A

PROJECT REPORT

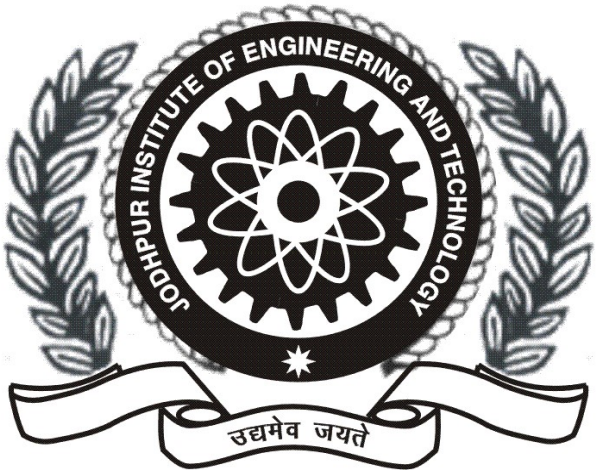
ON

"Social Distance Analyzer"

In partial fulfillment of

B. Tech IV year

Computer Science and Engineering.



Submitted To:
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Submitted by:
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VII SEMESTER

Department of Computer Science & Engineering
Jodhpur Institute of Engineering & Technology, Jodhpur
June 2021-2022

Certificate

This is to certify that the project entitled "**Social Distance Analyzer**" has been carried out by the student of "Jodhpur Institute of Engineering and Technology, Jodhpur" under my guidance and supervision in partial fulfillment of the degree of Bachelor of Engineering in Computer Science & Engineering of Bikaner Technical University, Bikaner during the academic year 2021-2022.

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Acknowledgment

I would like to acknowledge the contributions of the following people without whose help and guidance this project report would not have been completed.
I respected and thank **Ms. Harshita Khangarot**, for providing me an opportunity to do this project work and giving me all support and guidance, which made me complete the project up to very extent.

I am also thankful to **Prof. (Dr.) Rajendra Purohit**, H.O.D of Computer Science Engineering Department, Jodhpur Institute of Engineering and Technology, for his constant encouragement, valuable suggestions and moral support and blessings.

Although it is not possible to name individually, I shall ever remain indebted to the faculty members of Jodhpur Institute of Engineering and Technology, for their persistent support and cooperation extended during his work.

This acknowledgement will remain incomplete if I fail to express our deep sense of obligation to my parents and God for their consistent blessings and encouragement.

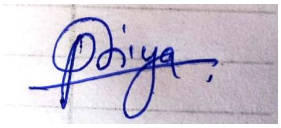
Letter of Real Client

To whom it may concern:

I hereby authorize **Dheeraj Kumar** and **Bhawani Singh**, students of Jodhpur Institute of Engineering & Technology, to work on the **Social Distance Analyzer**, which will be handed over to us after completion.

If, in any case, you have any questions or concerns regarding this matter, contact me at Priya Singh and +91 6350213116.

Thank You.



Priya Singh.

Abstract

In the fight against the corona virus, social distancing has proven to be an effective measure to hamper the spread of the disease. The system presented is for analyzing social distancing by calculating the distance between people in order to slow down the spread of the virus. This system utilizes input from video frames to figure out the distance between individuals to alleviate the effect of this pandemic. This is done by evaluating a video feed obtained by a surveillance camera. The video is calibrated into bird's view and fed as an input to the YOLOv3 model which is an already trained object detection model. The YOLOv3 model is trained using the Common Object in Context (COCO). The proposed system was corroborated on a pre-filmed video. The results and outcomes obtained by the system show that evaluation of the distance between multiple individuals and determining if rules are violated or not. If the distance is less than the minimum threshold value, the individuals are represented by a red bounding box, if not then it is represented by a green bounding box. This system can be further developed to detect social distancing in real-time applications.

