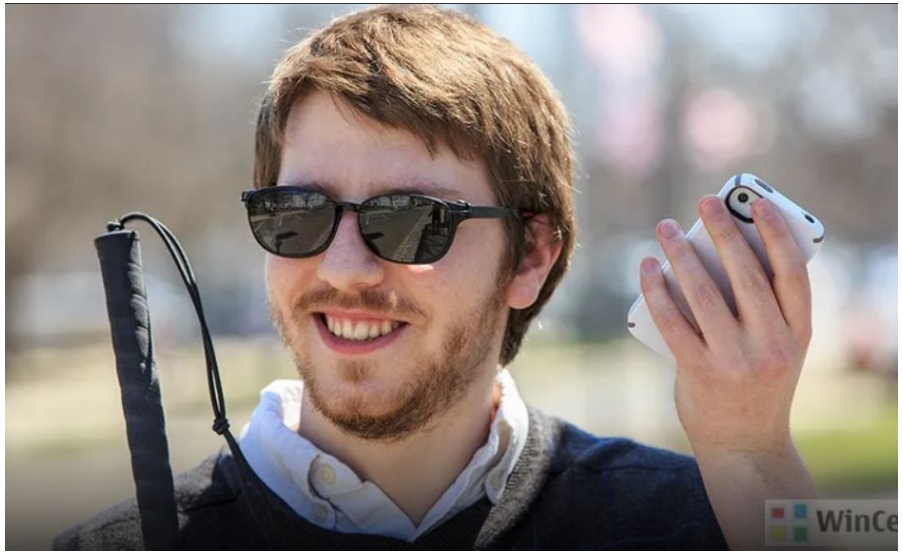
Drawback

Does not provide guided navigation.

Proposed Solution

Includes the following:-

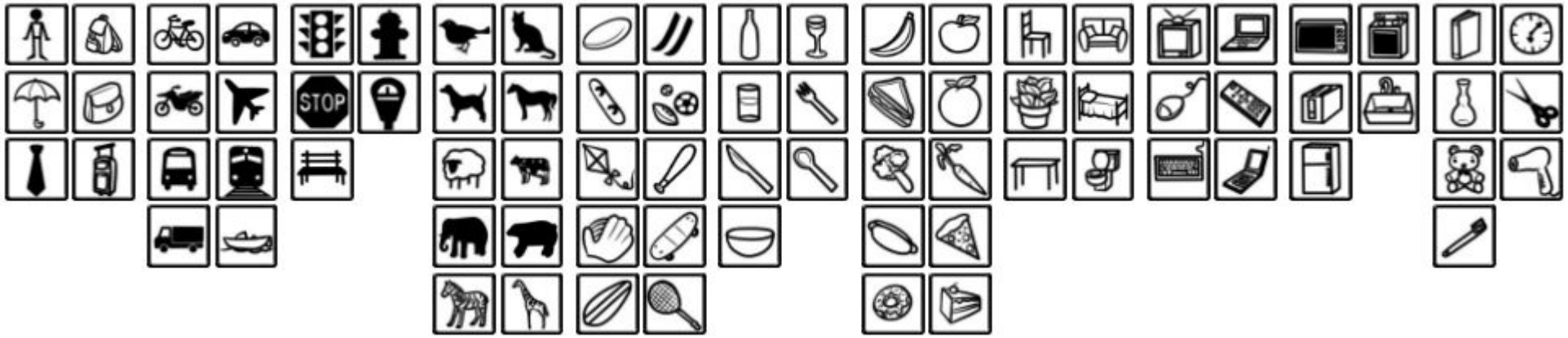
1. Object detection through photos/videos
2. Real Time Object detection
3. Speech output of recognized object
4. Distance measurement and danger alert
5. Guided Path Navigation



Dataset used

COCO Dataset

- 80 object categories
- Recognition in context
- Superpixel stuff segmentation
- 330K images (>200K labeled)
- 1.5 million object instances
- 91 stuff categories
- 5 captions per image
- 250,000 people with keypoints



Introduction to object detection

Object detection is a computer vision technique for locating instances of objects in images or videos. Object detection algorithms typically leverage machine learning or deep learning to produce meaningful results. When humans look at images or video, we can recognize and locate objects of interest within a matter of moments. The goal of object detection is to replicate this intelligence using a computer.

Available Algorithm

- Convolutional implementation of sliding windows
- The YOLO (You Only Look Once) Algorithm
- R-CNN – Region-based Convolutional Neural Networks

