Journal of Positive School Psychology
2022, Vol. 6, No. 4, 5046–5054

Covid Surveillance System Using Face Mask Detection with Body Temperature and Pulse Rate

K. Sunnihitha[1], J Swetha Priyanka[2]

[1,2] *Department of Electronics and Communication Engineering, Vardhaman College of Engineering, Hyderabad, Telangana, India.*

Abstract

Infection with the Corona virus has identified as a prominent public health concern in 2019. It is fast spreading due to its own contact transparency. As little more than a result, the Department of Health advised individuals to wear masks when they were out in public. Avoid densely packed areas as a precaution. As a result of inadequate disease control, the use of a face mask has led with in rapid spread of the disease in many regions. The COVID Viruses, which would be more contagious and dangerous, is more vulnerable to humans. More prophylactic measures to guard against viruses threats are being investigated in the wake of the COVID 19 pandemic. The mask is a soul device that protects the human body against pathogens. Carelessness is a character flaw that some people display when they cough and sneeze without wear a face mask, acting as carriers and spreaders. Without a face mask, entering public locations is extremely dangerous. For early diagnosis of COVID viral symptoms, temperature and Spo2 concentrations are much more important. To catch the face mask, a high-end camera is used in collaboration only with Raspberry Pi processor. The status of the facial mask when it's being worn is determined using the CNN classification algorithm. A pulse oximeter is used to quantify Spo2 levels, and non-contact measuring equipment is used to determine body temperature. The three criteria are utilized to close and open an office or retail mall's entrance gate. The gateway temporarily closed as well as the buzzer is triggered if such combination of three factors results in such a fault state. The Iot devices will be used to transport the aggregated data to a web page.

Keywords— CNN classification Algorithm, viral symptoms, prophylactic measures, pandemic

I. INTRODUCTION

SARS COVID 19 has been declared a pandemic that is impacting individuals of different ages. The virus is spreading swiftly throughout the world, presenting a significant threat to humans. Stopping the CORONA virus from spreading is critical. The virus's rapid spread across the population can be slowed by the use of appropriate surgical masks and routine sanitization. Viruses spread through the pulmonary and oral tracts via droplets. Methods such as keeping a social respectable distance six feet, adopting a facial mask, and consciousness are recommended to avoid community transfer. These days, an individual with a strong body temperature is extremely concerning. As a result, to reduce viral infection rates, non-contact temperature monitoring technology and face covering verification are required. A smart device is required for non-invasive temperature, SPO2, or body temperature monitoring. It is possibly unsafe and time-consuming to enter a human-supervised facility. When a virus is fast spreading and a person's life is at risk, it's critical to switch from manual to fully automatic mode. It is vital to assess the occupancy density of such a hall or store in order to avoid large gatherings. An down and up counter just at entrance and exit is used to determine the density of a building or mall. These two counters are used by the Raspberry Pi board to identify the location of a door whenever it is opened and closed. The

classification technique for face mask detection is much more versatile for detailed representation. Artificial intelligence is being used to identify people who are wearing facemasks, which is a novel technique. Face mask identification would be a more effective means of preventing COVID transmission. Facial recognition software is a tricky problem to achieved in order to activate the access badge for key premises. Deep learning and traditional neural networks are far better at detecting whether or not someone is wearing a face mask. The most important aspects of an image may be extracted using convolution neural networks. Deep neural networks are capable of segmentation and localization. Using a pair of input photographs, a deep neural network is utilized to classify the categories of having and not using the face mask. The features have been extracted from raw datasets that have not been processed.

II. RELATED WORK

Face mask detection employs a variety of methods. A few of these are covered in further depth farther down.

Face Detection Using Deep neural Networks and Gabor Filters [1] was proposed by Bodan Kwolek in 2012, and it used Gabor Filters as well as a convolutional neural network to identify facial areas. The Median Filtering is generally used to extract natural facial characteristics. The Gabor Filter's main advantage is that it allows signal analysis at a variety of sizes and resolutions. One or more planes make up the layer of a convolutional neural network. Six convolutional layers are used in this application. As a result, it demonstrated greater identification and a higher incidence of face detection when comparing to CNN alone.

In 2015, N. Ozkaya and S. Sagiroglu published an intelligent face mask identification system [2] that was used to produce face masks based on the user's fingerprint in order to develop an intelligent system for getting mask facial fingerprints with knowing anything about the user's face. In the multi-model database, there are 120 people. Data Enrollment and Module MMDB are two of the most important modules of the IFPSF (Multi Model Biometric Data Base).