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1. Introduction

The World Health Organization has claimed the spread of corona virus as a global pandemic because of the increment in the expansion of corona virus patients detailed over the world. To hamper the pandemic, numerous nations have imposed strict curfews and lockdowns where the public authority authorized that the residents stay safe in their home during this pandemic. Various healthcare organizations needed to clarify that the best method to hinder the spread of the virus is by distancing themselves from others and by reducing close contact. To flatten the curve and to help the healthcare system in this pandemic. A new report shows that practicing social distancing and wearing masks is a significant regulation measure to slow down the spread of SARSCoV-2 since individuals with mild or no indications at all may accidentally convey crowd contamination and can spread the virus to others. To contemplate data driven models and numerical models which are consistently the most favored decision. In the fight against the corona virus, social distancing has proven to be an effective measure to hamper the spread of the disease. As the name suggests, it implies that people are suggested that they should maintain physical distance from one another, reduce close contact, and thereby reduce the spread of corona virus. By referring to the already existing works, enhancements are to be done to the proposed system. The system to be developed aims to promote social distancing by providing an analyzer tool to monitor public areas, workplaces, schools, and colleges to analyze and detect any social distance violation and to generate warnings. This is done using a computer vision and deep learning model. Computer vision alongside image processing, machine learning, and deep learning provide effective solutions to measure social distancing among humans across the moving frames. Computer vision extracts information from the input images and videos to possess a correct understanding of them to predict the visual input just like the human brain. To achieve the above objective, objects are detected in real-time using YOLO (You only look once), an algorithm supported convolution neural networks which are employed for the detection & determine the distancing between the human using clusters of pedestrians during a neighborhood by grabbing the feed from a video.

Objective:-

The aim is to analyzing social distancing by calculating the distance between people in order to slow down the spread of the virus.

Scope of the Project:-

There are quite a few things that can be polished or add in the future work. Though, we were able to identify most of the crowded areas. There may be some more places that have too much to observe where needed improvement.

Audience:-

This project is general organizations which want to reduce the spread of the corona virus by maintaining the social distance among people

Features:-

1. It can detect the social distance among people to be safe or unsafe an alert authorities accordingly
2. The model is very fast and efficient.

Technologies Involved:

a. Python
b. Numpy
c. OpenCV

Tools Used:

a. Google Colab

2. Literature Survey

After the rise of the COVID-19 pandemic since late December 2019, social distancing is deemed to be an utmost reliable practice to prevent the contagious virus transmission and opted as standard practice on January 23, 2020 (B. News, 2020). During one month, the number of cases rises exceptionally, with two thousand to four thousand new confirmed cases reported per day in the first week of February 2020. Later, there has been a sign of relief for the first time for five successive days up to March 23, 2020, with no new confirmed cases (N. H. C. of the Peoples Republic of China, 2020). This is because of the social distance practice initiated in China and, latterly, adopted by worldwide to control COVID-19. Ainslie et al. (2020) investigated the relationship between the region's economic situation and the social distancing strictness. The study revealed that moderate stages of exercise could be allowed for evading a large outbreak. So far, many countries have used technology-based solutions (Punn, Sonbhadra, & Agarwal, 2020a) to overcome the pandemic loss. Several developed countries are employing GPS technology to monitor the movements of the infected and suspected individuals. Nguyen et al. (2020) provides a survey of different emerging technologies, including Wi-fi, Bluetooth, Smart phones, and GPS, positioning (localization), computer vision, and deep learning that can play a crucial role in several practical social distancing scenarios. Some researchers utilize drones and other surveillance cameras to detect crowd gatherings (Harvey and LaPlace, 2019, Robakowska et al., 2017).

Until now researchers have done considerable work for detection (Iqbal, Ahmad, Bin, Khan, & Rodrigues, 2020; Patrick et al., 2020; Yash Chaudhary & Mehta, 2020), some provides an smart healthcare system for pandemic using Internet of Medical Things (Chakraborty, 2021; Chakraborty et al., 2021). Prem et al. (2020) studied the social distancing impacts on the spread of the COVID-19 outbreak. The studies concluded that the early and immediate practice of social distancing could gradually reduce the peak of the virus attack. As we all know, that although social distancing is

crucial for flattening the infection curve, it is an economically unpleasant step. In Adolph, Amano, Bang-Jensen, Full man, and Wilkerson (2020), Adolph et al. highlighted the United States of America's condition during the pandemic. Due to a lack of general support by decision-makers, it was not implemented at an initial stage, starting harm to public health. However, social distancing influenced economic productivity; even then, numerous scholars sought alternatives that overcame the loss.

Researchers provide effective solutions for social distance measuring using surveillance videos along with computer vision, machine learning, and deep learning-based approaches. Punn et al. (2020b) proposed a framework using the YOLOv3 model to detect humans and the Deep sort approach to track the detected people using bounding boxes and assigned IDs information. They used an open image data set (OID) repository, a frontal view data set. The authors also compared results with faster-RCNN and SSD. Ramadass et al. (2020) developed an autonomous drone-based model for social distance monitoring. They trained the YOLOv3 model with the custom data set. The data set is composed of frontal and side view images of limited people. The work is also extended for the monitoring of facial masks. The drone camera and the YOLOv3 algorithm help identify the social distance and monitor people from the side or frontal view in public wearing masks. Pouw, Toschi, van Schadewijk, and Corbetta (2020) suggested an efficient graph-based monitoring framework for physical distancing and crowd management. Sathyamoorthy, Patel, Savle, Paul, and Manocha (2020) performed human detection in a crowded situation. The model is designed for individuals who do not obey a social distance restriction, i.e., 6 feet of space between them. The authors used a mobile robot with an RGB-D camera and a 2-D lidar to make collision-free navigation in mass gatherings.

