Social Distance Monitoring And Face Mask Detection System For Covid-19 Pandemic

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Abstract: In this time when COVID-19 is spreading rapidly, it is essential to maintain social distance and wearing a mask is compulsory and to avoid large public gatherings at one place to break the chain of corona infection. But maintaining this is not easy. Many people, knowingly or unknowingly, gather and roam on the streets without wearing a mask. Keeping an eye fixed on of these activities isn't a simple job. The authorities need reliable technology to keep track of these activities. This Project can help in monitoring the social distance and also it detects face mask. This whole system is placed in Public gatherings, traffic signals, on roads and also at the entrance of schools and college gates. This system uses a Raspberry Pi with an RPi camera for capturing live video. The video is then processed frame-by-frame. By using image processing with the help of TensorFlow and OpenCV people, vehicles in the video and are identified. First, it detects the presence of the crowd and then with the help of object tracking algorithm and distance algorithm the centroid distances from one person to another person is measured if the distance is violated it gives an alert and by using Keras, OpenCV and Mobilenet people without a mask are detected when this happens it gives alert by speaking.

Keywords: COVID-19, Keras,OpenCV, Raspberry-Pi, TensorFlow

1. Introduction

COVID-19 belongs to the family of coronavirus caused diseases, initially reported at Wuhan, China, in late December 2020. On March 11, it covers 114 countries with 118,000 active cases and 4000 deaths, WHO declared this a pandemic[1],[2]. On November 18, 2020, over 54,771,888 cases and 1,324,249 deaths had been reported worldwide. The second wave of covid in 2021 April became severe and rise in the cases, as of now it is reported 141 million cases causing 3 million deaths worldwide. Several healthcare organizations, doctors and scientists try to develop proper medicines and vaccines for this deadly virus, but to date, no success is reported. This situation forces the worldwide community to seem for alternate ways to prevent the spread of this infectious virus. Social distancing is claimed because the best spread stopper within the present scenario and everyone affected countries are locked down to implement social distancing. This research is aimed to support and mitigate the coronavirus pandemic along with side minimum loss of economic endeavours, and propose an answer to detect the social distancing among people gathered at any public place. The word social distancing is best practice within the direction of efforts through a spread of means, getting to minimize or interrupt the transmission of COVID-19. It aims at reducing the physical contact between possibly infected individuals and healthy persons. As per the WHO norms[3], it is prescribed that people should maintain at least 1 meter of distance from each other in order to follow social distancing. A recent study indicates that social distancing is a crucial containment measure and essential to stop SARS -CoV-2 because people with mild or no symptoms may fortuitously carry corona infection and can infect others[4],. Fig. 1 indicates that proper social distancing is that the best thanks to reducing infectious physical contact, hence reduces the infection rate[5],[6]. This reduced peak may surely match with the available healthcare infrastructure and help to supply better facilities to the patients battling against the coronavirus pandemic.

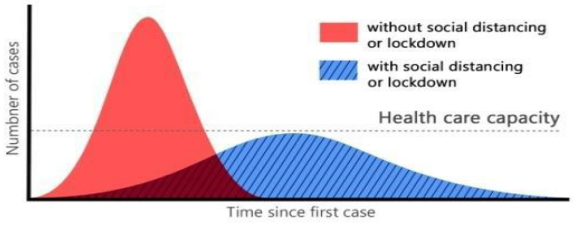

Fig.1:-An outcome of social distancing as the reduced peak of the epidemic and matching with available healthcare capacity.

This virus can be affected from human to human through droplets and airborne. According to the instruction from WHO, to reduce the spread of COVID-19, every people need to wear a face mask, do social distancing, evade the crowd area and also always maintain the immune system. Therefore, to protect each other, every person should wear the face mask properly when they are outdoor. However, most selfish people won't wear the face mask properly for so many reasons. People wear masks partially covering their nose and mouth and this is also detected by the camera.

