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Monitoring Social Distancing Using a New Social Spread Detector

Dr. K . Kranthi Kumar[1], K.V.N Sri Vathsav[2]
[1] Associate Professor, Dept of IT, Sreenidhi Institute of Science and Technology, Hyderabad, India, kranthikautula@gmail.com
[2]M.Tech Student, Dept of IT, Sreenidhi Institute of Science and Technology, Hyderabad, India, srivathsav4@gmail.com

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ABSTRACT

The Novel Coronavirus is the most dangerous and deadly virus in the present century of our living. It brings a serious concern to the life of the person when affected. It is mainly affected when there is less usage of masks and the negligence in following the guidelines that are prescribed by the World Health Organization (WHO). After a large number of cases and deaths WHO announced it as a pandemic. Many countries went in Lockdown for several months concerning the number of cases evolving in their region. This directly affected the economic status of those countries. Several studies suggest many waves of the virus are yet to come. To tackle this some countries after the Coronavirus cases gone down, paved way for the economic activities while following the preventive measures like social distancing to boost their economy. There is a need for an application that can alert the people based on location, that how strict social distancing is followed in that particular location hence they can be a bit more cautious when they are traveling to that location. This not only helps the people but also helps the governing authorities to ensure that strict social distancing is being followed in those particular locations and help in reducing the spread of the deadly virus.

Our proposed system will be connected to the social distance detector which has access to a stationary camera retrieves the information of the number of people following and neglecting the social distance in that particular location of the stationary camera in real time. By calculating an index showcasing the ratio of people following the social distance to the people detected and setting a threshold an alert is sent to the user through this application.

Key words : Coronavirus, Social Distancing, Monitoring, Economy, Real time

1. INTRODUCTION

Novel Coronavirus is a virus first registered in Wuhan, China. This virus was spread to many countries in the world and was declared a pandemic by World Health Organization (WHO) on 11th March 2020 [1]. The number of cases that are affected by Coronavirus is increasing day by day and the death rate also, it is a serious concern when seen in numbers. It is expected that many waves of this virus can occur increasing the number of cases rapidly. Hence, the governing authorities are forced to go into lockdown. The adverse effects of lockdown are shown on the economic status of the country [2]. So, these lockdowns cannot be prolonged more. Economic activities should start. The number of cases can be reduced if we strictly follow the guideline suggested by WHO. One of the most important guidelines is following social distancing. Social distancing means maintaining a safe distance between two individuals so that virus spread can be contained. According to WHO, the minimum distance should be six feet between the individuals.[3]

The people who are traveling to a place for his work can be worried about the situation at that place where he is traveling. An index is calculated by taking the ratio of the number of people following social distancing to the number of people detected. So, there is a need for an application that can monitor the social distancing in that place and helps him to decide either to visit the place or postpone it to a better day based on the social distancing index.

The following sections of this paper are organized as follows. In Section II, we discuss related work or existing work. Section III describes our proposed system. The experimental setup is presented in Section IV. Section V contains the result of our work. Finally, Section VI provides a conclusion of our work.

2. RELATED WORK

Covid-19 is one disease that affected numerous amount of people around the world. Many people have lost their lives their families in disguise. Some of the recovered people have rejoined the hospital due to various side effects like shortage of breathing, Black fungus, etc., which are lowering the morale of the individual and their families [4]. The only major step that a governing council can take is a lockdown, which shows an adverse effect on the economic situation of the country. If we can make people follow the guidelines then there is a chance for fewer cases without a lockdown.

Social distancing effects are evident in the case of the United States and China, Where the US is the most hit country by this disease [5]. Social interaction allows improving the economic situation of the country. It allows in boosting up the cash flow, ensuring small consumer ad traders earn their livelihood [6]. K .Prem et al. discussed the effects of social distancing in reducing the spread of coronavirus [7]. R. Eshel et al. discussed using multiple height homography for crowd detection and person count [8]. J Yao et al. used a surveillance camera as an input to perform background subtraction and training for the foreground shape of the crowd in videos [9]. M.K Guru charan proposed a social distancing detector that identifies people who are following and violating the social distancing [10].

