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Social distancing

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ABSTRACT

Social distancing is a process of keeping the minimum distance between yourself and other people around us. T is also called physical distancing. For maintaining social distance, one must keep at least seven feets from others . Limiting such close contact is very important during the Covid-19 pandemic[1]. As there exists a shortage of vaccines in many places around the globe, the only solution to prevent the fast spread is to maintain a safe distance and avoid close contact. This work focuses on a complex computer vision technique[2] that can measure the distance between two persons and capture the current location in case any close face-to-face contact is identified. This work uses Open image Dataset[3] and **OKATAMA** dataset [4] for detection. The work proposes a euclidean distance[5] calculation to measure the distance between objects. The observed distance can be used to check whether it is above a threshold value, which is the maximum allowed closeness factor and if it violates the given set of rules, certain alerts can be generated to the authorities.

Keywords: Physical distancing, Computer Vision, Open mage, OKATAMA Dataset,Euclidean Distance

I. INTRODUCTION

Covid-19 which is a coronavirus family originated and first reported at Wuhan, China during the last weeks of 2020. Many health care organizations with the help of medicine experts are trying to develop vaccines and solutions to prevent this threat. Although the vaccines were made available by the end of january 2021, there are a large number of communities waiting to be vaccinated due to various reasons. Such a situation claims social distancing as the best available solution , at least for a short period of time. Social distance measurement is the process of ensuring that the persons are keeping a safe distance always in open places such as roads , shopping malls, and other public places.

Fig (1) : Social distancing measurement

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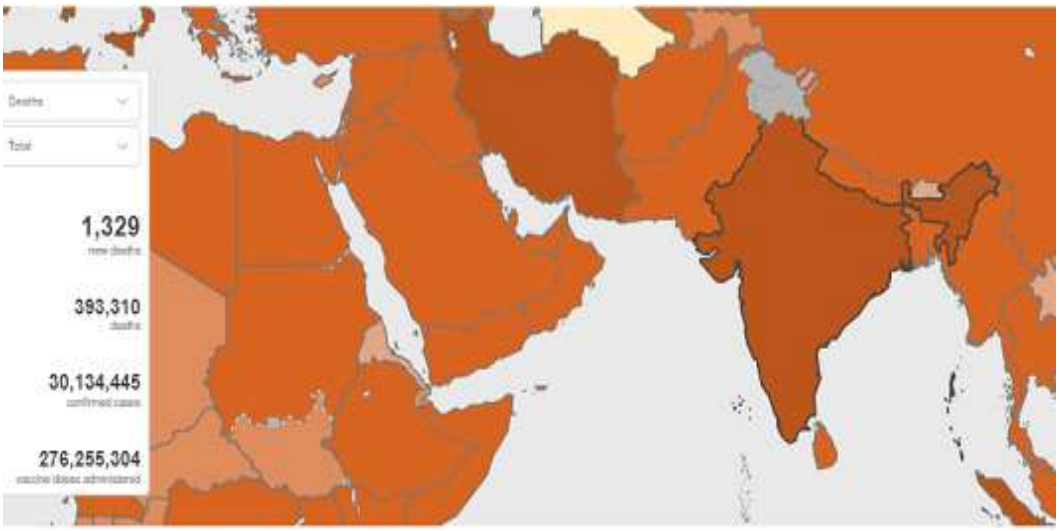
Several countries announced Lockdown for multiple months to prevent the spread. The governments want people to keep safe distance and stop the spread.This situation forces the global community and governments to find the best mitigation plan to stop the spread of coronavirus. Nations stopped their business and closed the border and public places such as schools and workplaces to avoid people's interactions. It has been reported that all infected countries who applied the lock-down for their communities achieved a reduction of the number of COVID-19 cases and the number of deaths from this pandemic. Fever and mild throat pain are the most common initial symptoms of Coronavirus. 90% of people infected with Coronavirus in China, were reported to have high temperature for the first 7 days. Non contact instruments can be used to detect body temperature in such cases. As on 25 th June 2021, WHO reported a total of 30,134,445 confirmed cases and 393,310 number of deaths in India as shown in figure (1) and is still counting.



Fig(2) : Spread of Covid 19 in India as on 25 th June, reported by WHO

Figure 3 describes the effect of lockdown and social distancing on Covid 19 spread using a Gaussian distribution function[6]. From the figure, it is clear that the spread has a wide increase when people are not keeping a safe distance. The Governments implemented many social distancing practices to stop the spread including restricting the public traffics, closing down the bars and restaurants, generating various alerts through policemen, closing down schools and colleges etc. The government has many limitations to monitor such activities when it is done manually by employing a huge amount of human effort. They cannot forcely block people from going out for emergency purchases. Online delivery of essential items may not be possible in many rural areas.

