

Social Distancing and Safety Detection Using Arduino

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Abstract— To deal with the worldwide Covid-19 pandemic situation, flattening the curve for the number of coronavirus cases will be difficult if the citizens do not take actions to prevent the virus from spreading. One of the main and most effective measures to contain the recent viral outbreak is the maintenance of the so-called Social Distancing (SD). To comply with this constraint, governments are adopting restrictions over the minimum inter-personal distance between people. Given this actual scenario, it is crucial to massively measure the compliance to such physical constraint in our life, in order to figure out the reasons of the possible breaks of such distance limitations, and understand if this implies a potential threat. To this end, we introduce the Visual Social Distancing (VSD) problem, defined as the automatic estimation of the inter-personal distance from an image, and the characterization of related people aggregations. VSD is pivotal for a non-invasive analysis to whether people comply with the SD restriction, and to provide statistics about the level of safety of specific areas whenever this constraint is violated. With the detection of unsafe distances between people, alerts or warnings can be sent to keep that distance safe. Distance is measured between the central points and the overlapping boundary that separates persons within the segmented tracking area.

Keywords: Social Distancing (SD), Visual Social Distancing (VSD), Arduino, Covid-19

I. INTRODUCTION

Humans are social species as demonstrated by the fact that in everyday life people continuously interact with each other to achieve goals, or simply to exchange states of mind. One of the peculiar aspects of our social behavior involves the geometrical disposition of the people during an interplay, and in particular regards the interpersonal distance, which is also heavily dependent on cultural differences. However, the recent pandemic emergency has affected exactly these aspects, as the extraordinary capability of COVID-19 corona virus of transferring between human has imposed sharpened sudden change to the way we approach each other, as well as rigid constraints on our inter-personal distance. This recently imposed restriction is widely, but imprecisely, referred to as “social distancing” (SD) since prevention of the virus diffusion does not require us to weaken our social bonds. The likely reason of SD naming is that, from a cognitive point of view, physical and social aspects of distance are deeply intertwined, a phenomenon that popular wisdom captures through a proverb that, in slightly different versions, appears in different languages and cultures, namely “far from eyes, far from heart”. Not surprisingly, the time spent in physical proximity with others, in opposition to the time spent in individual activities, is a crucial factor in the “social brain hypothesis”, one of the most successful theories of human evolution. Similarly, Attachment Theory, probably the development model most widely accepted in child psychiatry,

revolves around the ability of children and parents to establish and maintain physical proximity. Finally, the different modulation of inter personal distances is known to be one of the main obstacles in intercultural communication.

As part of the mitigation efforts on Covid-19, the study proposes a method for detecting people gathering in public places, such as banks, shopping malls and clinics. In order to detect a person in an area of interest, the concept of person detection algorithm is used. The technique is followed by measuring the distance between the detected persons. Besides detecting people in restricted or dangerous areas, this study is also targeting detecting people who are violating safety laws via heavy transport, aircraft, and personal property. These potentially important or dangerous areas need to be monitored because access by people can lead to unwanted incidents. Therefore, surveillance is necessary in these areas to prevent unauthorized entries into these areas

II. LITERATURE SURVEY

Human tracking and crowd management using Raspberry Pi and Open CV was proposed by Dr. S Syed Ameer Abbas along with his co-authors in 2017. A cascade classifier was trained as part of learning about human heads from the scene using Open CV features. The entire idea of their project was to record the crowded scene by recording the video frame-by-frame using a camera and Raspberry Pi3 which is equipped with a quad-core ARMv8 processor to process the video. By measuring the number of people and managing the crowd in relation to the threshold, the prevention can be done where necessary if the number of people exceeds the threshold.

The queue length and traffic densities were deduced from the camera images in a study by Joel Joseph Joy and his co-authors published in 2018. To address the concept of partial truth, fuzzy logic was used to the video input. The partial truth concept's consequence could be anything from entirely true to completely untrue.

The system, developed by Neel Bhawe and his co-author is a comprehensive and reliable system that uses YOLO (You Only Look Once) real-time object detection that has fewer shortcomings, faster response times, and better quality of data. It is capable of training for more than 200 classes and provides accurate results.

The Social Distancing Detector by Adrian Rose Brock was published in 2020. The concept is based on the Open CV, Computer Vision, and Deep Learning concept. A spotlight is shed on social distancing during the pandemic period and it examines the monitoring of social distance by CCTV cameras in public places. Cameras measure the distance between people in pixels and compare them with a standard measurement, functioning as a social distancing device. The file.py script contains the logic for this social distance detector application, which loops over frames in a video stream and ensures that people are maintaining a

healthy distance from each other. A video file or a webcam stream can be played.

III. PROBLEM STATEMENT

During social distancing, the aim is to decrease the transmission of Covid-19 among populations by minimizing contact between infected individuals or groups that experience high transmission rates.

IV. OBJECTIVES

- The measure aim to slow the spread of disease by stopping chains of transmission of covid-19 and preventing new ones from appearing.
- These results may increase our understanding of people concerns which can specifically from public oriented communication.
- Authorities can remotely keep a surveillance on public gathering.

V. METHODOLOGY

- Scene geometry understanding ground plane detection.
- Homography, Metric, Depth estimation.
- People detection/pose estimation 2D people detection.
- 2D and 3D pose estimation.