3. PROPOSED SYSTEM

The below diagram represents the flow of our proposed system. Our proposed system algorithm is displayed below in Figure 1.

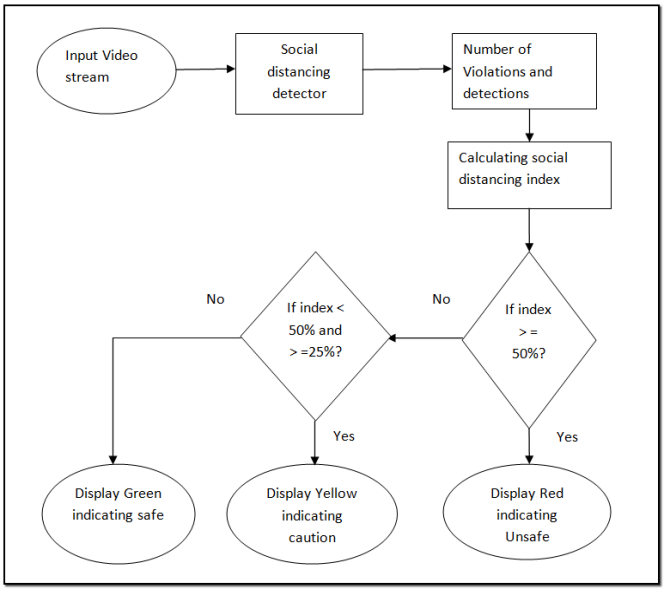

Figure 1: General schema of our proposed system

3.1 Algorithm

1. Initializing social distancing detector.
2. Giving input through the stationary camera.
3. Getting the output from the social distancing detector.
4. Obtaining the number of people following and violating the social distancing.
5. Calculating the social distancing index.
6. Alerting the situation of the place based on the social distancing index.
7. Alerting Red for the place where social distancing violations are more than 50% and yellow for those less than 50% and greater than 25% and green for those less than 25%.

3.2 Proposed system approach

A social distancing detector is chosen based on the accuracy and time taken to for processing. Input is given through the stationary camera to the social distancing detector. This social distancing detector processes the video in the form of frames and uses an object detection algorithm to detect human presence in the frame. The social distance detector uses the Euclidean distance [11] formula to calculate the distance between the two individual persons detected in the frame by the object detection algorithm. Hence, this obtains the output of people following and violating the social distancing.

The obtained information from the output of the social distancing detector is taken as the number of people violating and following the social distancing index. A threshold called the social distancing index is calculated based on the above information by taking the ratio of the number of violations and the number of people detected. The threshold values are set and the situation of that particular place is indicated based on those values. In our proposed system we set our threshold values to 50% and 25%. Anything above 50% is indicated as unsafe, values between 50% and 20% are indicated as caution and below 25% are indicated as safe. In detailed explanation is given below in section “Experimental setup”.

4. EXPERIMENTAL SETUP

We used a social distancing detector with the YOLOv3 [12] object detection algorithm because it has a high mAP (mean Average Precision) score and takes less time to process when compared to other object detection algorithms [13]. This detector is trained and tested using the COCO dataset [14]. This social distancing detector works in three phases.

- Preprocessing. In this phase, the video is taken as input from the camera using OpenCV and converted into a series of frames. These frames are again resized into the size of the frame in which the object detection algorithm is trained. These resized frames are given as input to the next phase.
- Image processing. In this phase, the obtained output from the preprocessing phase id obtained the object “person” is detected. Each frame is fed and people in that frame are detected. Using Euclidean distance the distance between two detected individuals is found. A threshold value is taken (generally 2meters) to mark people who are violating and following social distancing with red and green bounding boxes respectively.
- Reconstruction. In this phase, the obtained Frames are converted back to the video and displayed using OpenCV.

From the above detector, as it produces the values of the people violating and following the social distancing we can calculate as index called social distancing index as described in the section proposed system approach. A dropdown menu of locations is created and that index of that particular location is assigned to it. We created them using the languages HTML [15] and Javascript [16]. The cameras that are present in that location act as input to the social distance detector. These cameras are placed in a location where a huge crowd is expected. The criticalness of that location is based on the people violating the social distancing.