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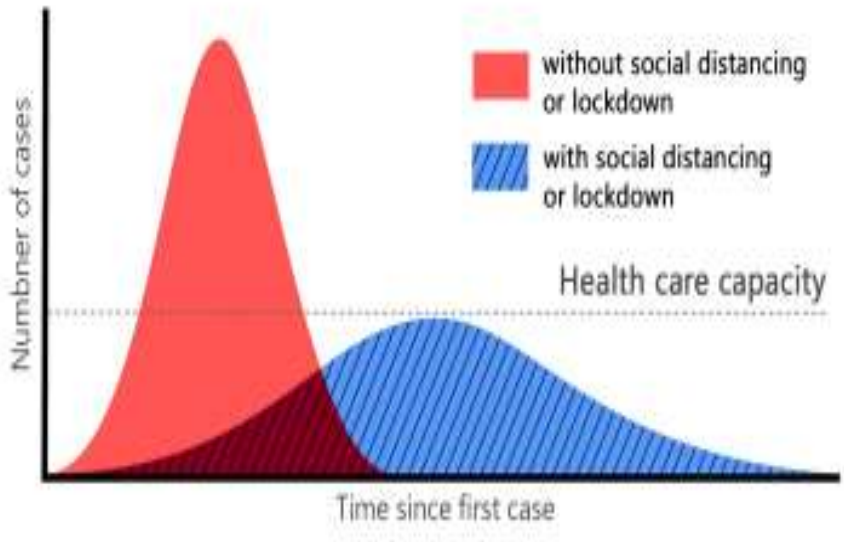

A solution is to use Computer Vision and Artificial intelligence based methods to monitor human activities in the public place and alert the authorities on certain malpractices. Crowd counting based methods were one of the first selected methods in this aspect. However, lack of efficiency demands the use of other effective techniques towards social distancing assurance. The crowd counting techniques use estimation algorithms to get an estimate of people in a public place, which is not adequate to ensure whether they are maintaining social distance or not. Any people counting mechanisms used in ATM counters and Queue based systems were found to be ineffective due to the same reason.

Some researchers used wireless signals for human detection and a particular amount of change in amplitude or wavelength transforms can be used to measure the distance between objects. The demand for large antennas and other equipment makes this method both bulky and costly and thus is not affordable for developing countries. Developed countries like India used Arogya Sethu [7] mobile application which uses GPS position of the reported Covid 19 cases and bluetooth to alert people about the super spread in certain areas. All these methods have certain demerits and thus an Artificial intelligence method needs to be proposed for ensuring social distancing in public crowds.

II. MATERIALS & METHODS

Our proposed work uses Open image dataset for measuring the violation of social distancing.

2.1 Open Image Dataset

OpenImages is a large collection of image datas which contains approximately 9 million images and more than 800 image categories. All the images are annotated properly by the google open source team. It is considered as the largest annotated image dataset for usie in training computer vision images. Version 5 of the open image dataset was introduced in 2020 mid with 391k visual relationships. Different annotations in the dataset include human relationships like ‘man feeding a horse’, or ‘man driving a bus’ and it varies to non human visual relationships like ‘dog catching fish’, ‘cat is eating something’ etc,some of them are listed in figure (4).

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The proposed system ensures the safety of people at public places by monitoring them through CCTV cameras and measuring the distance between them which is shown in fig (5).This result is achieved by using the architecture described in fig (6). The proposed system uses a transfer learning approach and computer vision techniques to automatically monitor people. The system first identifies people's images from the visuals. For detecting people, the YOLO version 3 [8]framework is used.