From the literature, we concluded that the researcher had done a considerable amount of work for monitoring of social distance in public environments. But, most of the work is focused on the frontal or side view camera perspective. Therefore, in this

work, we presented an overhead view social distance monitoring framework that offers a better field of view and overcomes the issues of occlusion, thereby playing a key role in social distance monitoring to compute the distance between peoples.

Python:

Python is a general-purpose programming language, so it can be used for many things. Python is used for web development, AI, machine learning, operating systems, mobile application development, and video games.

Google Colaboratory

"Colab" for short, is a product from Google Research. Colab allows anybody to write and execute arbitrary python code through the browser, and is especially well suited to machine learning, data analysis and education.

Numpy:-

Numpy is a Python library. Used for faster mathematical calculations.

OpenCV:

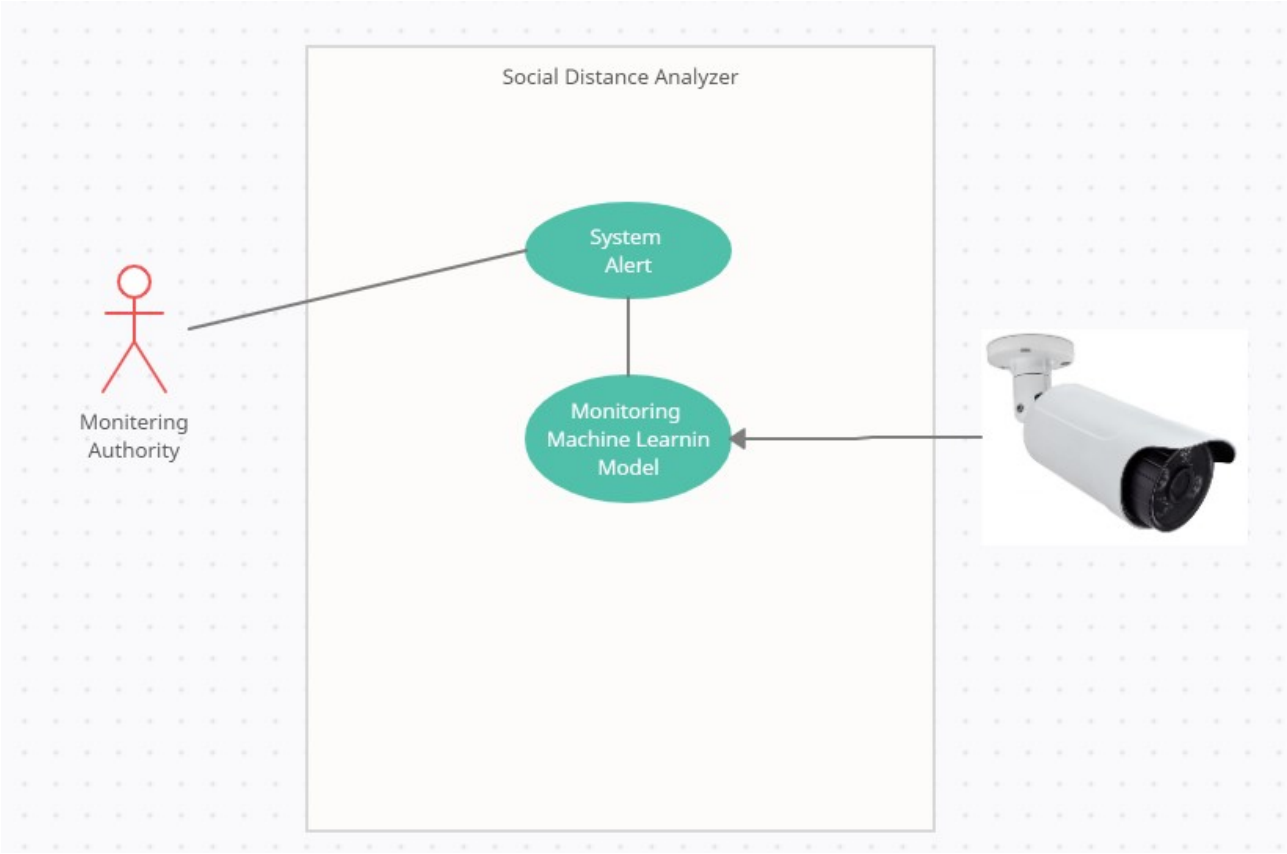
(Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products.