A threshold is calculated based on the output of the social distancing detector. The threshold values for our proposed system are described in the section proposed system approach. Based on those threshold values red color is displayed if the violations are more than 50%, displayed yellow color if the violations are ranged in between 50% and 25%, and green when below 25%. This should be displayed on the application of the user with the percentage of the index and the color to be displayed when the user access that particular location from the dropdown menu. This helps the user whether decide to travel to that particular based on the index or postpone to another day. This also helps in governing authorities to strictly impose the social distancing.

5. RESULT

The output of our proposed system is in the form of a webpage in which a dropdown menu is used to display location names. By selecting the location from the dropdown menu we can get the social distancing index and its criticalness of the particular location on the webpage. The below figures(Figure 2,Figure 3,Figure 4) represent our output.

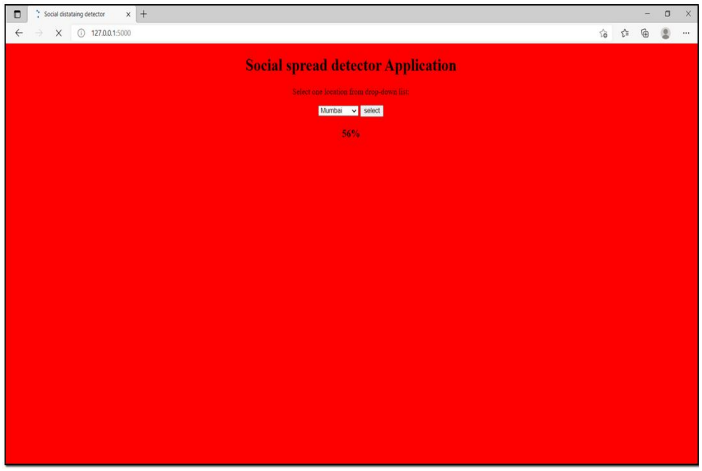

Figure 2: Displays red when social index is more than 50%

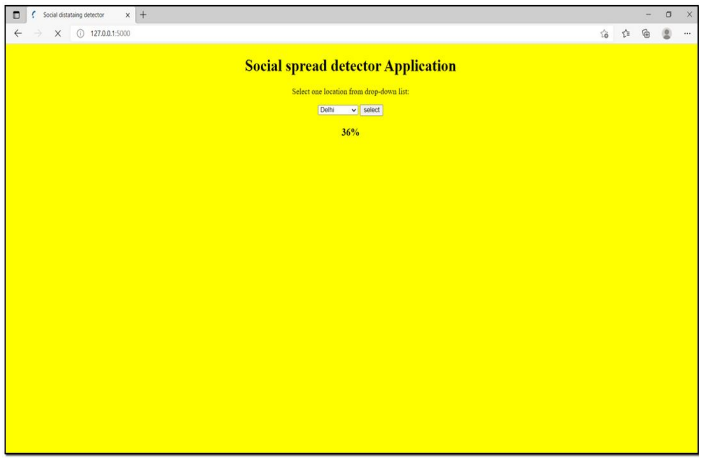

Figure 3: Displays yellow when social index is less than 50% and more than 25%

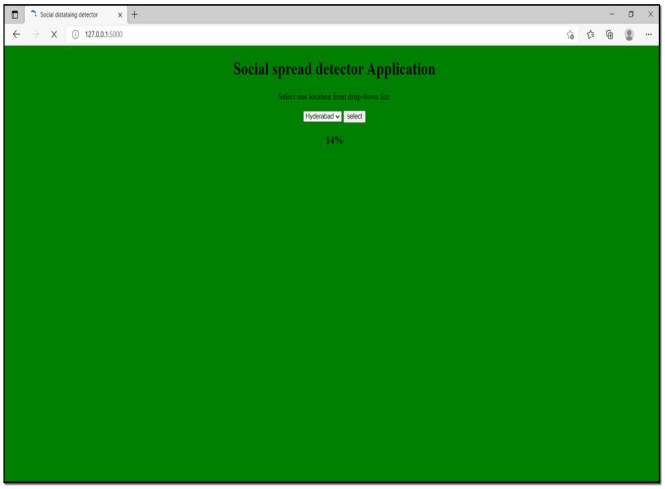

Figure 4: Displays green when social index is less than 25%

The social distancing index plays an important role in the working of our system. First, the elements that are needed for calculations i.e. number of violations, number of non-violation are taken from the social distance detector. We can calculate the total number of people detected using the equation below Equation 1.

