Distance Violation Alarm Using Raspberry Pi 3 and Firebase Cloud

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1. ABSTRACT

In the time of Covid-19, we all know that social distancing is so important to avoid the transmission of coronavirus. People are advised to reduce contact with each other to reduce the risk of the virus being transmitted through direct contact. Maintaining a safe distance is difficult when we are in rush places like factories, banks, hospitals, buses, or railway stations, etc. Social distancing is a simple step followed to regulate the spread of contagious diseases. The Social distancing detector uses the YOLO COCO model to detect people by capturing images at regular intervals. It computes the pair-wise distances between all the detected people. Based on the computed distances, we determine whether the social distancing rule is being violated or not. If anyone violates the social distance, then the distance violation alarm gives an alert to the concerned officers.

2. INTRODUCTION

We all know that the whole world, for the past many months, is severely suffering from the deadly coronavirus (COVID-19). Millions of cases were reported all around the world and Millions of deaths were reported too. We can see there were two waves reported till date, which made the world suffer so severely. We can also see the statistics of the cases that were being reported as follows,
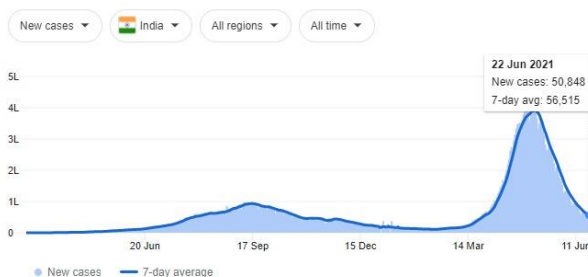

Fig -1: Corona Case Analysis

3. MOTIVATION

"PREVENTION IS BETTER THAN CURE".

We all have been listening to this since our childhood, which means it is better to prevent anything than curing it after its attack.

Similarly, with this covid-19, it is better to prevent it than trying our core to cure it after its attack.

We all know that in order to shield ourselves from the attack of corona or to prevent it from attacking us, we need to habituate some simple habits and need to follow them on a regular basis, which involves,

1. Proper Social distancing

2. Masking ourselves

3. Frequent Hand Sanitation

4. Regular Cleaning and washing of items.

As per World Health Organization guidelines, following these simple steps will shield us and help us from getting attacked by this deadly coronavirus.

Coming to these steps, one can effectively implement the steps of sanitizing, masking, cleaning and washing, but one cannot properly implement social distancing. As per WHO guidelines, one needs to maintain a minimum social distance of 6 feet from others in order to help themselves from getting in contact with the virus.

It is proved that the proper social distancing will break the chain of the spread of the virus and will aid to stop it.
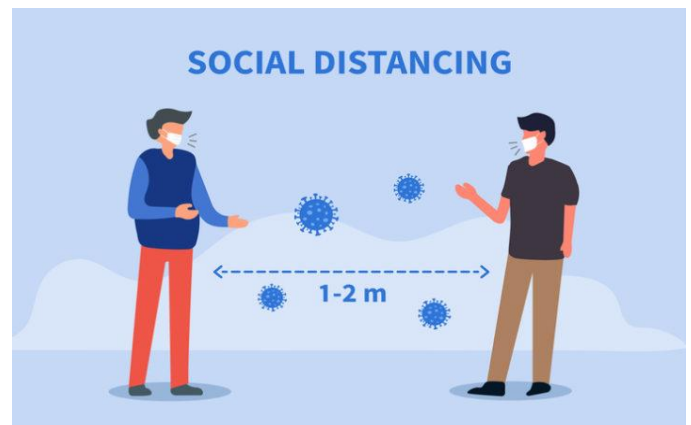

Fig -2: Social Distancing

But implementing social proper distancing may not work all the time, as with our naked eye, cannot make an accurate calculation of this 2 metered distance. Here, comes the need for a special device, which works faster and immediately alerts us whenever we violate the social distancing through an immediate signal.

There are already many types of devices available in the market, which alert corresponding officers and people when the social distancing is violated, but most of them are slow due to the process involved, which makes the execution of

output slow. So, we came up with the idea of designing a device that alerts people faster by capturing images at short, regular intervals and calculates the violations, and alerts the concerned people immediately. Hence, we designed "Distance Violation Alarm" which works faster and generates efficient output.

4. DESIGN

The design of our Distance Violation Alarm includes,

1. Raspberry Pi 3
2. Firebase Cloud
3. Telegram Bot
4. YOLO COCO Model
5. Alarming Device
6. Camera Module

4.1 Raspberry Pi 3

A Raspberry Pi is a mini-computer that can be plugged into a monitor or TV. It is a little device that enables people of all ages to explore computing and to learn how to program in Python.