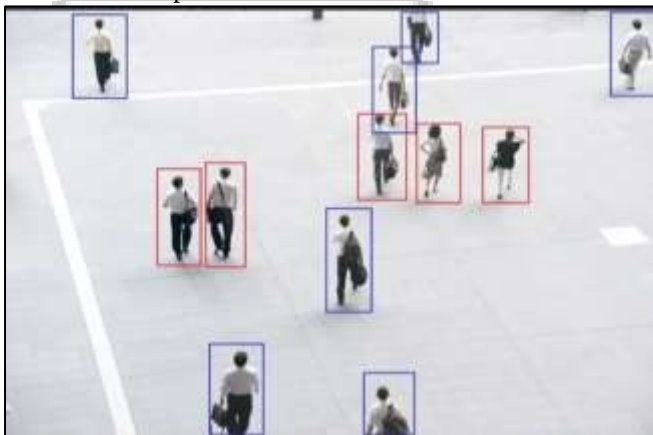


Fig. 1: Red bounding box indicates an alert or warning when there is social distancing violations

VI. PROPOSED SYSTEM

Initially, object detection in a video stream is used to detect pedestrians in the visual stream. Open CV, computer vision, and deep learning are used to monitor social distancing between citizens in the region. Detected pairwise distances are calculated between all people present in the scene, and these are compared with the standard distance (6 feet or 2 meters) that should be maintained. If violations occur, the red frame is shown, otherwise the green frame is displayed. When an object is detected in an area which is restricted, the authorities will be informed about it.

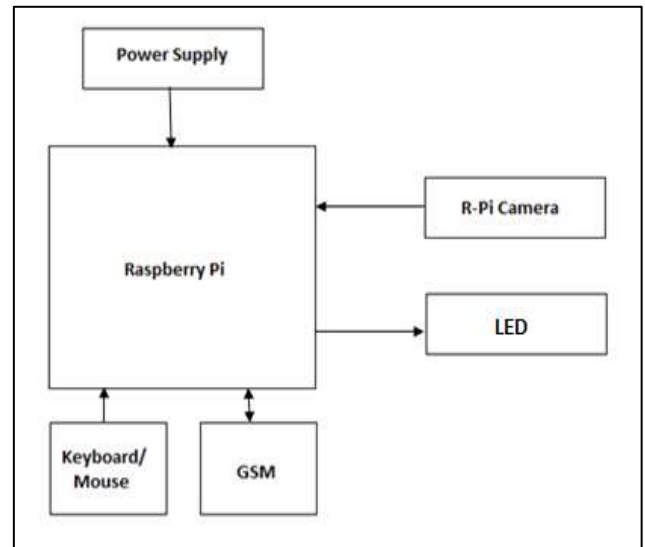


Fig. 2: System Architecture

VII. MODULES

- 1) Data Processing: Information processing, in the broadest sense, is "the change of information in any manner detectable by an observer." In this sense, it can be considered a subset of data processing as it is "the collection and manipulation of items of data."
- 2) Data Management: When databases are more complex, they are often developed with formal design and modelling techniques. A database is an organized collection of data, which is generally stored and accessed electronically.
- 3) Connectivity: System should connect within the network.
- 4) Conversation: The text is being converted into sign language, and the sign language is being translated into text.

VIII. SYSTEM DESCRIPTION

$S = \{I, O, F, DD, NDD, \text{Success}, \text{Failure}\}$

Where,

> I = Input to the system

I = {R-Pi Camera, GSM, Raspberry Pi}

> O = Output from the system

O = {LED}

> F = Set of Function

F = {Input Image/Frame, Object Detection}

> DD = Deterministic data

DD = {null}

> NDD = Non-deterministic data

NDD = {Input image/Frame, Object Detection, Check Distance For People, LED,}

> Success = Add them in non-violate Set & Display Green Signal Information of total number of social distancing Validation.

> Failure = Add them violate Set & Display Red Signal.

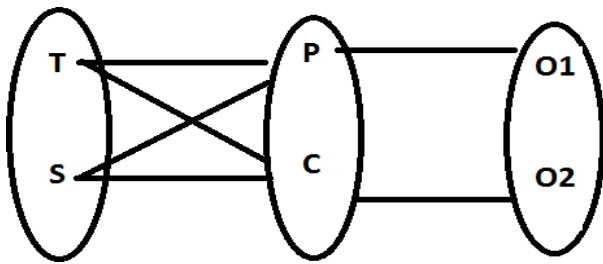


Fig. 3: System Description

IX. CONCLUSION

After COVID-19, the world will inevitably experience self-responsibility, as we will need to accept and follow essential precautions and rules set by WHO more precisely, as each individual will be responsible for their own actions. The installation of CCTV cameras and drones enables authorities to monitor activity in big crowds and prevent violations of the law using remote control technology. While people are keeping a safe distance, their green lights will be displayed, and as the CCTV is capturing more and more crowd gathering, red lights will be displayed, and the police of that area will be notified and the situation will be controlled immediately. In order to control large mobs, this study can be used in order to manage the conditions before they spiral out of control. In this way, the on-ground efforts of police may be reduced, as they are only required to supervise the conditions of those in charge.

ACKNOWLEDGEMENT

It gives us great pleasure in presenting paper on 'Social distancing and safety detection using arduino'.

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