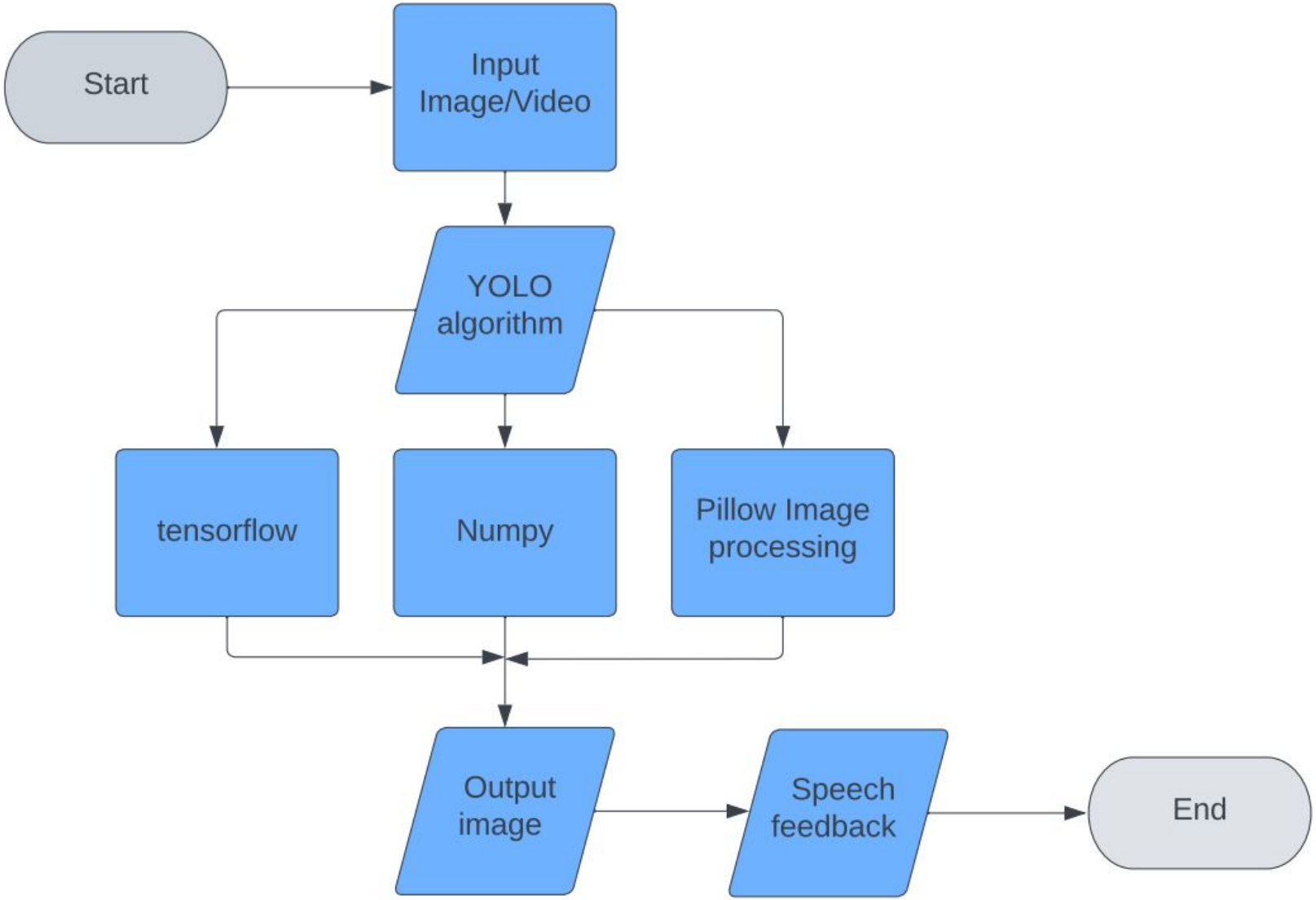
Yolo Algorithm

YOLO is an algorithm that uses neural networks to provide real-time object detection. This algorithm is popular because of its speed and accuracy. It has been used in various applications to detect traffic signals, people, parking meters, and animals.

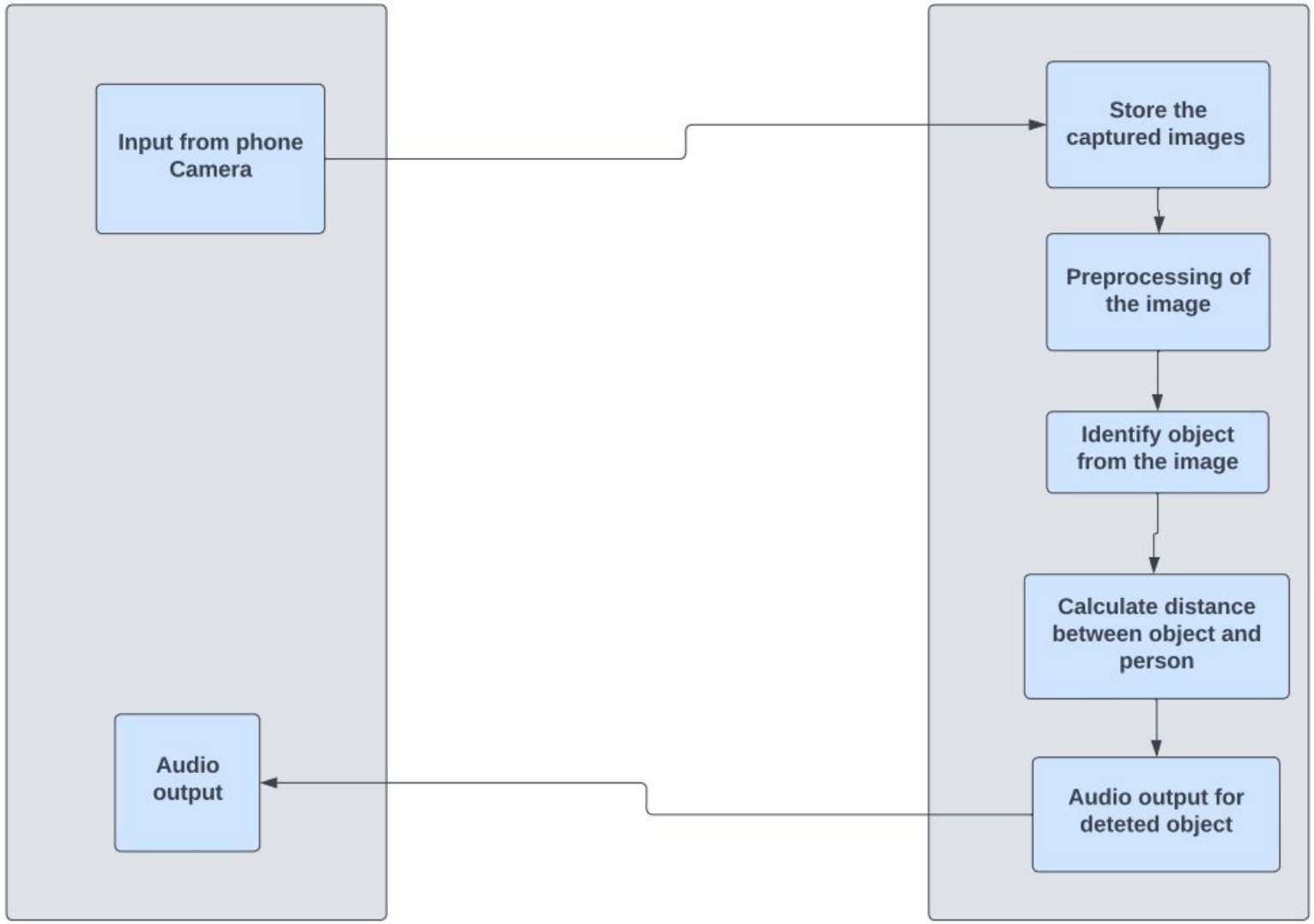
YOLO stands for you only look once and It's popular because it achieves high accuracy while running in real time. This algorithm is called so because it requires only one forward propagation pass through the network to make the predictions