Arrangements and Post-processing are the two processes of the Face Reconstruction Module.

The association between the face and the fingerprint is determined using an ANN (Artificial Neural Network) in this case. An unknown biometrics feature is derived from some other unknown biometric characteristic, where the unidentified biometric element is a full face and the unidentified biometric information is a fingerprint.

In 2016, Gayatri Deora and Ramakrishna released an article [3] on masking facial recognition in video analytics, which uses a video analytic approach to detect faces. Face recognition system can be activated when the range between a human and the webcam is computed. Jones, Viola An algorithm for detecting face features such as the eyes, forehead, and mouth. This method has a high detection rate and a low false positive rate. As a consequence, the picture quality is poor, leading to a high rate of false detection.

Face recognition and verification using LBP and Softening point was proposed by Naveens and Dr. R.S Moni in 2016 [4]. In this paper, we present a face detection and authentication system that enables for the identification and removal of masks. To create a realistic face, global and regional facial features are used. A mixture of LBP (Local Binary Pattern) and BSIF is used to create a 3DMAD using 3D mask data (Binarized Statistical Image Features) extraction of texture for facial verification Face identification, feature extraction, computer vision, and face recognition authentication are all covered in this section. The regional and international properties of such Face region are determined using feature extraction. When employing the face detection approach, one may determine whether such a person's face is legitimate or disguised classification of these qualities.

A Cascade Architecture for Masked Face Recognition was proposed by Weibu Jiangejinn and Chuanhong Xiao in 2017 [5]. Zhou used a

simple technique to recognize masks. Three spiraled convolutional masks make up the architecture. The detectors are Mask–12, Mask–24-1, and Mask–24-2. In this case, a ResNet 5 network with an eight convolutional layer and a max pooling is used. Mask 1 is the initial stage, following by Mask 3, and finally Mask 4. The masked detection method has reached its conclusion. A face mask is used, along with a dataset of 160 images and 40 photos for testing purposes. Models for pre-training and good training methods are also provided. Finally, PASCAL VOC is employed during the evacuation procedure. Face accuracy in Masked Testing was 86.6 percent.

As an anti-spoofing strategy, Arti Mahore and Meenakshi Tripathi proposed Identification of 3D mask in 2D face recognition software using DWT and LBP [6] in 2018. It's broken down into many types of detection methods, such as hardware, programming, and user collaboration. To generate a mask, the hardware approach uses external hardware. The texture-based analysis is used in the software-based approach. The brightness and luminance components of the entering RGB image are successfully processed by DWT. In extracting the features, a Local Binary Pattern is used (LBP). The Classification algorithm determines whether an image is genuine or fake.

Facial Mask Detection Using Semantic Segmentation [7], a method for recognizing facial masks using semantic segmentation, was developed by Toshanlal Meenpal, Ashuthosh Balakrishnan, and Amit Verma in 2019. In this case, the selected features are designated as face or non-face. The VGG-16 convolutional neural network architecture is used for segmentation, subsequently by a convolution neural network. As a consequence, it can recognize a wide range of facial expressions. This method is effective on both frontal and semi faces. As a consequence, its main goal is to get rid of erroneous projections.

In 2020, C. Jagadeeswari and M.Uday Theja reported a performance evaluation of intelligent face mask detection systems using multiple deep learning classifiers [8]. A range of computational intelligence classifiers, namely mobile Net V2, ResNet 50, VGG 16, ADAM, and SGD, are used to evaluate the performance of face mask identification. The classifiers that were used are listed in this section. For each classifier, monitor the effectiveness of three optimizers. Optimizers like ADAM, ADAGRAD, and SGD (Stochastic Gradient Descent) are employed in this case. As an outcome, the ADAM optimizer performs admirably, and the Portable Net V2 classifier produces the most precise results.

Mingjie Jiang, Xinqi Fan, and Hong proposed the Retinal Face Mask Detector [9] in 2021, which is the subject of this article. It's a straightforward, one-stage object detection system. There are a total 7959 images in the collection. The ResNet and the mobile Net make up BACKBONE. ResNet, on the other hand, is considered a traditional backbone. A backbone, a neck, as well as a head are the three modules that make up the detection network. As a conclusion, ResNet outperforms Mobile Net in terms of accuracy.

