Futuristic Tool for Pandemic Control Using AI In Ergonomics – A Typical Approach to Stay Safe

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Abstract: After pandemic intensity gets over, the people have started work from office. People now-a-days are moving freely after pandemic restriction blow off in certain parts of the world. However, there are still some basic standards of procedure that needs to be followed voluntarily as per government regulations imposed according to the number of cases in certain areas of world in which covid cases numbers are picking up as the new mutants are being identified amongst certain countries. Mostly the contagious transmission is spreading through touching the surface which is previously touched by the symptomatic person of COVID or to come across direct or indirect with the COVID affected person with or without masks. This paper demonstrated the design of helpful application using AI integration with ergonomics in effective way to cope up with wide spread of new mutants. It elaborates various cases of real-life situations which consist of people movement and their interaction with people and things around. It also demonstrates the useful features of object detection and activity classification using some sort of algorithms which gives overall monitoring of environment inside and outside workplaces. Number of actions which are suspicious in terms of spreading infection and awareness steps are also staked up in the paper.

Keywords: Intelligent Surveillance, Ergonomics, Safety, Symptoms Monitoring, SoP Violation, Economic Stability

Introduction:

Ergonomics till the pandemic was focusing on certain work and space related aspects of an employee [1]. But after pandemic, the social distancing and hybrid work of mode [2] in office the ergonomists have to look upon the safety of employees in terms of their health as new parameter of sanitizing and other norms were added apart from sitting arrangement in work from home mode [3]. The pandemic after covid outbreak had just been under control in most of the region across the world but it has been persisting in some parts of the world and even worse situation like
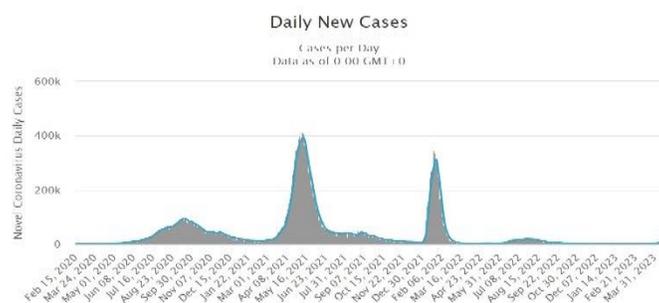

Figure 1 Stats for corona virus till March 2023 Source: <u>Johns Hopkins University</u>

Lockdown in China was still strict requirement since December,2022 onwards [4] making more difficult in economic development.

Taking statistics into the consideration, with reference to figure 1, the peaks of new cases can be seen when covid protocols were compromised after rolling out optional or voluntary following guidelines in terms of standard operating procedure in India. The effect of such events ended up with consecutive peak values in 2021 and 2022, however this depends on numerous factors but transmission of virus usually got widespread as direct contact amongst people without much intervention of standard operating procedure were increased. Apart from that, the denser region in festive season were monitored without social distancing amongst people and sanitizing, however the effect of pandemic has been on flat line at bay but in China the cases are rising nearly above 50000 daily, in November,2022[4]. The similar occurrence of peak can be found in different parts of the world where such protocol of operation during pandemic were compromised. The after effects in Gujarat like states entails the patients of asthma like respiratory syndromes are found on daily bases well during April, 2023. However, it may be noted that asthma may be different phenomenon in contrast with virus spread but common flu or cold can also trigger asthma attack as during spring season the flu effect has affected considerable amount of people.

Standard Operating Procedure and some myths:

However specific countries in the same continent are having different stats of pandemic situation, the figures of infected people are still increasing because it depends on number of reasons [6]. The people engaged in various activities in day-to-day life for their domestic stuffs as well as professional stuffs ought to visit multiple places that require interaction with the people. [7-9] Moreover, certain activities including shopping and medicines or even jobs are the most prominent places where possibly the transmission of virus takes place.[10-11] There are some common myths about the infection of spreading like staying alone and isolated with mask protection may be adequate for the healthy environment. Here few of the loopholes will be described how these myths are wrong[12-14]:

1. Mask in not necessary in the place where you are alone
2. Social Distancing with Masking is sufficient for the safe environment
3. Sanitizing once upon a time while entering or exiting the workplace is enough

Most of the viruses are having ability to be air suspended and with dust in the air it may be entered into the system while respiration.[15] There are possibilities of such cases while sneezing and coughing of someone prior to someone takes over the place to reside although being alone. So, people having strong faith in first myth may be susceptible host. Touching contaminated surfaces again is the way through which the someone catches the infection. The viruses may last longer on some surfaces including metal, glass and plastics.[16] So, possibility of catching infections by touching contaminated surfaces cannot be ignored. However, the possibility of getting infected through surface is lower with respect to airborne transmission but mild infection might be causing difficulty for elders. [17].