YOLO algorithm works using the following three techniques:

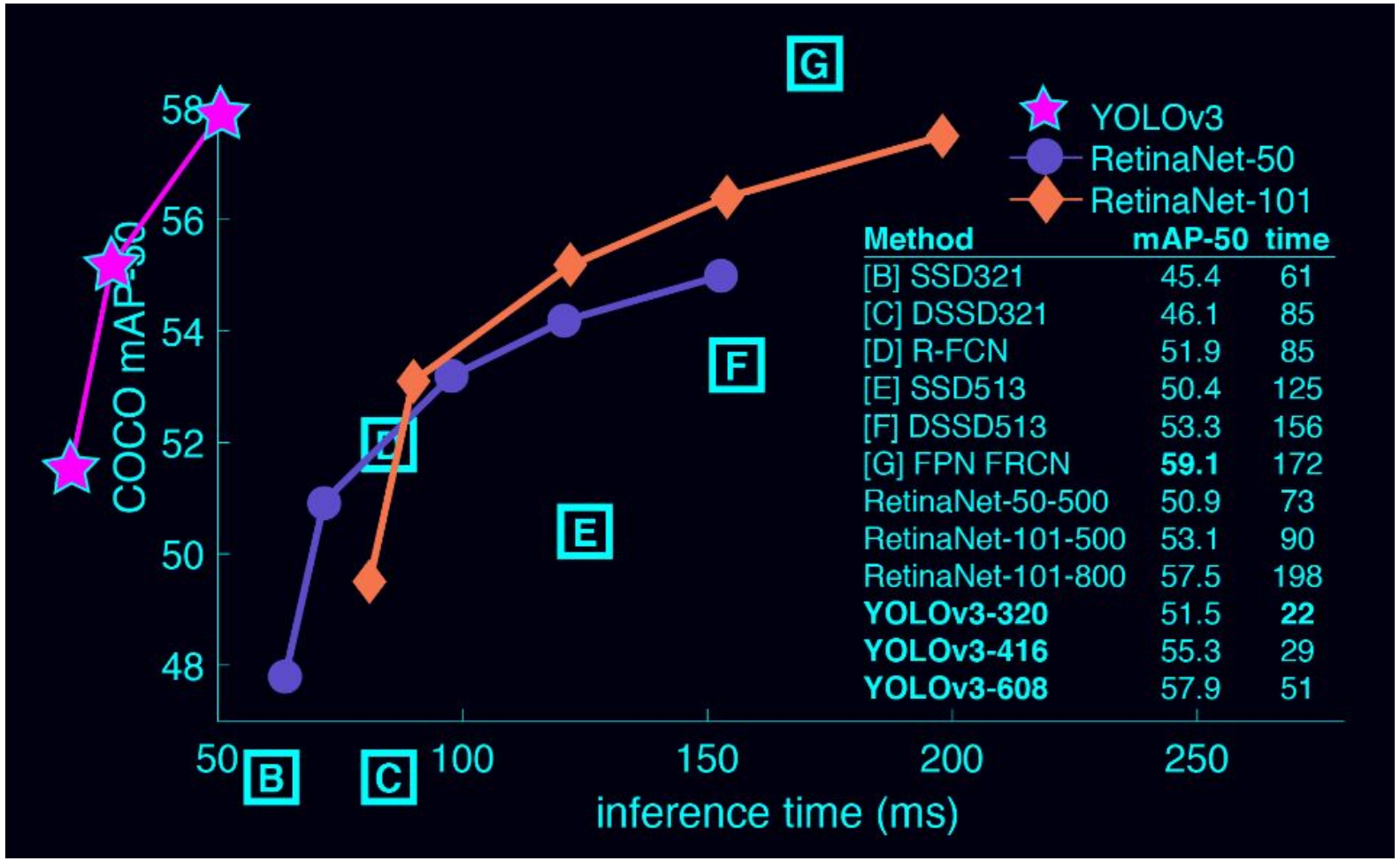
- Residual blocks
- Bounding box regression
- Intersection Over Union (IOU)


Start
Input Image/Video
YOLO algorithm
tensorflow
Numpy
Pillow Image processing
Output image
Speech feedback
End