$$Total\ number\ of\ people = Number\ of\ violations + Number\ of\ Non-violations \quad (1)$$

After getting the total number of people detected we can find the social distancing index using the number of violations and the total number of people detected using the formula in the below equation in Equation 2.

$$Social\ distancing\ index\ (in\ \%) = \frac{Number\ of\ violations}{Total\ number\ of\ people\ detected}\ x\ 100 \quad (2)$$

Table 1. Represents the calculation of the social distancing index.

S.No	Time	Number of Violations	Number of Non-Violations	Number of people detected	Social distancing index (in %)
1	0	0	0	0	0
2	1	1	5	6	16.6
3	2	3	3	6	50
4	3	2	8	10	20
5	4	3	1	4	75
6	5	5	3	8	62.5
7	6	4	6	10	40
8	7	2	8	10	20
9	8	3	4	7	42.8
10	9	5	3	8	62.5

6. CONCLUSION

This paper proposes an effective real-time system, that indicates through a webpage how the people are following social distancing in that particular region. This also helps the people living in a region planning to travel to another region to know how well the social distancing is followed which indicates the chances of spreading Covid-19 disease. It helps the government authorities in the strict implementation of social distancing measures. This system is extended to the places like Shopping malls, Cinema halls, Railway stations,

and several other places where there is a high chance of crowds. This helps us in regulating crowded places and ensures social distance is followed.

REFERENCES

1. World Health Organization (WHO) Official Website, https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020, Last accessed on 2021/07/01.
2. World Bank official website, https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world ,Last accessed on 2021/07/03
3. World Health Organization (WHO) Official Website, https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public , Last accessed on 2021/07/03.
4. World Health Organization (WHO) Europe website, https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/noncommunicable-diseases/mental-health-and-covid-19 , Last accessed on 2021/07/03
5. M. Greenstone and V. Nigam. (2020). **Does social distancing matter?. University of Chicago, Becker Friedman Institute for Economics Working Paper**, no. 2020-26.
6. Fahim Aslam1 University of Wolverhampton. (2020). **COVID-19 and Importance of Social Distancing.** 202004.0078/v1.
7. K. Prem, Y. Liu, T. W. Russell, A. J. Kucharski, R. M. Eggo, N. Davies, S. Flasche, S. Clifford, C. A. Pearson, J. D. Munday et al. (2020). **The effect of control strategies to reduce social mixing on outcomes of the covid19 epidemic in wuhan, china: a modelling study.** The Lancet Public Health.
8. Eshel and Y. Moses. (2008) .**Homography based multiple camera detection and tracking of people in a dense crowd. IEEE Conference on Computer Vision and Pattern Recognition.** IEEE, pp. 1–8.
9. J. Yao and J.-M. Odobez. (2011). **Fast human detection from joint appearance and foreground feature subset covariances. Computer Vision and Image** Understanding, vol. 115, no. 10, pp. 1414–1426.
10. Towards data science website, https://towardsdatascience.com/covid-19-ai-enabled-social-distancing-detector-using-opencv-ea2abd827d34, Last accessed on2021/07/03.
11. WikipediaHomepage,https://en.wikipedia.org/wiki/Euclidean_distance#:~:text=In%20mathematics%2C%20the%20Euclidean%20distance,being%20called%20the%20Pythagorean%20distance, last accessed 2021/07/01.
12. YoloV3 Official Website, https://pjreddie.com/darknet/yolo/, last accessed 2021/06/20.
13. Joseph Redmon, and Ali Farhadi. (2013) .YOLOv3: **An Incremental Improvement" arXiv preprint** arXiv:1804.02767.
14. COCO dataset homepage, https://cocodataset.org/#home , last accessed on 2021/07/04.
15. Wikipedia homepage, https://en.wikipedia.org/wiki/HTML, last accessed on 2021/07/05.
16. JavaScript website homepage, https://www.javascript.com/ ,last accessed on 2021/07/05.