Websites Referred:

1. geeksforgeeks.com
2. towardsdatascience.com
3. python.org
4. opencv.org

3.Requirement Specification

Use Case Diagram:



Hardware requirements:-

Latest OS: Make sure you're running the latest version.
Processor: 1 gigahertz (GHz) or faster processor.
RAM: 1 gigabyte (GB) for 32-bit or 2 GB for 64-bit.
Hard disk space: 16 GB for 32-bit OS or 20 GB for 64-bit OS.

Software requirements:-

Operating System: Any operating will work fine which has ability to run Python.

4.Work Distribution

	Name of function/ module	Start Date	End Date	Responsible Person
1.	OpenCV Input Module	05-09-2021	15-10-2021	Bhawani Singh
2.	YOLO integration	07-09-2021	20-11-2021	Dheeraj Kumar
3.	OpenCV Output Module	20-11-2021	25-11-2021	Dheeraj Kumar
4.	Testing and validation	25-11-2021	30-11-2021	Bhawani Singh

5. Design Document

The proposed system, the social distancing analyzer tool was developed using computer vision, deep learning, and python to detect the interval between people to maintain safety. The YOLOv3 model based on convolution neural networks, computer vision, and deep learning algorithms is employed in the development of this work. Initially, for detection of the people in the image or frame YOLOv3 is used an object detection network based on the YOLOv3 algorithm was used [4]. From the result obtained, only the "People" class is filtered by ignoring objects of classes. The bounding boxes are mapped in the frame. The distance is measured using the result obtained by this process.

The working of the Social Distancing Analyzer is depicted using a flowchart shown in Figure 1.

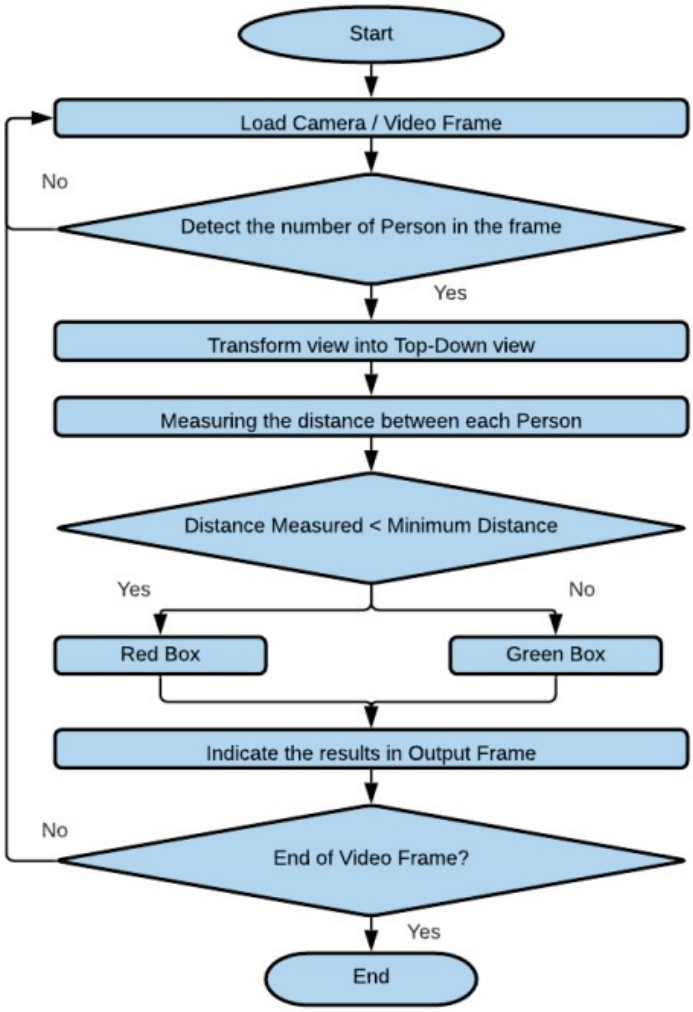


Figure 1. The flow chart for the social distancing analyzer model.

