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An IoT-based COVID prevention system for the workplace

Kakade Vaishnavi V.[1] Dr. Rokade M.D.[2]

[1]Department of Computer Engineering
[2]Sharadchandra Pawer College of Engineering, Dumbarwadi, Otur, Maharashtra, India

Abstract:

The recent global pandemic of COVID-19 has brought drastic changes in the livelihood of people from all walks of life across the country. As normalcy is slowly being restored, it is also essential to ensure the health and wellness of members. Instead of a manual biometric system, facial recognition can be deployed to mark the presence of members. In addition, a non-contact infrared sensor can be used to check the body temperature of individuals. If the body temperature exceeds the threshold, an alert will be sent to the superior authorities regarding the individual's health, otherwise their presence in the organization/institution will be recorded. In addition, each person's health history will be taken into account using the QR scanner as per the Arogya Setu app. The attendance control function has been supplemented with health verification, so that every employee must report to the system, because presence at work is important for everyone. The data generated by the static portal setup is recorded daily by the device, then uploaded to the database and stored on the Cloud. The system can be further enhanced by including a Bluetooth proximity module.

.I. INTRODUCTION

The coronavirus is a group of viruses that aim to affect and infect the respiratory system of individuals. This group of coronaviruses includes SARS and other commonly known cold and flu viruses. However, the global pandemic caused by the well-known disease COVID-19 was named 2019-nCoV by the World Health Organization (WHO) in January 2020. It is expected to have its roots in the first cases that appeared in Wuhan, the capital of Hubei province in China.The few nurses and medical personnel of the PICC crew are completely immersed in the task of caring for infected patients and working around the clock to restore them to their normal state of health on a global scale. In the United States, of the first 300 patients admitted to several hospitals across the city, 60.7% are recorded as male. 91.3% of them required a ventilator support to facilitate the breathing process. A problem with the process of effective detection and testing is that a significant portion of the population remains asymptomatic to infection and shows no visible symptoms of contracting the virus, making tracing its roots a challenging process.However, normalcy must be restored even though the COVID situation has left several students, teachers and workers at home.IoT (Internet of Things) allows multiple devices to be connected across multiple regions to ensure connectivity. It can be effectively deployed in the current COVID scenario to address the challenges encountered in restoring normalcy while ensuring that safety and security are not compromised at any cost in organizations and institutions. The invention and boom in the use of mobile phones and smart appliances in health and social care has paved the way for data on every individual to be evaluated and evaluated on a mass scale. Under the current scenario of COVID-19, IoT offers more applications such as smart ventilators and masks or measures to enable self-isolation at home while being monitored by medical devices. Several modern needs such as secure data storage systems, cloud and edge computing, intelligent data management, sensors for smart health devices. What began as a country-level scare in China with few speculations about its origin has now become a global pandemic with an abundance of research being conducted to identify a cure. As a global pandemic, COVID-19 is causing great casualties and losses to the human population worldwide from all walks of life. Approximately 31.9 million people have been affected by the SARS-CoV-2 virus, and according to radars, almost 977 thousand deaths have been reported. The table is topped by the countries namely USA, India, Brazil and Russia which represent the maximum number of infected individuals. In India alone, 5.73 million people have been and are affected by COVID, of which nearly 91 thousand have succumbed to the virus. Maharashtra, Andhra Pradesh and Tamil Nadu have huge numbers of COVID-infected people. Although several measures are being taken at the state and central levels to combat this situation, it has become high time, at least for the working population, to step out from the comfort of their homes to sustain their livelihood and also to resolve the economic imbalance. For these reasons, the proposed model will certainly help ensure the safety and health of all employees while managing in their organizations.

II. RESEARCH CONTRIBUTIONS

On January 30, 2020, the World Health Organization (WHO) declared COVID-19 to be the sixth health emergency of international concern, shortly after being named a "global pandemic". Even more difficult was the fact that a significant group of the COVID-infected population was asymptomatic, who were able to serve as potential carriers of the virus, as a result of which it was necessary to strengthen mass testing. The Intel OpenCV computer vision library, introduced in 1999, enables a number of functions such as face detection and recognition to simplify computer vision. 90-95% accuracy is achieved in face detection, while face recognition is the process of comparing a face to a database of faces. It involves the collection of Haar features,

which are calculated using the difference of the summed pixel intensities in adjacent rectangular regions at a specific location in the detection window. This process can be accelerated by using Integral images. Thermal imaging can be used to measure the temperature of individuals. The heat of the human body is proportional to the amount of radiation it emits. Capturing the emitted radiation and displaying it in the form of an electronic image is the essence of thermal imaging. When the amount of radiation emitted exceeds a preset threshold value, a person's ill health will be noted. With the data that is obtained from the thermal image, it is possible to establish the health status and extensive diagnosis on the condition of the individual.
Based on the results obtained from the above two analyses, the table is updated with the results of the registration and recognition phase. This finds strong implementation in both institutions and organizations, removing the need and time invested in manual attendance verification. The Wi-Fi module can be used to send messages about the generated status report to higher authorities . The ESP8266 in particular dominates the world of IoT projects. This module can be programmed using a Raspberry Pi3+. It is operated on the basis of TCP/IP technology, which can be connected using a WR841N router with a PCB antenna.