However, sanitizing hand and objects regularly is a bit good habit prior to eating or after getting from outside. The surfaces which are touched by the infected person needs to be monitored and sanitized them right after he or she found covid positive.

Now looking into overall aspects of the monitoring for the safety, the surveillance system works well for the people interaction and object detection.[18] Apart from that how objects are utilized by persons can also be detected if algorithms can further be enhanced.[19] However, surveillance cameras ought to be more advanced with zoom in facilities. For instance, the resolution of camera decides the object interpretation visually. Modern cameras tend to be having different characteristic for their purpose. [20]

How Infection is spread

The disease is caused by the SARS-CoV-2 virus, which spreads between people in a variety of ways. According to current evidence, the virus spreads primarily between people who are in close contact with those around them, such as at a

conversational distance. When an infected person coughs, sneezes, speaks, sings, or breathes, the virus can spread in small liquid particles from their mouth or nose. When infectious particles in the air are inhaled at close range (this is often referred to as short-range aerosol or short-range airborne transmission) or come into direct contact with the eyes, nose, or droplet transmission by mouth, another person can contract the virus.

The virus can also spread in poorly ventilated or crowded indoor environments, where people spend more time. This is due to the fact that aerosols can remain suspended in the air or travel further than a conversational distance (a phenomenon known as long-range aerosol or long-range airborne transmission). People can become infected by touching their eyes, nose, or mouth after touching surfaces or objects contaminated with the virus.[33]

Application of Surveillance camera to curb the covid

Camera works well for surveillance under the environment monitoring of cabins or office in which various people works with precautions. If some regulations are violated then it can be easily diagnosed by the camera[21]. However, sanitizing, masks and social distancing are visible parameters; for instance, the factors which are very important to reconsider apart from sops including above factors: sneezing, coughing, fever, etc. Moreover, masks are required to wear when sitting amongst the people in workplace[23-26]. However sometimes, due to pulling off some restrictions imposed on people due to less severity in certain zones have increased number of infected people. [22] Not wearing masks, they may expose more infection in case of sneezing of coughing people interaction. Now, severity of the case can be monitored after increasing covid infections after removing some SOP constraints in UK and other parts of the world.

Problems in current situation:

The viruses that cause flue like symptoms and covid infections are miniscule and detection of such viruses on the surface or air suspension is necessary but practically not feasible to inspect all the time.[15] So preventing people from catching infections is only necessary option in order to control the pandemic situation. However, monitoring the all criteria or symptoms of people using camera is a huge problem due to angle and movement overlapping, apart from that certain occlusions also create problems as well. So, here overall strategy to cope with raise in covid infection.

Here the block diagram is presented to monitor the situation:
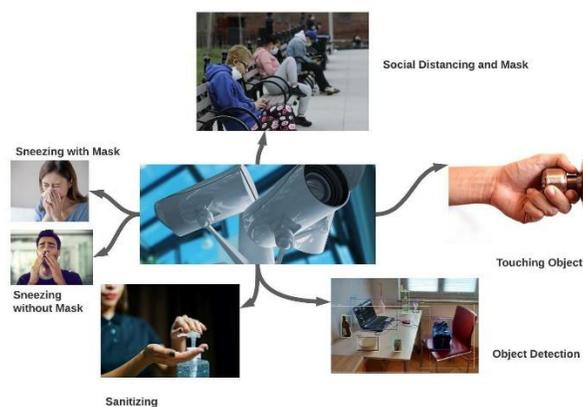
Figure 2 Activity Monitoring by Camera

The person who sneezes or coughed can be identified using camera. At the same time when one does the same without mask, hand contains some sort of viruses that may spread the infection by shaking hand with others. In addition to that, the hands can definitely have their footprints on numerous surfaces that can transfer the viruses on the surface which are being touched.