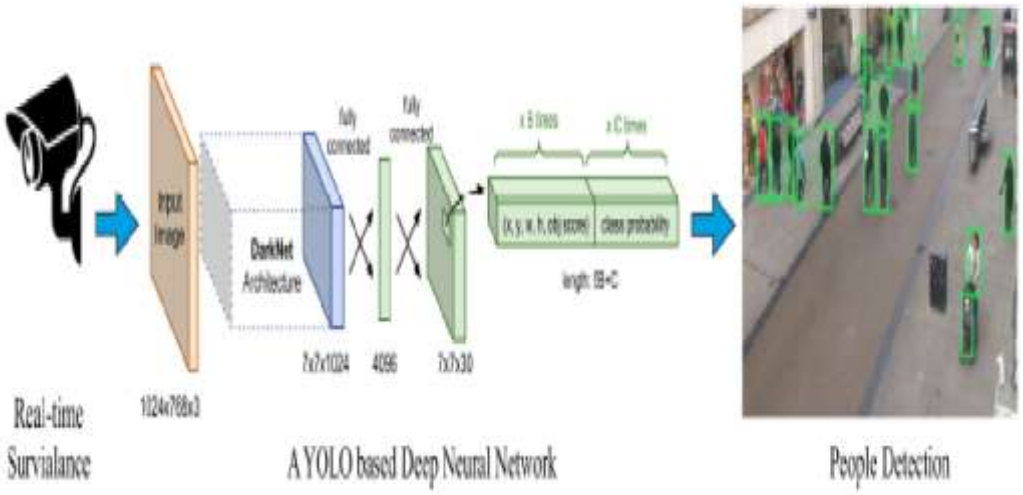

Fig (6): People detection from CCTV Images using YOLO

The proposed system architecture for distance measurement is described in figure 7.
Once the humans are identified from the visual, the next step is to calculate the social distance between humans. The best and simple method is to find the euclidean distance between the points . The distance calculation is done to find the exact distance between two human centroids. As the next step, the centroid tracking algorithm[9] is used to continually monitor the distance between located parties.

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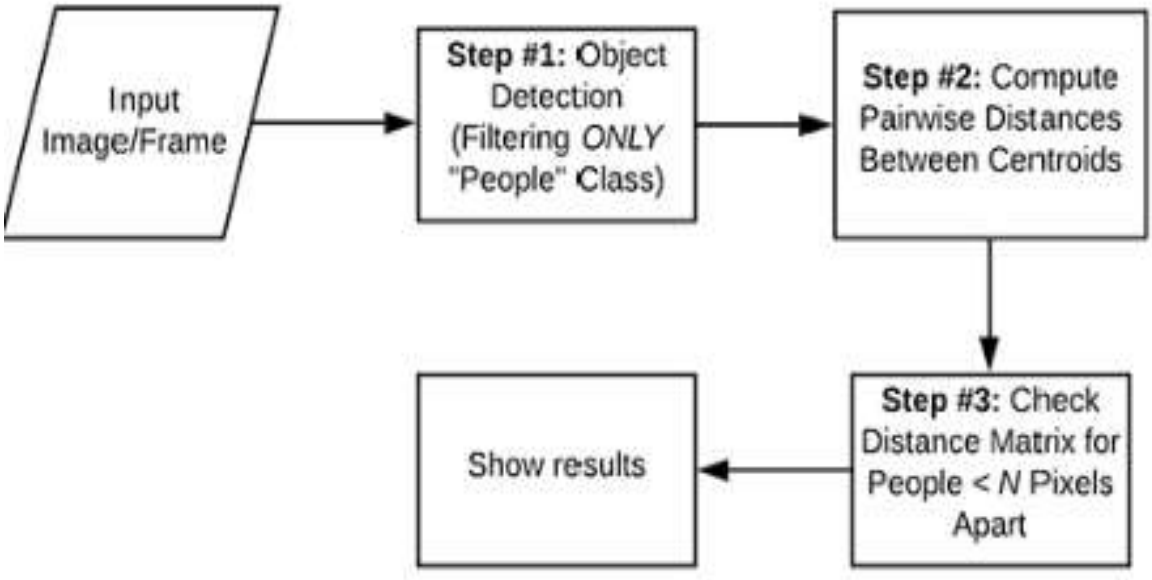

