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Crowd Monitoring System

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Article History	Abstract
  	In this time when COVID-19 is expanding quickly, it is imperative to keep a separation from one another and avoid the group in this manner we can diminish the infection spread. Numerous individuals, deliberately or accidentally, gather and meander in the city. Screen every one of these exercises is intense. Our Smart COVID-19 Crowd Detection Camera using Computer Vision Technique will watch out for all exercises and distinguish any group on the spot. The gadget additionally can alarm the concerned authority about unnecessary social affairs. A functioning reconnaissance framework can recognize the distance among people and caution them in this manner we can diminish the spread of dangerous illnesses. **Keywords:** *COVID-19, Crowd Detection, Computer Vision Technique, alarm, social distance*

1. Introduction

Covid-19 is a deadly disease that is initially reported in Wuhan, China. It spread rapidly over all the countries within a few months and on 11th March 2020, WHO declared it as a global pandemic. The virus mainly spread when people move close to each other and the infected people will be having the symptoms like cough or sneeze and they will have a fever. Maintaining distance is the best measure to oppose the Covid-19. However, the public is not used to keep safe around them. Mostly mass gatherings were seen in public areas like schools, colleges, shopping malls and airports in these places there is a lot of chance of growth of the virus to maximum people so to reduce the virus transmission from an infected person to other social distancing is very important if we start implementing social distancing at starting stages, it can perform a critical role in controlling the virus growth and obstruct the pandemic diseases high. It is seen that there is a lot of difference is observed after implementation of social distancing, infection of the virus has been reduced and even load on healthcare organizations can be reduced so that the death rates also can be decreased. An automatic warning system can help to alert the individuals. This project mainly focuses on implementing smart crowd detection camera which will detect the distance between people and alerts the authorities. In this paper, we even deployed IR sensors that will identify the temperature of a person and if it is more than the threshold value then he is not allowed to enter a particular place [1-23].

Literature Survey

The crowd monitoring system is not a new concept it is already being implemented in some parts of the world. Various authors have published their papers regarding smart crowd monitoring systems. Some of these as follows:

Prof. Adwan Alownie Alanazi, Mohammed Bilal has published a paper entitled Crowd density estimation using novel feature descriptor. In [1] authors have discussed about the framework which consists of CBLP characteristics that are taken from the local regions of the image and categorize every sector of the image to multiple density levels. Input images are taken into the framework and divided into blocks of distinct crowd density levels, repeatedly the blocks are divided to extract CLBP features. Every cell has determined with the feature and integrated together to obtain a single vector. As per the crowd density level, the blocks are manually viewed to initiate the ground-based control.

They have also proposed an approach for estimating the crowd density using a non-linear SVM classifier and demonstrated the capability by extracting the features of this approach. The main benefit of this approach is its simplicity and robustness.

Prof. Shivashree G, Dr. Anuradha S G has published a paper entitled Crowd Analysis using computer vision technique. In [2] authors have discussed about the conditions they have sent for classification and art of crowd analysis of the common approach of the crowd analysis that might be helpful to researchers and may serve as a good introduction to the area under consideration. Crowd analysis is the major concept for analyzing the characteristic, especially in detecting the unusual characteristic in a crowded situation. Three processes are involved in crowd analysis: preprocessing, object tracking, and event/behavior identification. Researchers used these procedures to determine and analyze unusual behavior in a crowded situation. When we identified we got a bit of recognition for learning and motion pattern in a crowded scene rather than its significance in video surveillance also it is difficult to acquire the steady track. We have to explore and classify the varied learning which is focused on motion patterns in crowded situations for the purpose of further study.

Prof. Siti Mariyam Shamsuddin, Nilam Nur Amur Sjarif, Siti Sophiyati Yuhaniz has published a paper entitled Crowd Analysis and its Application. In [3] the authors have discussed about the common structure and classification of design in identifying the uncommon action in a crowd. They also presented the state-of-art of crowd scanning with three steps object tracking, preprocessing, event identification where all these steps have discrete examinations. In the initial step, it was about the area where they checked for environmental conditions and they will check the shape and size of the object. In the second step, they have used discrete levels like picture, appearance, shape mainly focused on characters which bring the data of mass, not the number. The last step which is event identification here helps to find the position of a person and the distance between the persons.

A.N. Marana, et al. Drumond has published a paper entitled Real-Time Crowd Density Estimation Using Images. In [4] authors have discussed a simple method for face recognition and crowd estimation. The algorithm accuracy in this proposed system varies from image to image, giving an average accuracy of 75%. The algorithm is capable of determining faces under distinct lighting conditions. In most of the areas, 100% accuracy doesn't fall into the picture. The main reason behind this is the shape as well as the size of the designing element, determining the number of faces varies when we change the shape as well as the size of the designing element. One more reason is the limitation of the skin colour model which identifies both faces as well as a background object. In terms of eliminating false positives by differentiating between facial and non-facial regions, further improvement can be done

Problem Definition

Social separating is a proficient method to diminish the transmission of diseases infection. With the goal that we made Smart COVID-19 Crowd Monitoring Camera which will keep an eye and screen any group/individual. The gadget additionally makes individuals aware of keep up friendly distance.