Navigation flowchart



Challenges faced and Implementation



choosing weight and cfg

Performance on the COCO Dataset

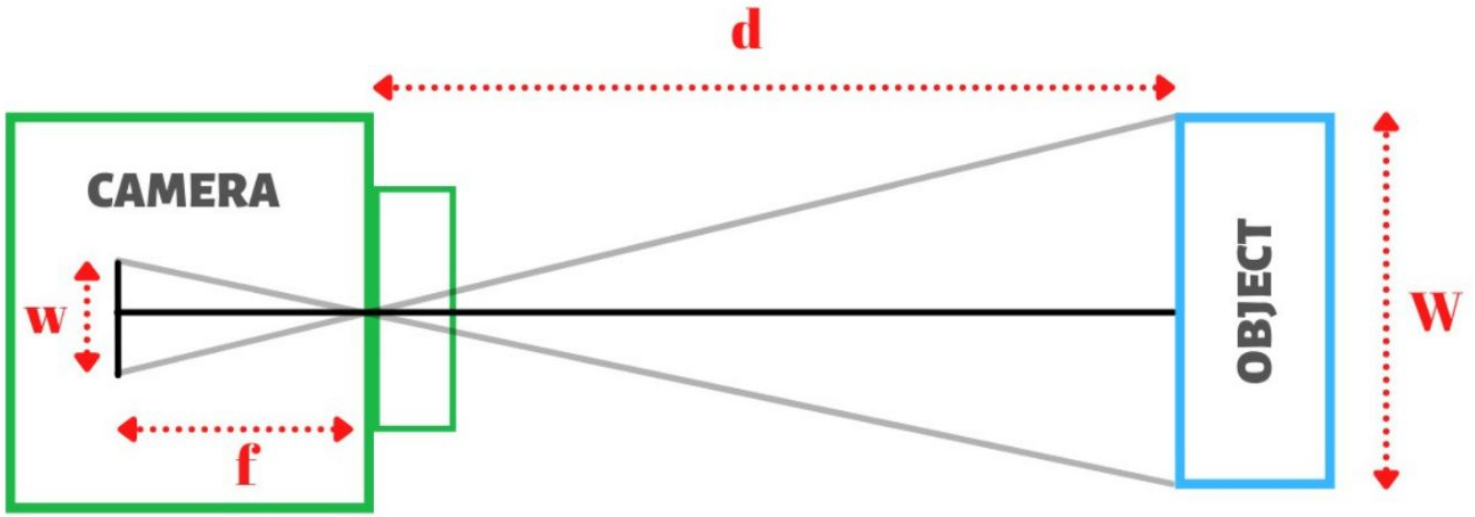
Model	Train	Test	mAP	FLOPS	FPS	Cfg	Weights
YOLOv3-320	COCO trainval	test-dev	51.5	38.97 Bn	45	cfg	weights
YOLOv3-416	COCO trainval	test-dev	55.3	65.86 Bn	35	cfg	weights
YOLOv3-608	COCO trainval	test-dev	57.9	140.69 Bn	20	cfg	weights
YOLOv3-tiny	COCO trainval	test-dev	33.1	5.56 Bn	220	cfg	weights
YOLOv3-spp	COCO trainval	test-dev	60.6	141.45 Bn	20	cfg	weights

Determining Distance

Traditionally we measure distance of any object using Ultrasonic sensors such as HC-sr04 or any other high frequency devices which generate sound waves to calculates the distance it traverse.