It contains USB ports, LAN port, camera port, display port. It is provided with 1.2 GHz, 1 GB RAM which also has onboard Bluetooth and Wi-Fi. It has 40 GPIO pins.
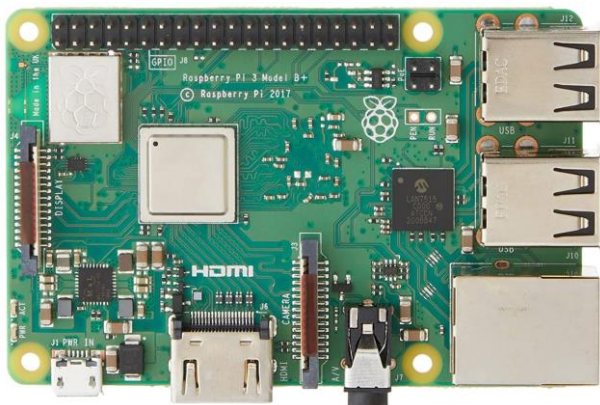

Fig -3: Raspberry Pi 3

4.2 Firebase Cloud

Firebase cloud is a temporary storage space that interferes raspberry pi with the display unit for transfer of themselves, input and output images. During the intake of the input image, the firebase cloud takes the image from raspberry pi and transfers it to the display unit where it undergoes Yolo coco model computation and if there are violations in the output, the image is transferred from the display unit to the raspberry pi through this firebase cloud which then activates the speaker and telegram bot.
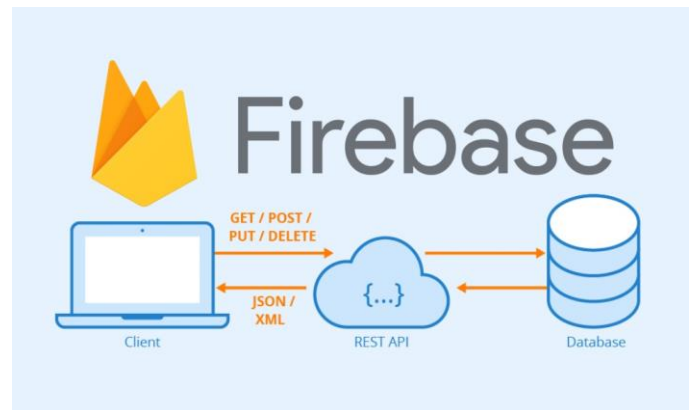

Fig -4: Firebase Cloud

4.3 Telegram Bot

Telegram Bot is used to execute the operation of commands given accordingly. The Raspberry is connected to the Telegram bot and the commands to take input, provide output, stop the process, etc are executed using this telegram bot.
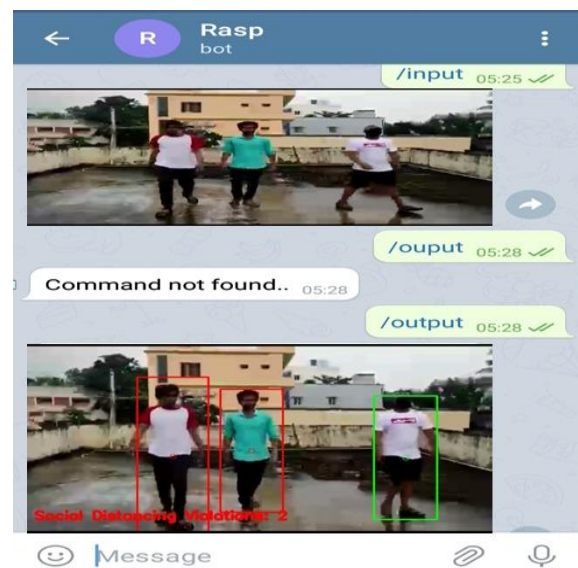

Fig -5: Telegram Bot

4.4 YOLO COCO Model

Yolo Coco model works on the process of image processing. Firstly, the Yolo Coco model takes the input of the image and detects the centroids of the objects present in the input image.