III. LITERATURE REVIEW

The setting for marking attendance when checking an individual's health condition will be fixed in a fixed place. When an individual applies to an organization/institution every day, it will be mandatory for him to report to the machine. An individual's presence will only be recorded after the individual's well-being has been determined. in the event that an individual is unwell, notification will automatically be sent to designated higher authorities. The overall system workflow is in. A unique aspect of the proposed model is that it integrates multiple distinct health and wellness entities and structures them into a unified model. Aarogya Setu app has a large database of users' health status as its use has been given a lot of emphasis and emphasis from the government side. Thus, the inclusion of this application will ensure that accurate and reliable results can be obtained in each individual's health records. Pairing a health and wellness system with attendance procedures works well as it ensures that every person who reports to the organization gets to the portal as attendance is of utmost importance to the working individual. Thus, implementing the system in this way will ensure that the maximum of the corporation can be obtained from the employees ,Giant 1. Overall system workflow

A. Thermal detection

Infrared radiation is the basis of thermal detection. Every person captures infrared radiation. The radiation an individual emits is proportional to body temperature. This radiation is captured by a thermal imaging scanner and displayed as an image. It should be noted that the temperature near the eyes and forehead tends to be relatively higher when a person has a fever. Based on the created thermal images, the presence or absence of fever can be measured.

B. Face detection

For a face to be detected, Haar features are considered by taking adjacent rectangular regions and summing the pixel intensities in each region and calculating the differences between them. By deploying Adaboost training, the feature selection and training process can be accelerated.

C. IR sensing

In this project, a non-contact infrared sensor GY-906 was deployed to perform the temperature detection process. From the image captured by the camera, GY-906 singles select the best place on the forehead to measure the temperature. If the temperature is within the normal range, the system will proceed to the next stage. Otherwise, the non-completion of the process is indicated by a buzzer sound and the notification is forwarded to higher authorities.

D. Mask detection

Once the person's identity is confirmed by the facial detection and recognition modules, it is necessary to ensure that the person is masked. This can be achieved by initially training the model using a dataset that is categorized by the presence and absence of masks. Using this model when an individual is standing in front of it, similar to face detection, mask detection can also be successfully performed. If the mask is detected, the individual can continue. Otherwise, an indication in the form of an LED light will be displayed to alert the individual to put on the mask.

E. Application Analysis of Aarogya Setu

Aarogya Setu app plays a vital role in checking the medical history of an individual coming to work. This application provides the ability to generate a QR code. By scanning the generated QR code, an individual's well-being can be assessed and analyzed over a set period of time. Details such as the name of the registered mobile number and the health status of the individual will appear on the screen after scanning the QR code. If there is a notification that the individual is COVID positive or has been sick with COVID in the last 15 days, this information is immediately passed on to the higher authorities and an alert is sent.

F. Storage in database

Once the individual's recognition and good health are verified, the person's presence is recorded. And also all the details that have been analyzed are stored in the database.

IV. SYSTEM DESIGN

The system is an integration of multiple health verification and attendance management procedures. It performs processing on all the input data that has been obtained and generates out the desired response in the form of buzzer notification and blinking of LED lights.Fig. 2. System Architecture The Raspberry Pi3+ which is connected to the Internet via Wi-Fi forms the center of the entire system. The images captured by the camera and the display produced to serve as the inputs for the mask detection and attendance enlisting phase. These are fed into the Raspberry Pi3+ system which receives power supply.To check whether an individual's body temperature is below the marked threshold level, GY-906 non-contact infrared sensor is utilized in this case. This temperature s ensor facilitates in determining the best spots on the forehead from the image captured of the individual by the camera to measure his body temperature. This is also fed into the Raspberry Pi3+ as an added input. To determine the health status of an individual from his previous medical history, the application which has been made mandatory Aarogya Setu is brought into use here. Each individual is expected to generate a QR code from the Aarogya Setu application on his/ her mobile device. This QR code then gets scanned by the camera on the static portal setup and given as input. With all these inputs that are obtained, the processing is done to ensure if the individual is healthy or not. If an individual clears all stages of detection and is deemed fit and healthy, then the system displays a green light allowing the person to proceed and marking their attendance as well. If the individual fails in any of the stages raising speculations that he/she might be unhealthy, then the information is directly sent over to the higher authorities. This is done with the help of a GSM module which facilitates sending out a texting message to the designated authorities. All these details are constantly updated and stored in the database or on the server. When a disruption occurs in any of the stages, a buzzer is sounded as a warning to highlight to the user to follow the steps or as a warning that the detection phase has not been completed successfully. System Architecture is shown in Fig. 2.