Stereo camera

Our approach to distance measurement

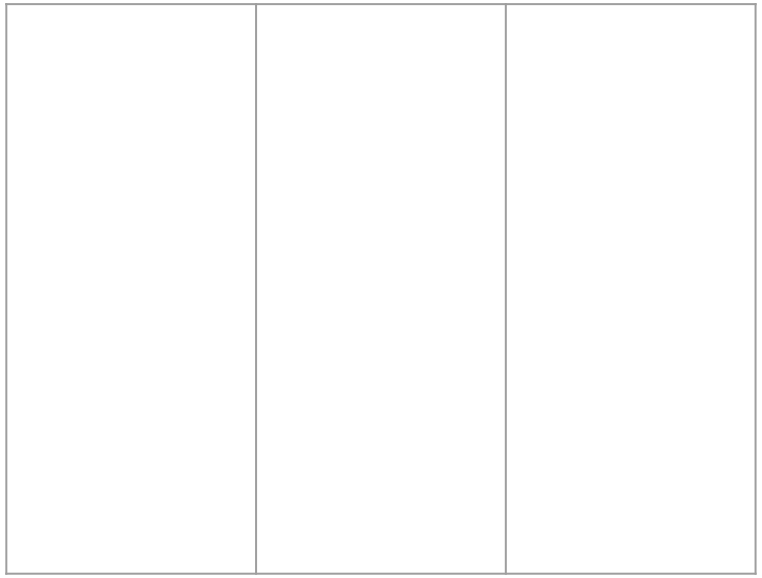


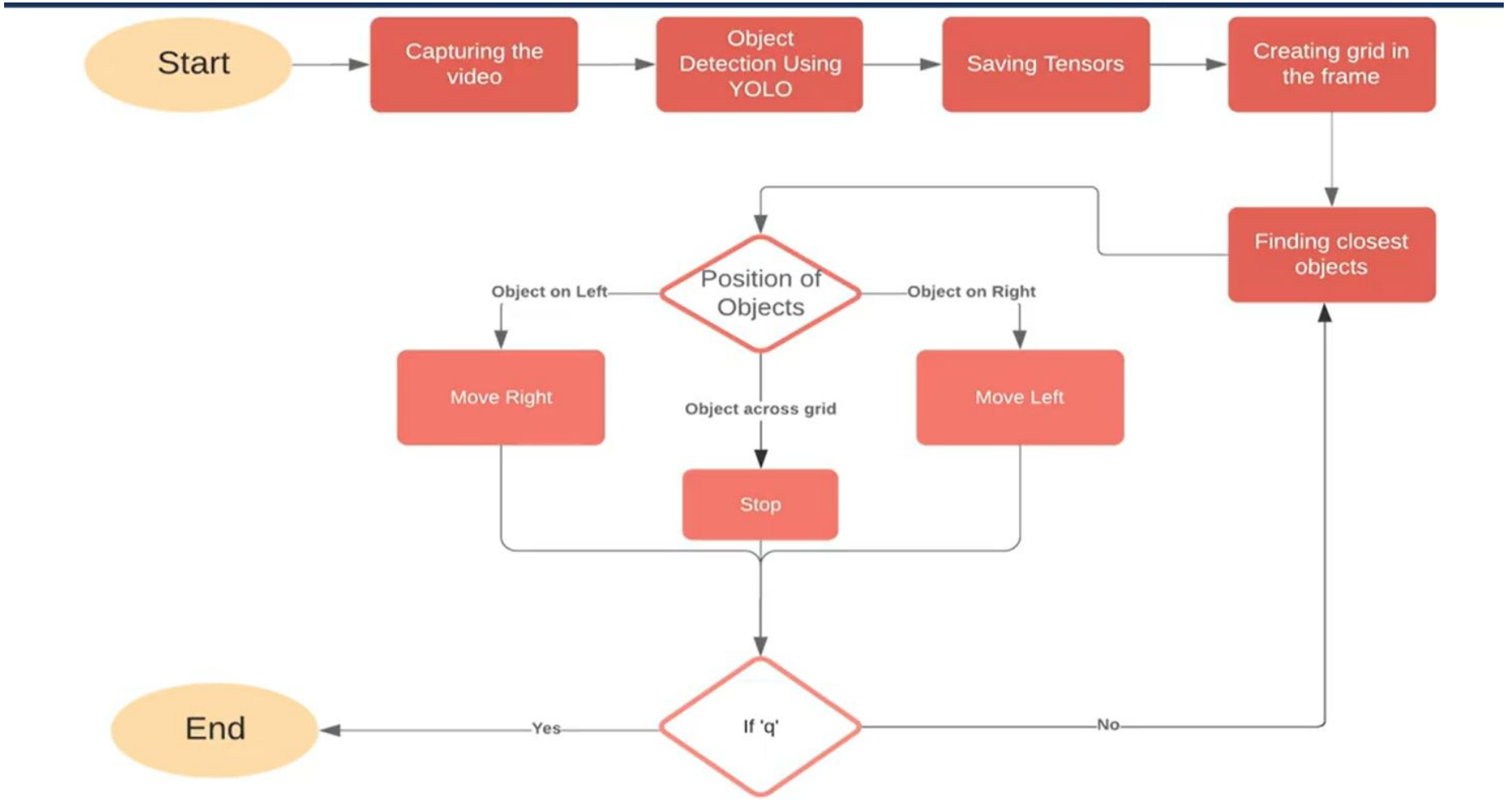
f = focal length
w = width in pixels
d = distance in cm
W = width in cm

Focal Length	Distance
f = (w*d) / W	d= (W*f) / w

Navigation

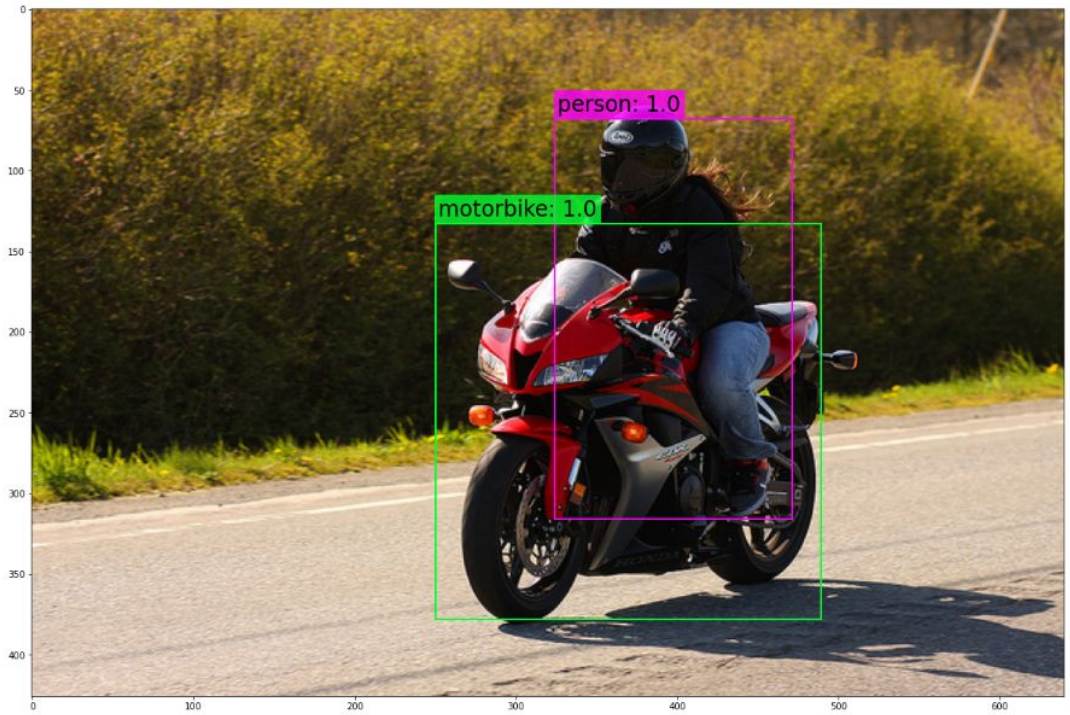
- Not able to detect walls
- not able to determine depth from each and every object
- what if a mobile object came across
- How to provide path navigation if no accurate depth estimation?




Start
Capturing the video
Object Detection Using YOLO
Saving Tensors
Creating grid in the frame
Finding closest objects
Position of Objects
Object on Left
Object on Right
Move Right
Move Left
Object across grid
Stop
If 'q'
Yes
No
End