However, the number of viruses that are being transmitted amongst community varies depending upon the contagious people around but from surveillance it can definitely help to identify the source of infection.

The surveillance system includes various aspects of SoP to monitor:

1. Social Distance
2. Handshake
3. Sneezing and Coughing
4. Surfaces Encountered Afterwards
5. Mask Identification
6. Sanitizer use or Hand Wash
7. Sitting change
8. Eating and Drinking monitoring
9. Canteen Provision Monitoring
10. Wash Room Monitoring
11. Reuse Of Things
12. Postures Around Wall

However, each and every activity plays an important role in overall monitoring:

1. Social distance: effective social distancing can be identified using following algorithms from the CCTV footages, violations of each event can be recorded.
2. Handshake: shaking hands activity falls under social distance violation which inhibits people encountering business events or personal gathering, such close contact can be identified using activity classification
3. Sneezing and Coughing: The activity of sneezing and coughing falls under contagious zone and it may be observed alongside with social distancing and masking followed by hand touching
4. Surfaces Encountered: This activity is observed after the person is found infected and the number of times, he or she has touched the objects. In addition to that, how many times multiple persons have used the same surfaces without masks.
5. Mask Identification: This activity is foremost and inhibits more impact as the possibility of catching infection by going outside or touching surfaces becomes less. However, touching masks by hands improves the probability of catching the same as it turns around the virus spot on the masks which may get into the body.
6. Sanitizer Use or Hand Wash: It is better etiquettes often leads to good health as washing or sanitizing hand before eating has been considered the most important thing. Microscope can monitor the bacteria however every Cameras have been monitoring the activity of eating but prior and after eating, or even after sneezing or after touching any surface it needs to be monitored to avoid the adverse consequences of viruses and bacteria
7. Sitting Space: The most common things in routine life whether in office or public transport is sitting change when the perspiration comes into the picture. The viruses associated with the surface often get a wider spread however monitoring such micro level in transport is big issue as lot of back-and-forth frames needs to monitored in a video and some deep learning algorithms.
8. Eating and Drinking monitoring: The most common place for transacting virus and bacteria are places for food courts or institution where everyone has to remove masks for consuming food and soft drinks or water. Water dispenser often touched by lot of people however there is no any evidence about covid through water but surfaces touch may be the soft target by viruses as it may infect the person.
9. Canteen provision monitoring: Mostly all food packets are supplied by packing properly but provision by maintaining hygiene using gloves and mask can be monitored from the CCTV apart from that any sneezing and coughing can be monitored at the same time.

10. Washroom capacity monitoring: limited number of individuals entering and leaving can be set up and monitored from the CCTV outside

11. Reuse of things: As shown in figure the things which are common in office to use may be the spot of getting infection and apart from that the object with the person need to be captured so future requirements in case of contagious case has been detected.

12. Postures around wall: This is often notified that some walls near the doors and window often touched by people while standing and sitting, this needs to under surveillance as well.

Measuring the flow of events mentioned above need to be divided into various modes of algorithms which is specific to event. Like static and dynamic intensity of people and objects.
The use of various objects detection techniques along with human pose estimation techniques and human identification techniques can be useful for the overall detection.
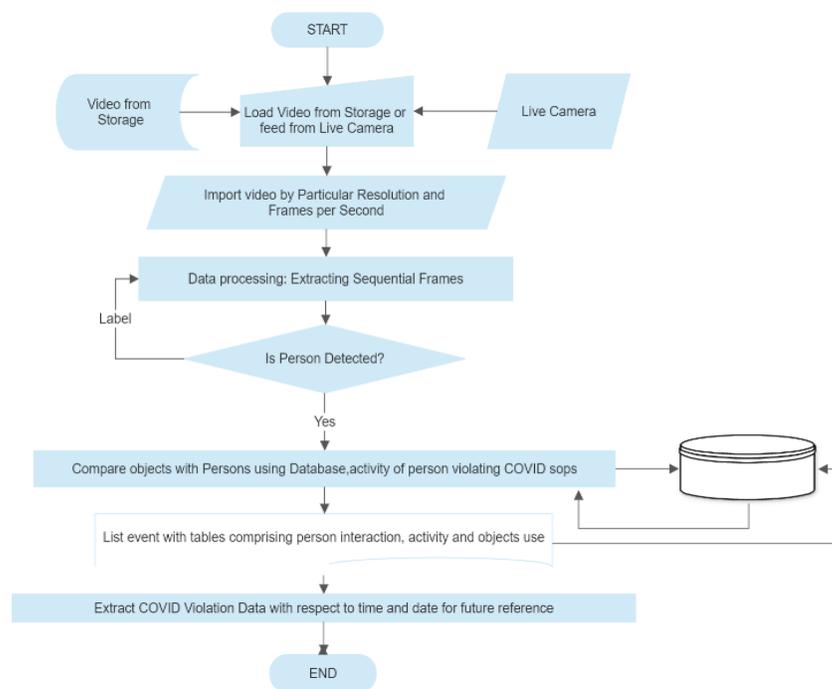
Figure 3 Flow Chart for Logging Activity of People