2. Literature survey

Social distancing is surely the most trustworthy technique to stop the spreading of infectious disease, with this belief, in the background of December 2019, when COVID-19 emerged in Wuhan, China, it was opted as an unprecedented measure on January 23, 2020[7] . Within one month, the outbreak in China gained a peak in the first week of February with 2,000 to 4,000 new confirmed cases per day. Later, for the first time after this outbreak, there have been a sign of relief with no new confirmed cases for five consecutive days up to 23 March 2020[8]. This is evident that social distancing measures enacted in China initially, adopted worldwide later to control COVID-19.

Prem et al[9]. aimed to study the effects of social distancing measures on the spread of the COVID-19 epidemic. Authors used synthetic location-specific contact patterns to simulate the ongoing trajectory of the outbreak using susceptible-exposed-infected-removed (SEIR) models. It was also suggested that premature and sudden lifting of social distancing could lead to an earlier secondary peak, which could be flattened by relaxing the interventions gradually. As we all understand, social distancing though essential but economically painful measures to flatten the infection curve.

Adolph et al[10]. highlighted the situation of the United States of America, where due to lack of common consent among all policymakers it could not be adopted at an early stage, which is resulting into on-going harm to public health. Although social distancing impacted economic productivity, many researchers are trying hard to overcome the loss. Following from this context, Kylie et al[11]. studied the correlation between the strictness of social distancing and the economic status of the region. The study indicated that intermediate levels of activities could be permitted while avoiding a massive outbreak.

Since the novel coronavirus pandemic began, many countries have been taking the help of technology based solutions in different capacities to contain the outbreak[12],[13],[14]. Many developed countries, including India and South Korea, for instance, utilising GPS to track the movements of the suspected or infected persons to monitor any possibility of their exposure among healthy people. In India, the government is using the ArogyaSetu App, which worked with the help of GPS and bluetooth to locate the presence of COVID-19 patients in the vicinity area. It also helps others to keep a safe distance from the infected person[15].

Single Shot Detector architecture is used for the object detection purpose. In this system face mask detector can be deployed in many areas like shopping malls, airports and other heavy traffic places to monitor the public and to avoid the spread of the disease by checking who is following basic rules and who is not.It takes excessive time for data loading in Google Colab Notebook. It did not allow the access of webcam which posed a hurdle in testing images and video stream.We have modeled a facemask detector using Deep learning. We are processed a system computationally efficient using MobileNetV2 which makes it easier to Extract the data sets. We use CNN architecture for better performance. We can fix it in any kind of cameras.

Human beings have not tremendous ability to identify different faces than machines, so automatic face detection system plays an important role in face recognition,head- pose estimation etc.It has some problems like face occlusion, andnon uniform illumination. We use Neural Network to detect face in the Live video stream. Tensor flow is also used in thissystem . In existing they use Adaboost algorithm, we are using mob net CNN Architecture model in our proposed system.We will overcome all these problems in this paper.

3. Hardware and software used

The following hardware and software components are used during development, designing and testing phases.

Hardware requirements:

- Raspberry Pi 3
- Raspberry pi Camera
- Power Adapter
- Speaker
- Connecting wires
- Power supply

Software requirements:

- Rasbian
- Python IDLE
- Tensor flow
- Open CV
- Keras
- VNC Viewer

4. Proposed methodology

The main aim of this project is to detect the crowd if the crowd is detected it measures the distance between the people in the crowd and also detects face masks of the people in the crowd. This system uses a Raspberry Pi with an RPi camera for capturing live video. The video is then processed frame-by-frame. By using image processing with the help of TensorFlow and OpenCV people, vehicles in the video and are identified. With the help of an object tracking algorithm and distance algorithm, the centroid distances from one person to another person is measured if the distance is violated it gives an alert. and by using Keras, OpenCV and Mobilenet people without mask and also partially wore masks were detected when this happens it gives alert by speaking. Let's have a brief how these algorithms work