Data Flow Diagram

The Data flow pipeline for the Social Distance Analyzer is shown in Figure 2

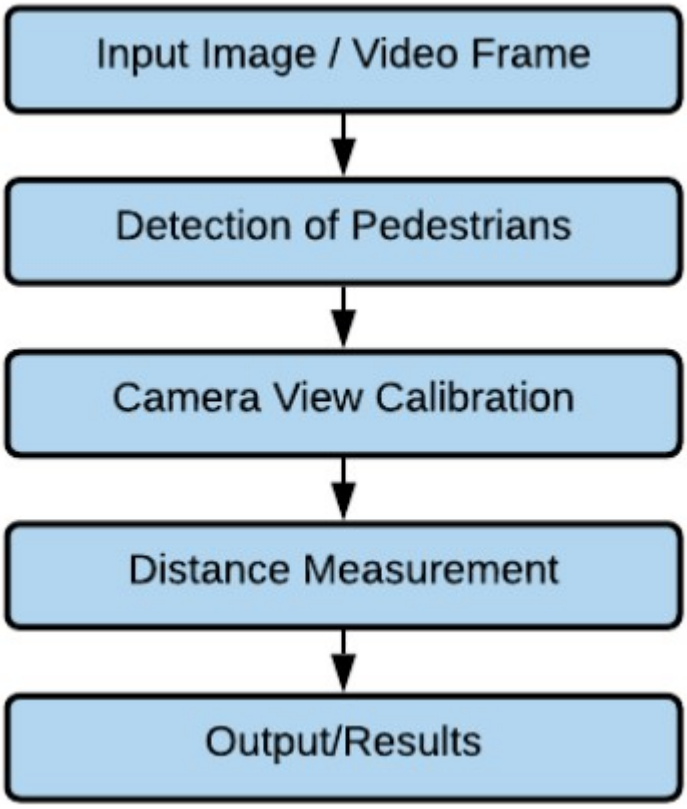


Figure 2. Process flow of the Social Distancing Analyzer model.

Design and Implementation:

User Interface:

The user interface for this project is in build python interpreter which generate an message alert for the Monitoring authority once configured

Datasets:

The dataset for this system is camera feed through the surveillance camera which is used for the social distancing analysis by the module

Methodology:

1.Input Collection:

The image captured and video recorded by the CCTV camera is given as the input as shown in Figure 4. The camera is set up in a way it captures at a fixed angle and the video frame's view was changed into a 2D bird's view to accurately estimate the distance between each person. It is taken that the people within the frame are leveled on the horizontal plane [1]. Then, four points from the horizontal plane are chosen, and then it is changed into the bird's view. Now the position of each person can be calculated based on the bird's view Figure.