Results

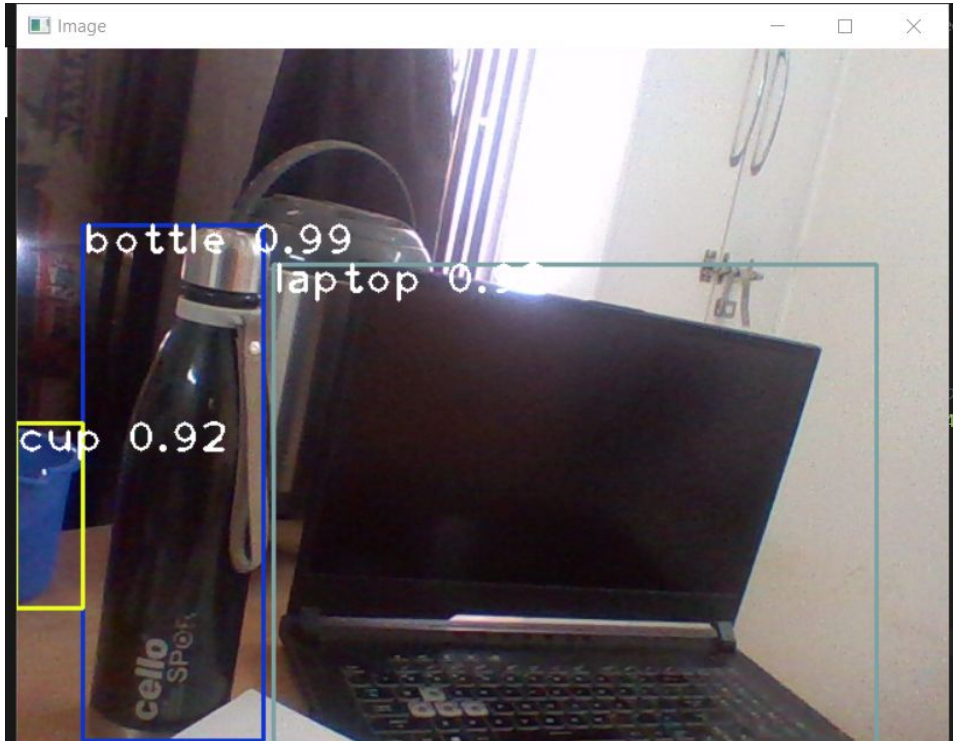
```
It took 0.444 seconds to detect the objects in the image.

Number of Objects Detected: 2

Objects Found and Confidence Level:

1. motorbike: 0.999995
2. person: 0.999999
```



detection through Images/video

- Object detection through images / videos

Results



Real time object detection

- Produces speech output of detected objects

Results

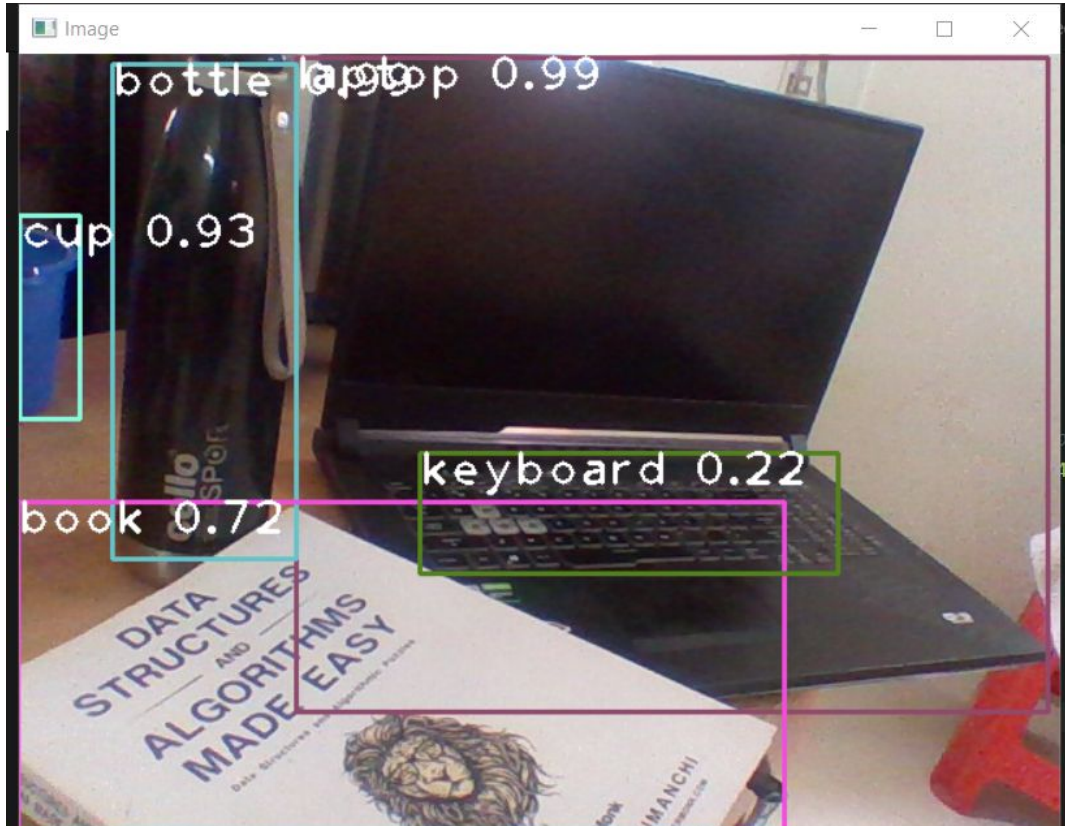
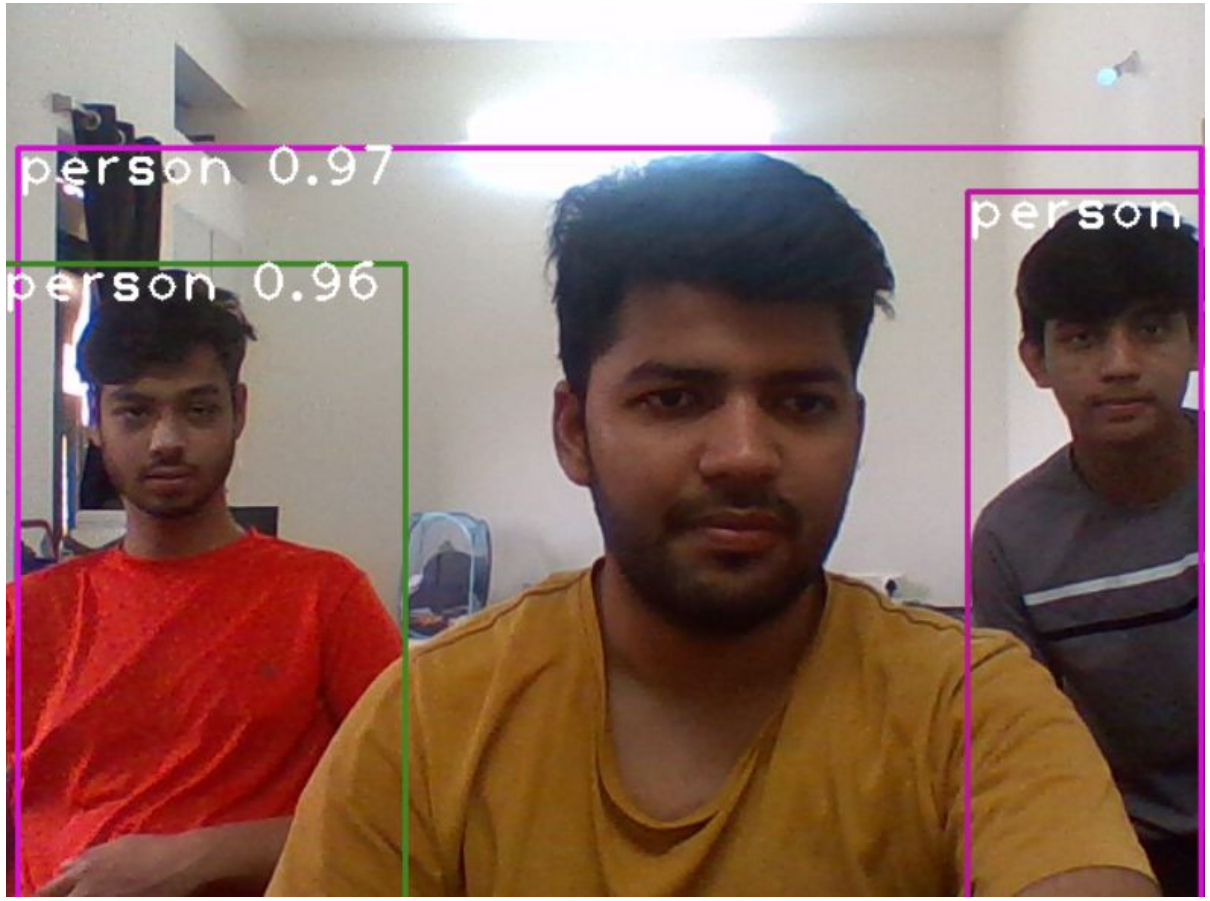