SYSTEM REQUIREMENTS

ULTRASONIC SENSOR HC-SR04

Ultrasonic sensors can gauge distance or sense objects. it assesses the distance by the basic equation Distance = Speed * Time. The ultrasonic sensor is a 4pin module, whose pin names are VCC, trigger, reverberation and ground. Ultrasonic distance sensor comprises of two transducers one is a transmitter that changes over an electrical sign into 40khz and another is the receiver.

RASPBERRY PI

Raspberry Pi® 4B is the amazing advancement of the incredibly effective charge card estimated PC framework. The Raspberry Pi is a solitary PC board created to energize and help the instructing of programming and figuring. The minimal effort and attachment and play nature of Pi makes for a board that is open to all and has various network choices Pi is the ideal test device, regardless of whether you need to utilize it as a personal computer, media focus, worker, or checking/security gadget.

RASPBERRY PI CAMERA

We are using a Raspberry Pi camera for image processing which is very light in weight and portable. The Camera is used for continuously capturing the frames and then these frames will be processed to recognize the objects in the image.

DHT TEMPERATURE SENSOR

The DHT11 is a digital sensor for sensing temperature and humidity. This sensor can efficiently be connected to any microcontroller (Arduino, Raspberry Pi, etc.) to calculate humidity and temperature in real-time.

SPEAKERS

The speakers are the yield units. The sound signs from simple/computerized are changed over into the perceptible recurrence in the speakers and produce voice yield (sound information).

MONITOR

The screen is a regularly utilized yield gadget, now and then called a showcase screen/visual presentation unit (VDU). it is to some degree like a TV. Practically all data conveyed from the PC to the client is through the screen.

KEYBOARD

A console is a significant apparatus that permits a client to speak with the PC. It comprises of the standard typewriter keys just as a numeric console and capacity keys.

MOUSE

The mouse used to speak with the PC. It acts like a handheld pointing gadget used to move a little white Arrow pointer - the cursor on the screen.
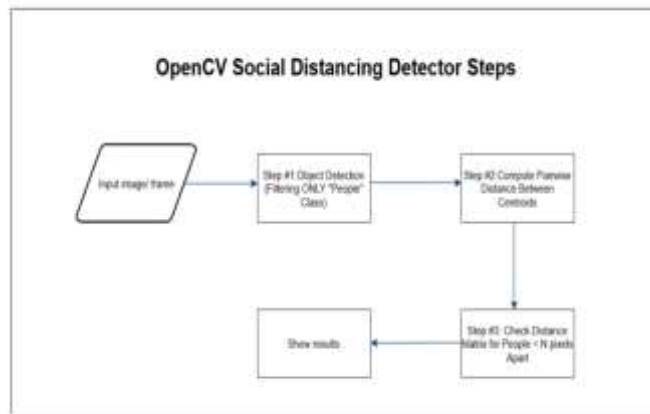
V.   Methodology

Figure:1 Block Diagram of Open CV

Open CV could be a cross-stage library that licenses us to make constant PC vision applications. It is fundamentally worried about picture preparation, video catch, and examination, with highlights like face recognition and item location.

In this Open CV, PC vision and profound learning is used to screen social removing across the district. At first, object discovery is applied to recognize walkers during a video transfer. In the following stage, the pairwise distances between totally recognized individuals are determined and finally, these distances are contrasted and the quality distance that should be kept (6 feet or 2 meters) and is addressed by a red casing in the event that they are disregarded and green edge in any case. In this way, if 5-6 individuals accumulate around in an extremely specific region the neighbourhood specialists or the nearby police headquarters will be promptly informed.
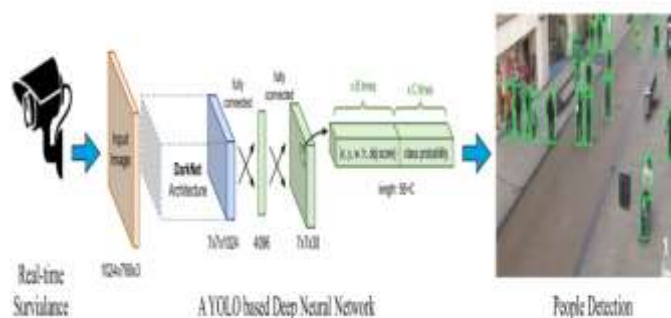
Proposed System