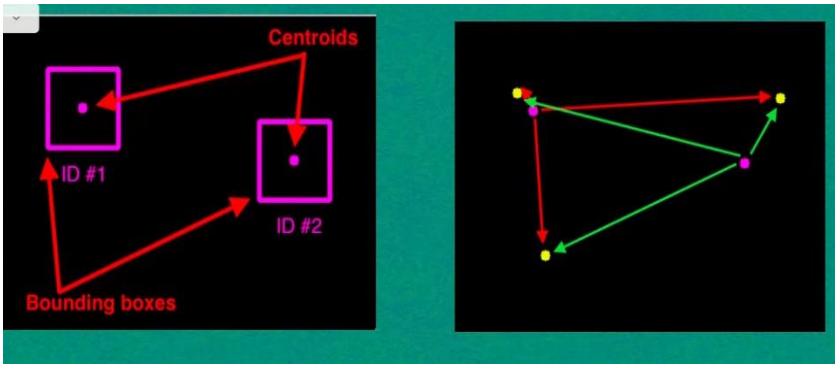

Fig.2 Object tracking Algorithm

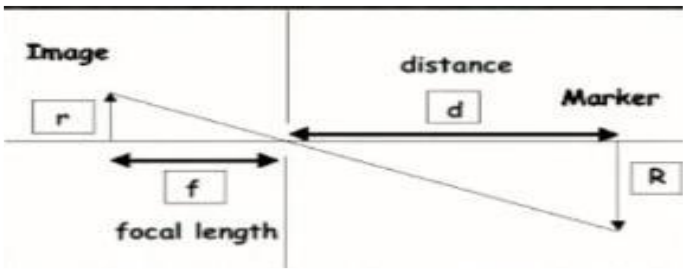

Fig.3 Distance tracking Algorithm

- **F = (P * D)/W**
- **D'=(W * F)/P**

F –Camera's Focal Length

P – How much pixel the image covered
W- Width of the Image
D- Distance between the camera and image
With the help of above equations we can calculate the distance between two persons.