Fig (7): Social distancing process

III. RESULTS & DISCUSSIONS

Figure(8): Social Distance Violation detection

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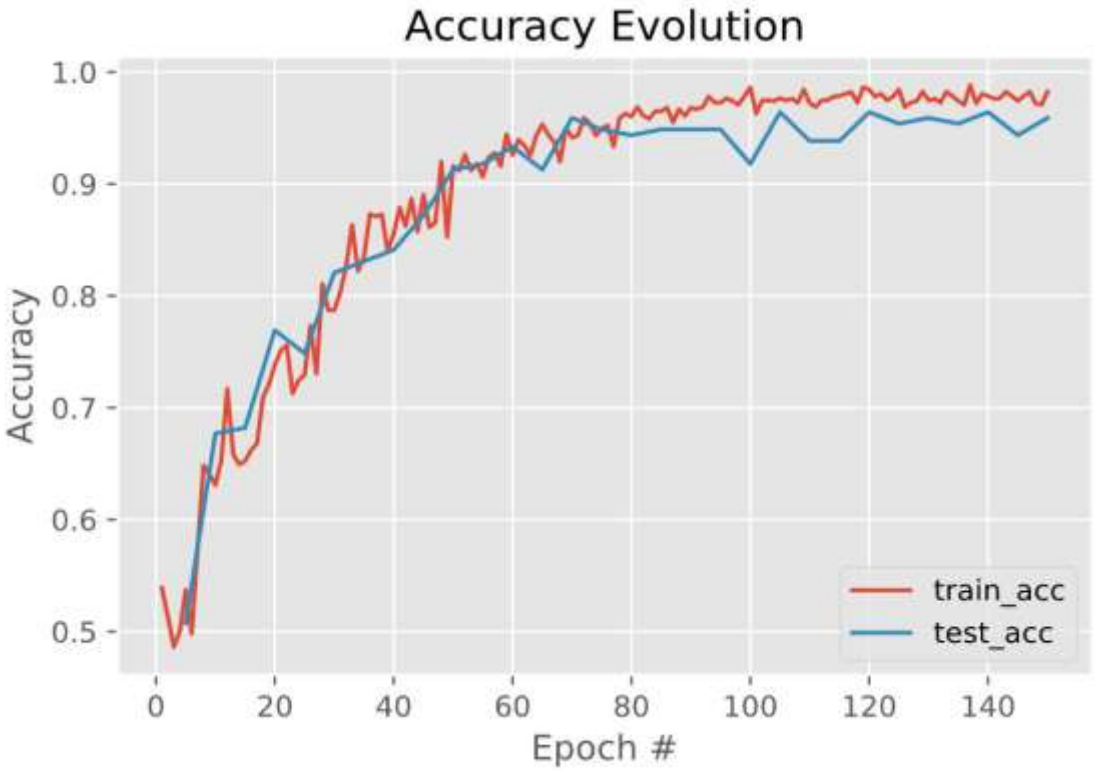
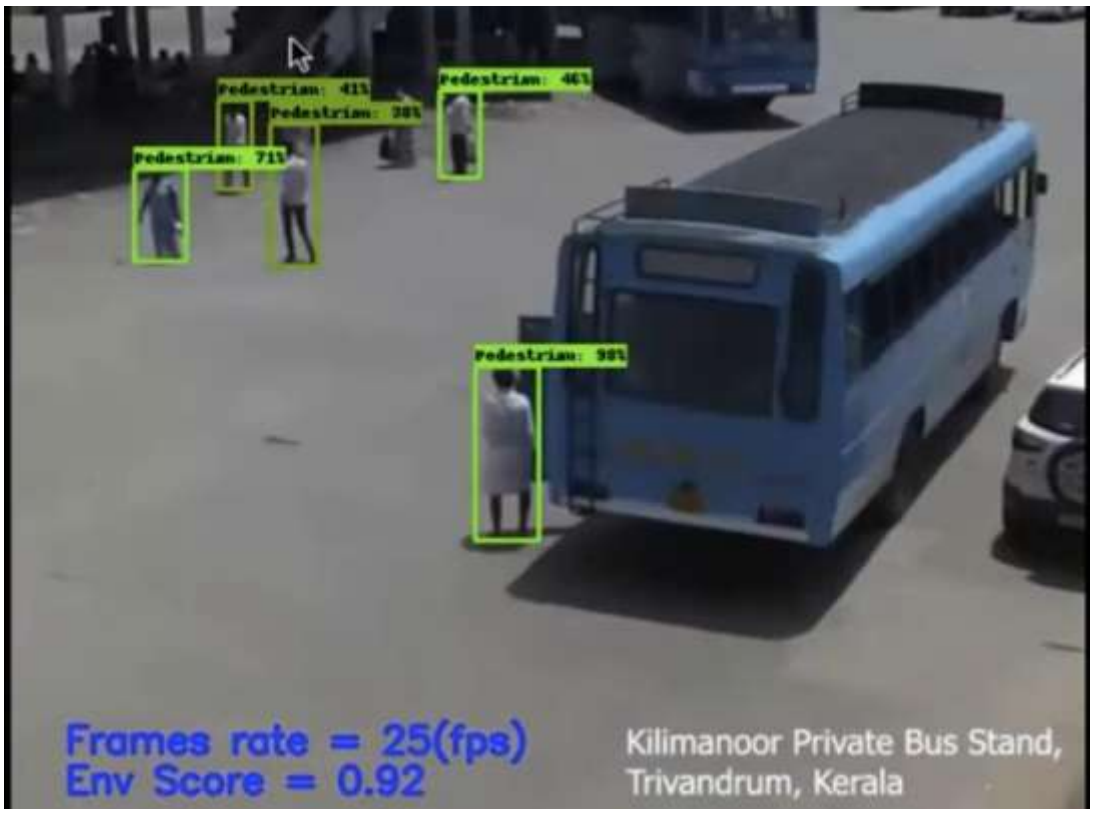


Figure(9): Accuracy Evolution Graph



Figure(10): Result Social Distance Violation detection

IV. CONCLUSION

In this work, a deep learning-based social distance monitoring framework is presented Using an aerial perspective. This work uses Open image Dataset[3] and **OKATAMA** dataset [4] for detection. The work proposes a euclidean distance[5] calculation to measure the distance between objects. The observed distance can be used to check whether it is above a threshold value, which is the maximum allowed closeness factor and if it violates the given set of rules, certain alerts can be generated to the authorities.

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