Figure2: A YOLO based Deep Neural Network

YOLO (You Only Look Once) is real-time object detection and a unique algorithm that incorporates maximum innovative ideas of the computer vision research section. Object detection is the main analytic characteristic of autonomous vehicle technology. It is the branch of computer vision which explores as well as performs well than a simple image recognition algorithm. Object detection is a classic computer vision technique in which we can figure out where and what respectively, where those objects are in the given image also what type of objects are within an image. When compared to the classification object detection is the most difficult problem because in object detection, we can identify objects but cannot indicate where those objects are within the images likewise classification doesn't work if there is more than one object within the image. YOLO takes a unique approach. It is a real-time object detection convolutional neural network (CNN). This algorithm predicts bounding boxes and their chances for every region by making use of individual neural networks also by dividing the image into regions. To weigh the bounding boxes these estimated probabilities are used. YOLO is one of the popular algorithms as it is having a high level of accuracy as well as it can run in real-time. This algorithm "only looks once" at the picture as it requires only one forward propagation to be passed in the neural network for the prediction purpose. After non-max suppression, it outputs identified objects together. We train a machine using a Raspberry Pi camera to identify the human beings first and to identify the distance between the people by using the Yolo (you only look once) we find the human and Yolo is a smart convolution neural network for object detection. This algorithm relates to the image and it takes images as input later images are converted to numerical arrays using deep learning.
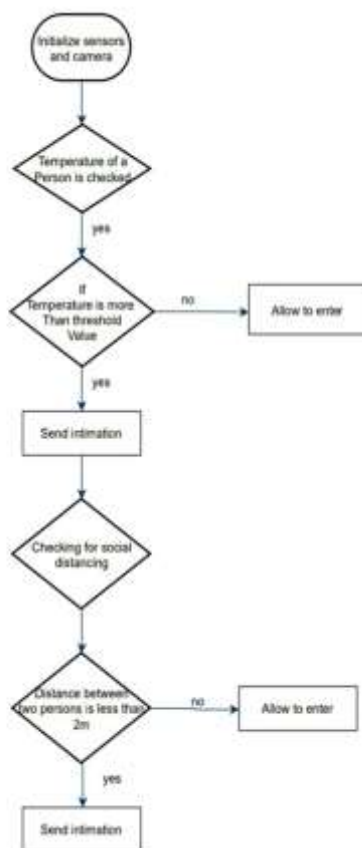

Figure3: Workflow diagram of crowd monitoring system
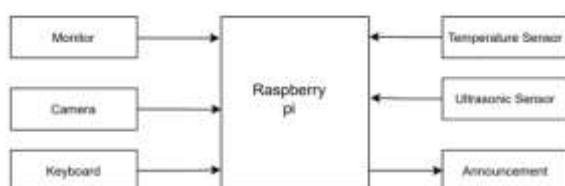
VII. SYSTEM DESIGN

Figure:3 Detecting social distancing

The proposed system takes two sensor inputs. The first input is the temperature reading which is read when a user puts his/her hand in front of the sensor. If the temperature of the person is normal then it sends the signal or interrupts and the camera monitors the person and maintaining the social distancing with the people (less than 2m). The other way to avoid cases where the temperature of the person is high then there is an alarm trigger (announcement) which indicates the person's temperature is high and the person cannot enter the premises. In our system, we are using a pre-trained YOLO algorithm which helps to detect the individual person with bounding boxes in a camera module frame. That detection of the image domain is converted into a real-world view. If the distance is less than the given threshold level then our system emits the alert message saying to keep distance. Raspberry pi camera is capable of taking photographs, along with the video. In our project, the Raspberry Pi camera will be able to detect a person. Raspberry Pi camera will be connected to the raspberry pi board. Also, we are implementing a temperature sensor, because when a person is entered in a public place like a shopping mall, office, or at any place that sensors are reads its temperature, if a temperature is more than 40 degrees Celsius, then the buzzer will be on and the announcement will be there like your temperature is high you cannot enter and if the temperature is less than 40 degrees Celsius then it announces you can proceed.

VIII.   Experimental Result and Analysis

In this proposed crowd monitoring system, we fed the video as input and we will run the algorithm and output is generated as in the algorithm. It detects the individuals and calculates the distance between them and generates an alert message if the social distance is not maintained.
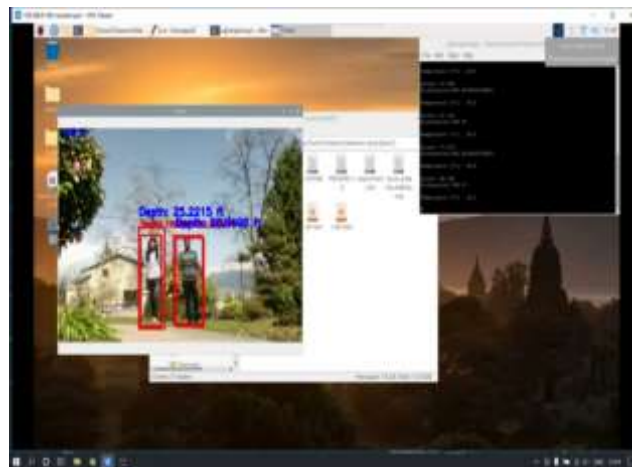

Figure 4. Output of social distancing

4. Conclusion

Our proposed system presents a framework for a crowd monitoring system where we can extract some kind of information from live video and alert people to maintain social distance and temperature of a person is also detected through sensors if the persons temperature is more than the given value then he is not allowed to enter.

Acknowledgment

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