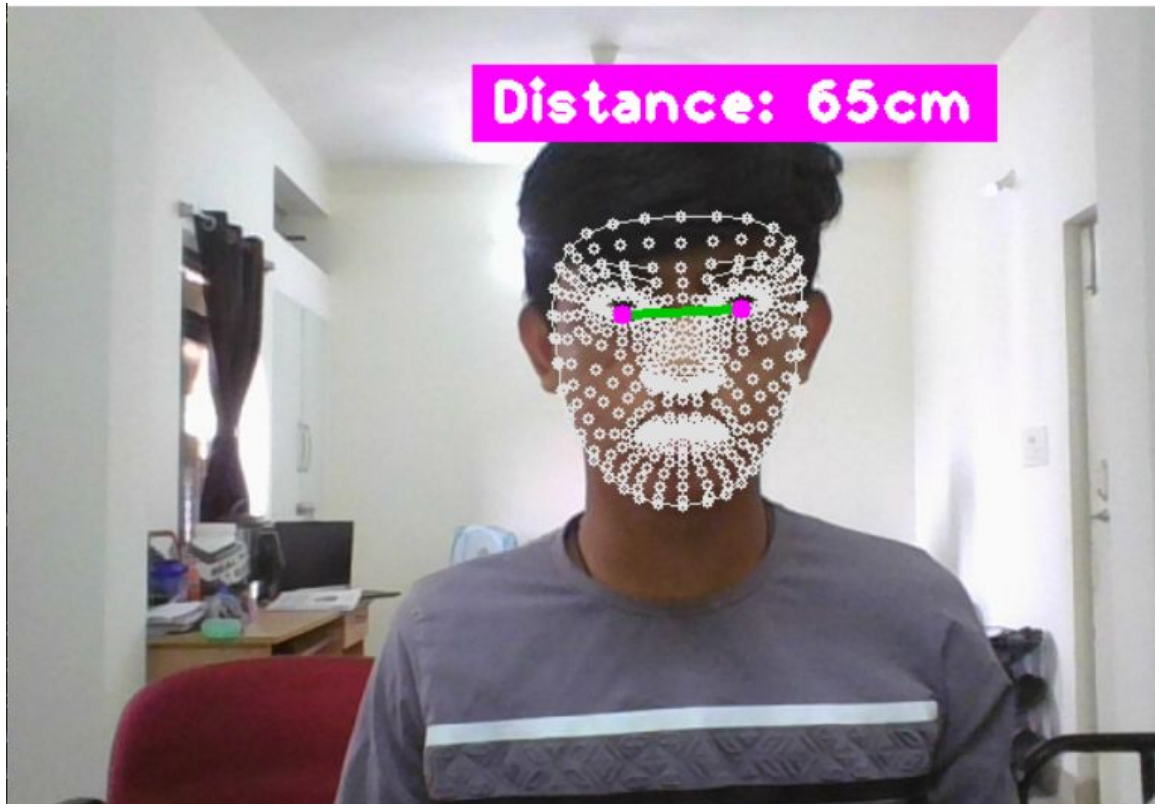
Image
bottle
laptop 0.99
cup 0.93
keyboard 0.22
book 0.72
DATA STRUCTURES AND ALGORITHMS MADE EASY