After locating all the centroids present in the input image, it forms the outline of the object present in the input. Later, it measures the distance from one centroid to all other centroids, thus finalizes all the distances between centroids and provides the no. of distance violations as output, if any present.
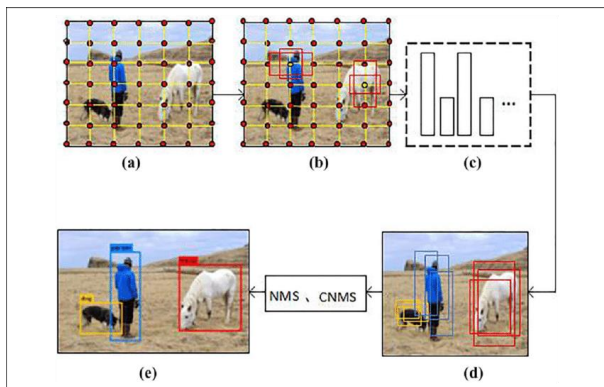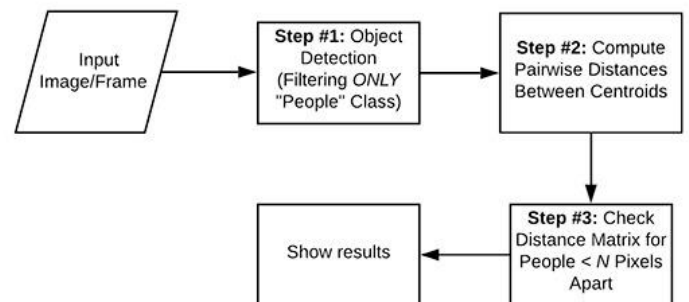
Fig -6: YOLO COCO Model

4.5 Alarming Device

Generally, a speaker is used as an alarming device in our distance violation alarm. Whenever a distance violation is detected in the output, the alarming device is set to give an alarm sound as the output.
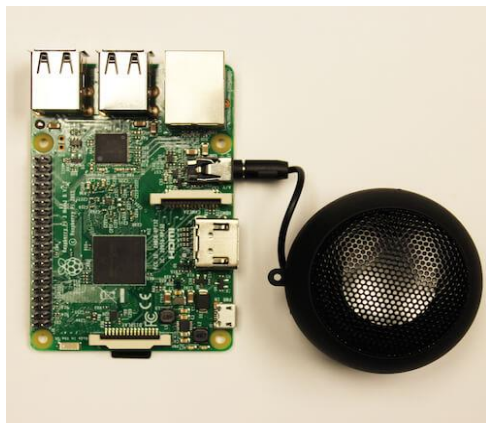

Fig -7: Alarming Device

4.6 Camera Module

A Camera module is used to take the image input at regular intervals.

Fig -8: Camera Module
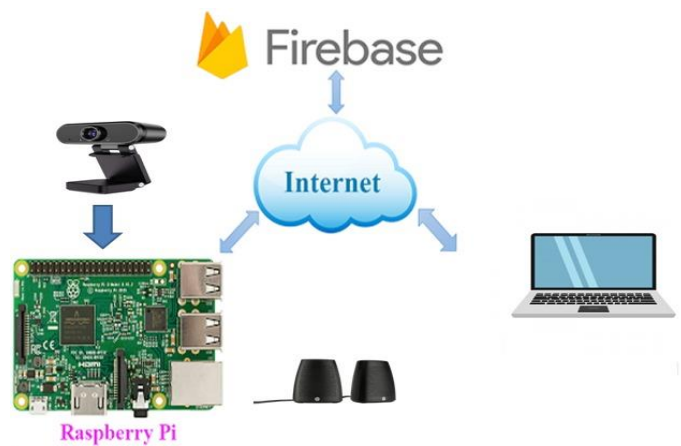
5. OPERATION

Fig -9: Flow Chart

Fig -10: Data flow

The detailed functioning of the Distance Violation Alarm is as follows,

- The camera module takes the image input by capturing it at regular intervals.
- The captured image is uploaded to firebase cloud by the raspberry pi by importing pyrebase library and this image is processed to the display unit.
- The processed input image in the display unit undergoes Yolo coco model processing and the output image is produced.
- If there are no violations present in the processed output image, then it is terminated itself in the display unit and the display unit gets initialized for the next image.
- If there are any violations present in the processed output image, then this image is uploaded into firebase cloud through pyrebase library and is processed to the raspberry pi which indicates that there are violations present in the processed output image.
- Thus the raspberry activates the alarm which produces the corresponding alarm sound as output and the output image is displayed in the telegram bot.

6. SAMPLE INPUT AND OUTPUT

Fig -11: Sample Input

Fig -12: Sample Output

7. FUTURE SCOPE

Distance Violation Alarm has its applications and implementation in various types of fields in our day-to-day life. It can be applied in various fields like

- Traffic regulation and monitoring
- Monitoring people in hospitals, queue lines and any other crowd places.
- Security purposes

8. CONCLUSION

As discussed above, social distancing is currently the most helpful step in order to shield ourselves from the attack of this deadly virus. There are many models based on the YOLO COCO model and the raspberry pi, but they are slower compared to this device. This is due to the that, they take the video input through the camera module and process the output whereas this device captures the images at short and regular intervals which are taken as inputs and are processed for the output which makes this processing faster and more efficient.

9. REFERENCES

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