5. Block diagram

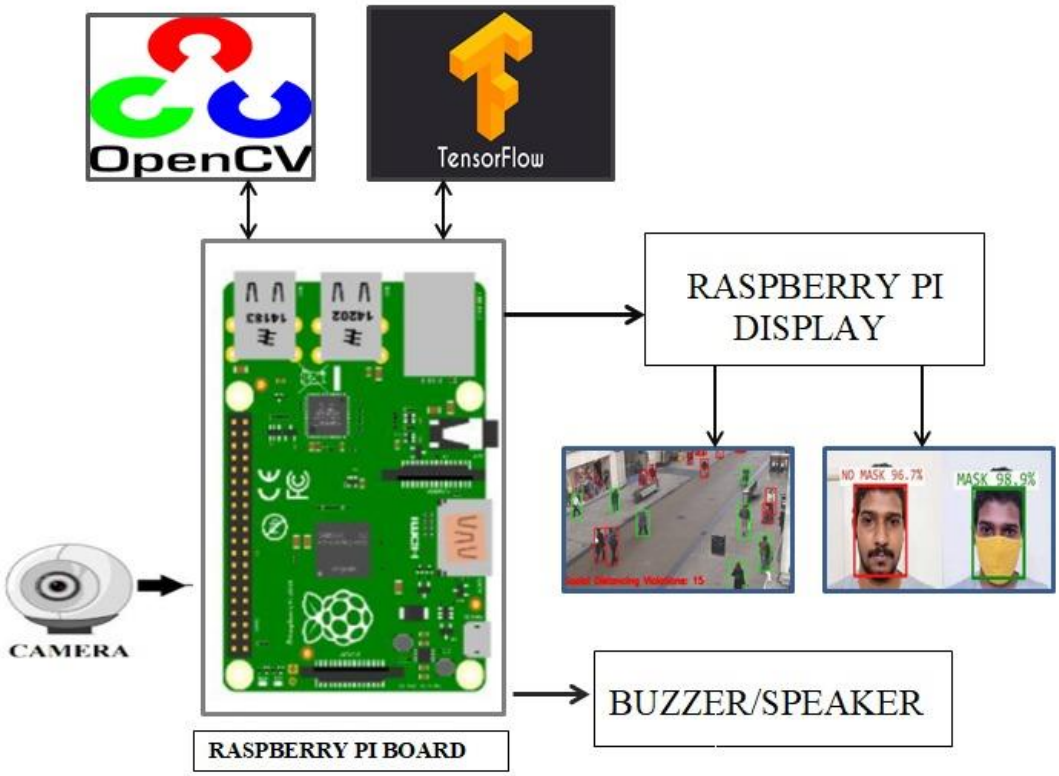

Fig.4 Proposed Block Diagram

In detail flow of the complete project implementation is given in the below

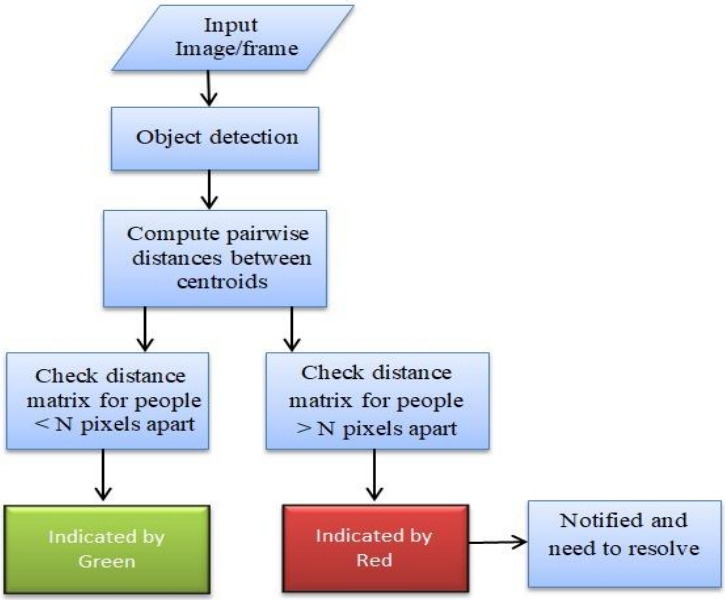

Fig.5 Flow chart for the Social distancing

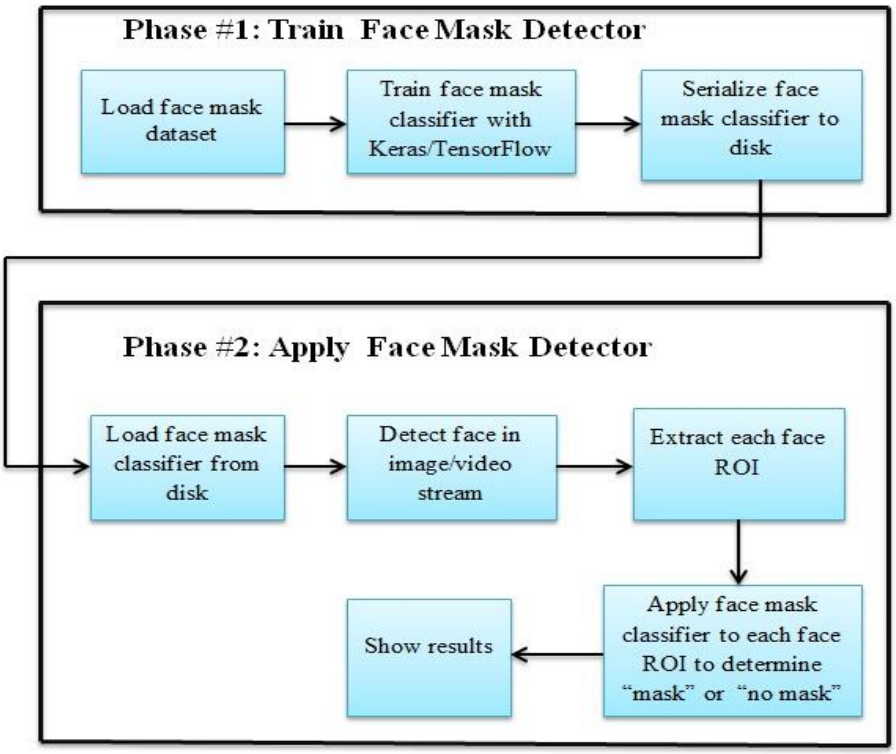

Fig.6 Flow chart for the face mask detection.

6. Results and discussion

We present the results of our proposed methodology in below figures.

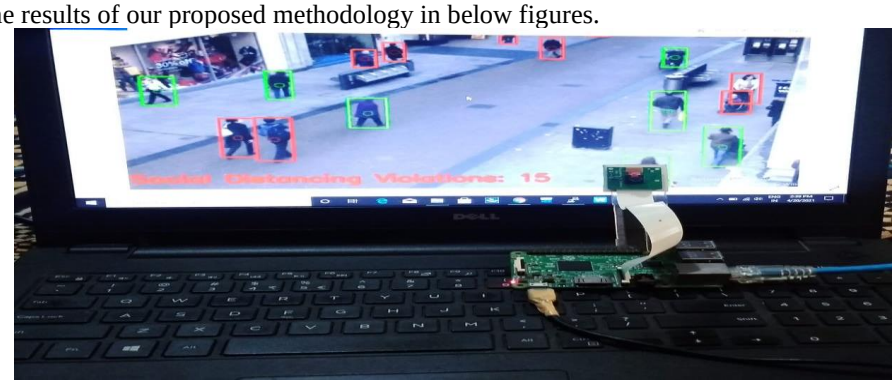

Fig.7. Output of Social distancing and violations.

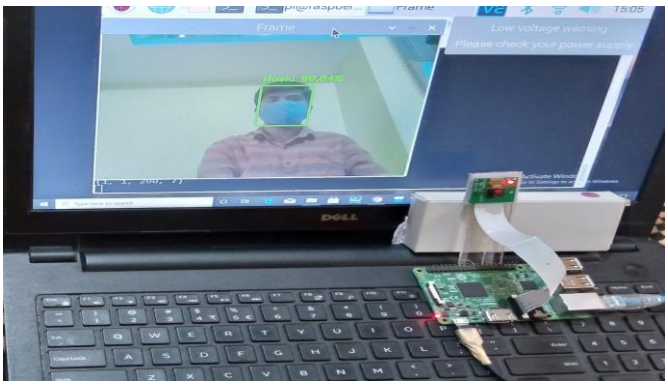

Fig. 8 Output of alert showing a mask

Fig.9 Output of alert for not wearing mask

7. Conclusion

An effective solution to make sure COVID-19 safety compliance is presented during this work. As we know COVID-19 is a deadly disease it is advised to follow some precautionary measures such as Social distancing and wearing a mask is compulsory. But people are neglecting this, here comes our model to keep track of the people.This system uses raspberry pi with a Raspberry pi camera which is cost-effective and can be implemented anywhere such as shopping complexes, metro stations, Airports etc. and also this system can assist police by minimizing their physical surveillance work in containment zones and public areas where surveillance is required employing camera feeds with raspberry pi in real-time. Thus, this proposed system will operate efficiently in the current situation when the lockout is eased and helps to track public places easily in an automated manner. We have addressed thorough the tracking of social distancing and therefore the identification of face masks that help to make sure human health. The implementation of this solution was successfully tested in real-time by deploying the model in raspberry pi3. The solution has the potential to significantly reduce violations by real-time interventions, so the proposed system would improve public safety by saving time and helping to reduce the spread of corona virus.

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