A. Module 1 Thermal Detection

Post-COVID scenario arises with the situation that many have to step out of their houses while at the same time ensuring that their health and security is assured. As an important measure, it is becoming mandatory to detect the temperature of individuals who report to institutions/organizations since fever is said to be one of the leading symptoms of a likely COVID infection among symptomatic people. GY-906 infrared non- contact temperature sensor is used to measure the temperature of people on the static portal setup. Once mask detection has been performed by assessment of facial landmarks on the captured image, temperature measurement is done by the GY- 906 temperature sensor that is fixated in the static portal setup. For temperature detection, the individual will have to temporarily remove his mask for the system to perform detection of facial landmarks. The process of facial landmark detection is done to find the best point on the forehead to measure the temperature. The static system then aligns the chosen position on the forehead with the GY-906 temperature sensor using the PID control system, from where the temperature is noted. If the temperature is normal, the data gets stored on the database or updated in the cloud, flashing a green light indicating approval. If the temperature noted exceeds the threshold level, then a buzzer sound is emitted and intimation is sent out to the higher authorities. The output display is shown in Fig. 3.

B. Module-2 Face detection for Attendance purpose

In current conventional attendance systems, a lot of time has been invested and lost in it which can be minimized. This system can also help to efficiently replace the laborious manual process of marking the attendance of an individual in either an organization or institution. The camera takes the image of the person who reports before the static terminal. The camera is connected to the RPI4 module. The Raspberry Pi 4 which is to be deployed in this system offers far greater processing speed compared to its predecessors. The perks of using RPI4 lies in the fact that it is embedded with 802.11n wireless LAN and Bluetooth 4.1. The WIFI feature on the raspberry pi can be enabled by using the command-line raspberry pi config tool. The image of the individual can be effectively taken in any direction. Once the image has been captured, face detection and recognition phases are undergone. The camera is linked to the Real-Time Clock (RTC) which accurately notes the reporting time of the specific person. Along with the recognized individual's identity, the clocking time is fed as input to the raspberry module. The Wi-Fi feature on the raspberry pi performs the role of transferring the data that has been received by the camera and the timing that has been clocked by the RTC to be transferred to the cloud or any other form of database utilized. The outputted data which has been stored on the cloud or the server can be retrieved to use for further processing or future references. The Output is shown in Fig. 4 and Fig. 5 Face detection can be performed effectively using OpenCV, which has a built-in face detector that is capable of detecting 90%-95% of the faces accurately. Haar-like features are initially generated to be used in object recognition. The presence or absence of Haar-like features can be determined by integrating all the features into an Integral Image. This allows the detector to compute the features quickly. This process can be enhanced by using an Adaboost learning algorithm. Finally, the portions which are not needed can be removed and joining the classifiers in a cascade.

C. Module-3 Aarogya Setu App Analysis

In the wake of the current COVID-19 pandemic, it is incumbent for every individual to install the Aarogya Setu application on their mobile device. This application provides instant information about the health and welfare of the person, which draws light to the fact on why it is being extensively deployed in multiple organizations and institutions. With the click of a button, a user can generate a QR code from the Aarogya Setu app installed on his/her mobile phone. The camera in the static portal setup will scan the QR code generated from the mobile phone to verify and validate the health status of the individual. The details which are displayed upon scanning include the name, mobile number as well as the medical status. The medical status is displayed with varying colors to highlight the details. These medical status messages fall into one of pre-set 5 categories which quickens the process of method.

V.CONCLUSION AND FUTURE SCOPE

The proposed working setup constantly checks the individual's temperature and when it exceeds the threshold value, it alerts higher authorities about the individual's poor health status. the packet assembly consists of a sensor that checks for the presence of the individual and ensures that the packet assembly is always located near the individual. the thermal imaging sensor measures the individual's temperature continuously at regular time intervals. this packet setting can be additionally deployed as a precaution if individuals resort to alternative temporary measures to defeat the static portal setting. if the temperature is not within the appropriate range, a warning is sent to the superior authorities about the individual's poor health. this packet setting will further increase the process of checking the effectiveness of the system in continuously ensuring the health and safety of its employees or members. in future work, a portable device that checks if an individual is healthy and well will be designed to fit in a pocket.

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