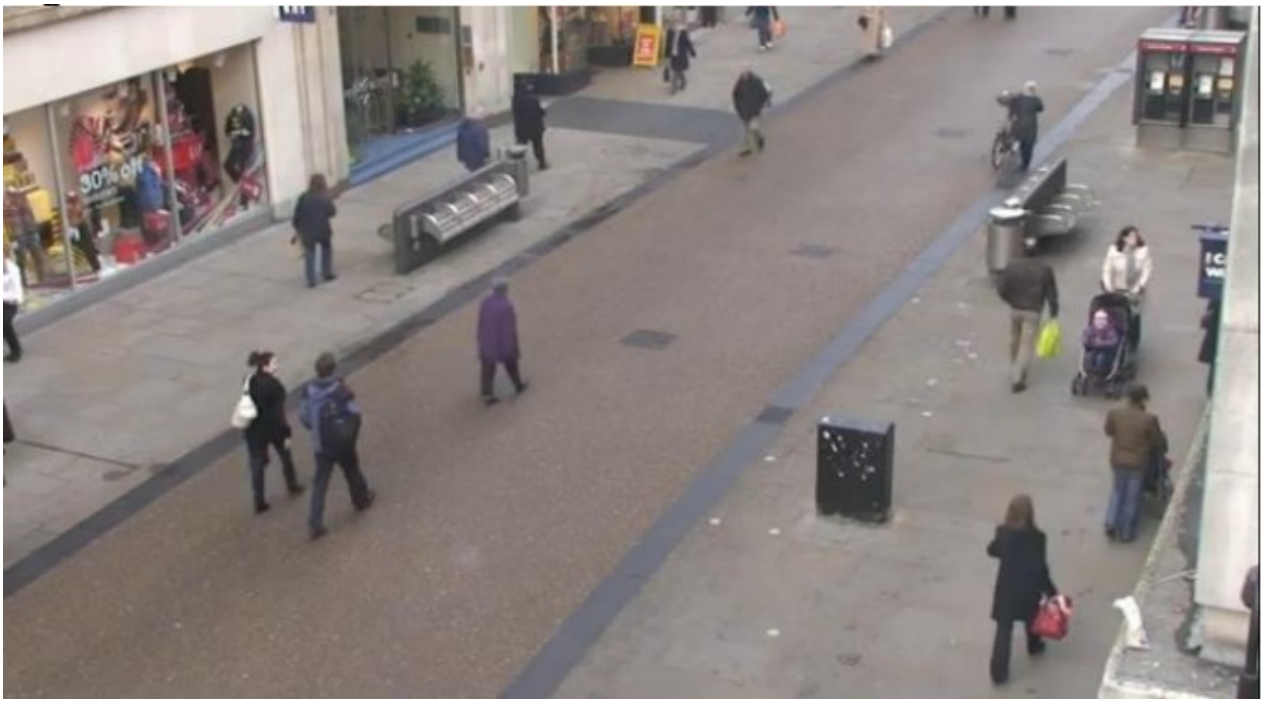


Figure 4. Sample Image captured by CCTV camera.

The interval between people is easily estimated, scaled, and measured by calculating the Euclidean distance between the centroids. A threshold value or a preset minimum value for the distance is set. Depending upon this value, any distance lower than the preset minimum threshold value is found, then a warning is shown using red-colored bounding boxes.

2.Calibrating the Camera

The region of interest (ROI) of an image or a video frame focused on the person who is walking was captured using a CCTV camera was then changed into a two-

dimensional bird's view. The changed view's dimension is 480 pixels on all sides. The calibration is done by transforming the view frame captured into a two-dimensional bird's view. The camera calibration is done straightforwardly using OpenCV. The transformation of view is done using a calibration function that selects 4 points in the input image/video frame and then mapping each point to the edges of the rectangular two-dimensional image frame. On performing this transformation [1], every person in the image/frame is considered to be standing on a leveled horizontal plane. Now the interval of each person in the frame can be calculated easily as it corresponds to the total pixels present in between each person in the changed bird's view.

3.Detection of Pedestrians

Deep Convolution Neural Networks model is a simple and efficient model for object detection. This model considers the region which contains only "Person" class and discards the regions that are not likely to contain any object. This process of extracting the regions that contain the objects only is called as Region Proposals[1]. The regions predicted by region proposal can vary in size and can be overlapping with other regions. So to ignore the bounding boxes surrounding the overlapping region, depending upon the Intersection over Union (IOU) score maximum non suppression is used. The object detection approach used in the Social distancing analyzer model reduces the computational complexity issues. It is done by formulating the detection of objects with the help of a single regression problem. In object detection models based on deep learning, the You Only Look Once model. This model is suitable for real-time applications and it is faster and provides accurate results. Figure 5 shows the pedestrian detection using the YOLOv3 model [4]. The YOLOv3 is an object detection model that takes an image or a video as an input and can simultaneously learn and draw bounding box coordinates (tx, ty, tw, th), corresponding class label probabilities (P1 to Pc), and object confidence. The YOLOv3 is an already trained model on the Common Objects in Context dataset (COCO dataset). This dataset consists of 80 labels including a human class known as pedestrian class.

There are different objects present in a single frame; the goal is to identify "Only Person" class map bounding boxes related to only the people.

4.Measurement Of Distance:

The interval between the set of individuals in an input frame can be easily calculated once the bounding box for each person is mapped. To do so the bottom

center of the box mapped to every person within the range is considered. The steps involved in the social distancing analyzer model [4]. For each person in the input frame, the orientation in the bird's view transformation is calculated based on the central axis point of every person in the input frame. The distance interval of every set of people can be estimated from the bird's view by calculating the Euclidean distance between centroids. As the camera is calibrated, more accurate results can be obtained. The set of individuals whose interval is lower than the preset minimum threshold value is considered as violation. The people who violate the condition are marked using a red box, and the remaining people are marked using a green box.

References

[1.] D.T. Nguyen, W. Li, P.O. Ogunbona, Human detection from images and videos: A survey, Pattern Recognition, 51:148-75, 2016.
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[4.]Ahmed, I., Ahmad, M., Rodrigues, J. J. P. C., Jeon, G., & Din, S. (2020). A deep learning-based social distance monitoring framework for COVID-19. Sustainable Cities and Society, 102571. doi:10.1016/j.scs.2020.102571
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