The flowchart contains the mechanism of developing the surveillance system for SoP monitoring for COVID as it starts with the loading the object in format of the video from the IP cameras or from the database containing the video footage. After loading the frames, it needs to be extracted to the temporary database in which the motion needs to be captured; if motion is found then detect and identify the person with or without social distancing using yolo object detection and other deep learning algorithms to find SoP violation including CNNs[27-32]. Put the scenes of the activity into classification box after testing by the algorithm. The repetitive occurrence in contagious case scenario may be helpful afterwards in terms of the person in close contact with any one apart from that where the person resides before he got infected and the persons with whom one is closely associated with. The database is containing people violating the sop of covid so, if any case in nearby future is encountered then the people associated with such symptoms in previous few days will be found in the frames, if in violating guidelines the same person persists.

Results:

As a part of creating model for classification of various activities that are relevant to COVID sop is depicted below. Identifying features for sneezing and coughing from video is a key to identify potential threat of spread of virus whether it is covid or influenza virus. Here as a part of creating model, few images with coughing and sneezing labeled images were used for training model for classification on google teachable machine and with posenet model as coughing and sneezing correspond to human pose while carrying out the same. The model stats involve 60 epochs with batch size of 16, and learning rate 0.00001.

Images for sneezing

Images for coughing
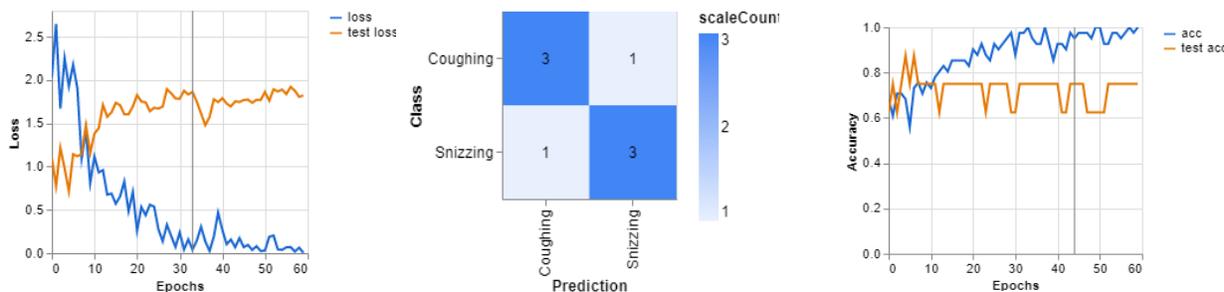
Accuracy found to be 75 percent it could be improved with large amount of training data. Similarly all the activity which resides under SoP Surveillance can be monitored to track the records of how people are actually under the effect of influenza or COVID virus.

Conclusion:

The pandemic has not been diminished yet some countries there are number of patients which are drastically increased and in some parts the lockdown is being imposed. The applicability of proposed design of algorithm can easily identified the infected person and can find the other people associated with the same person. Apart from that, the monitoring in overall environment can be simultaneous be done with respect to all case encounters.

Future Scope:

Over the time, this applicability can be extended to certain visual behavioral symptoms identification as well. This paper demonstrates the overall monitoring of environment using cameras to mitigate the situation where viral infection dramatically increases due to people carelessness or unawareness. Apart from that, the cases which can be seen as normal or safe but timeframe recording of camera can further analyze about the current situation and improve information about the place or office. Not only the place but people with more or less interaction can be very important clue for virus. This leads to better professional safe environment and will prove best for economic development for entire world.

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