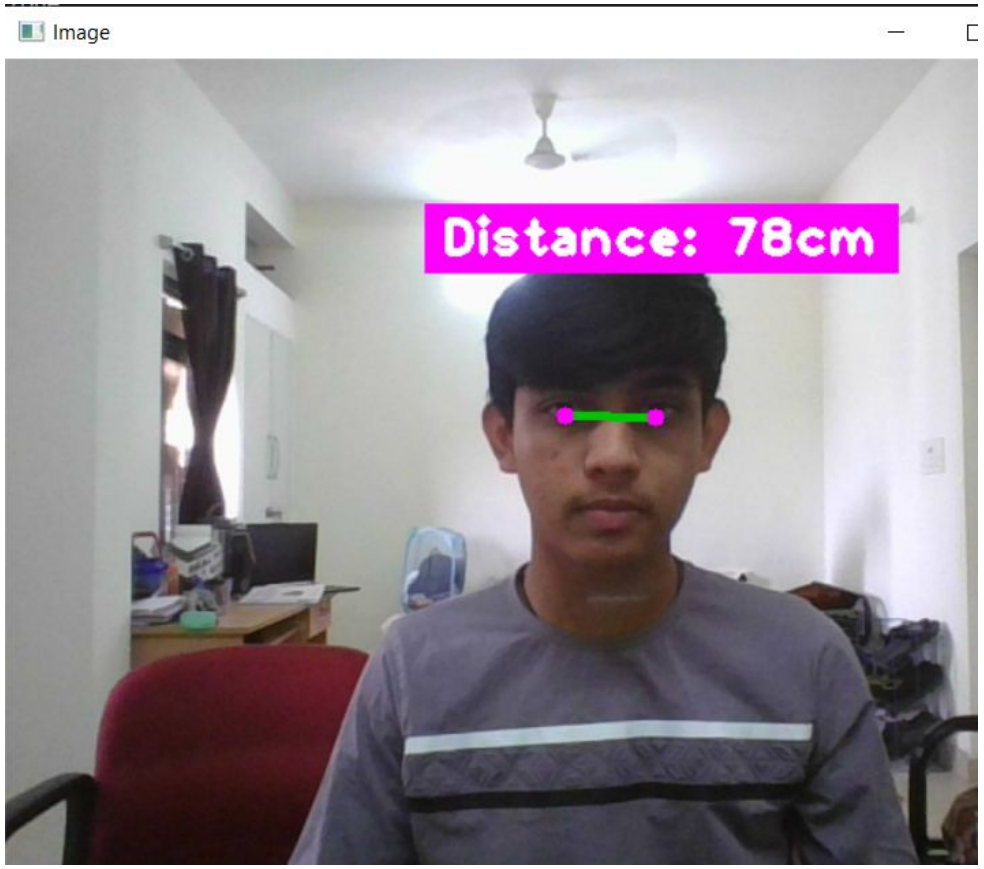
Results



Real time object detection

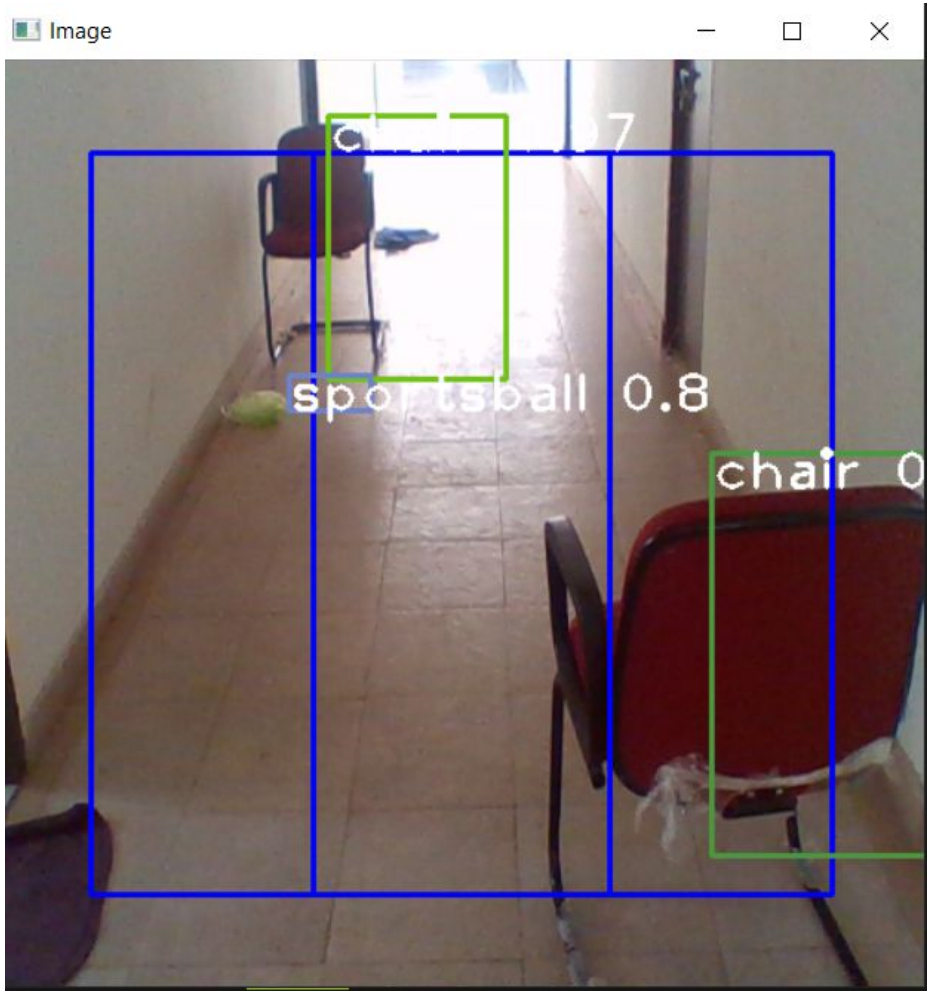
Results





if person too close alerts the user

Results



Thank You

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