III. PROPOSED APPROACH

Prerequisite software

3.1 Tensor Flow

Tensor Flow has an easy-to-understand syntax, which is critical for getting the most out of these software applications. The advanced nature of machine learning necessitates extensive syntax, which developers should be aware of. Tensor Flow outperforms other popular deep learning frameworks in terms both features and functions. These high-level procedures are required for these complex parallel calculations and the creation of powerful neural network models.

Tensor Flow is a low-level library with additional flexibility. As a result, you'll be able to create your personal model functionalities and services. This is an important element for researchers to grasp since it allows them to modify the models to changing user needs. Tensor Flow allows you to have more control over your networks. Designers and developers will have a better grasp of how procedures are

carried out across the business as a result of this.

3.2 PuTTY

PuTTY is a software that allows users to connect towards the Raspberry Pi control interface from your computer's desktop or laptop. It launches a command prompt on your laptop, allowing you to submit instructions and receive data via SSH (secure shell). Although PuTTY seems to be the most popular, other procedural programming are also accessible with both the Raspberry Pi terminal.

A communication link or a USB – serial conversion adaptor can be used to access PuTTY. The first example shows how to connect a serial port to your computer.

3.3. VNC viewer

Virtual Network Computing (VNC) is a graphics desktop sharing application that allows us to remotely watch the desktop interface of another computer or mobile device. The VNC viewer delivers data to the Personal server and receives updates on the display using a cursor, keyboard, or touch case. Working directly just on Raspberry Pi isn't always practical. You might also want to provide a remote from some other device to control it. Real VNC, which is included with a Raspberry Pi operating system, is used by VNC. It includes a VNC Viewer and a VNC Server for local Raspberry Pi monitoring and remote desktop connection to a Raspberry Pi. The VNC server must be activated before it can be used. The VNC client is in charge of allowing the Raspberry Pi to communicate wirelessly.

Hardware specifications

3.4 Raspberry pi

In the 1970s, the information age began. This period provided the right to access data at the push of a button or even the click of such a mouse, first from largest computing systems to the smallest home computers. As a consequence of technological breakthroughs, computers have developed from behemoths housed in vast warehouses to gadgets you can carry in your pocket or wearing on your wrist. Today, it would be rare to find a company or field which doesn't use computer technology in some way.

While there are tremendous advantages to computer technology, the imbalance it generates between groups and sectors is difficult to ignore. Those countries who lack the infrastructure to take use of sophisticated technology will tend to slide behind those that can. Individuals who lack basic computing abilities are often unable to remain up with technology advancements and fall behind their peers. Students who do not have access to educational opportunities, whether young or old, risk having their education hampered. In other words, a lack of technology knowledge as well as an inability can navigate the World Wide Web exacerbates the difference between have and and have-nots.

Linux is used to run all Raspberry Pi models. Linux operating system that acts as a link between a computer's hardware and software. Python is just the language of programming that Raspberry Pi makes use of. Python is a high-level and general-purpose programming language for creating graphical interface (GUI) applications, websites, and internet applications. One of the benefits of Raspberry Pi it can not require any existing experience of Linux or Python to begin a project. Indeed, the goal of the software is to teach customers about just the system and terminology through fun projects.

Fig 1: Raspberry pi

3.5 Camera for Raspberry Pi

A Raspberry Pi based Camera with just an 8-megapixel sensor is used in this project. At a resolution of 3270 2444 pixels, this camera module enables 1080p30, 720p60, and 640 480p90 video. Figure 2 depicts the Raspberry Pi camera module. It has a fixed lenses and a Sony IMX219 imaging system that was created specifically for use as a Raspberry Pi add-on

board. The Pi module is linked to the RPi through one of the tiny ports on the board's top area, and it also takes use of the CSI gui, which is designed specifically for camera connectivity.

Fig 2 : Camera for Raspberry pi

3.6 Temperature Sensor

The temperature probe (MLX90614) is a non-contact infrared temperature reader that reads temperatures without making direct contact with them. The MLX90614 temperature controller is shown. Both the Signals ASSP and the IR Mood Detector Chip are TO-39 (a type of metal can' (also referred as metal header) package for semiconductor technology.) The thermometer's noise reduction amplifier is used, together with a 17-bit ADC and a strong DSP efficient unit, to help achieve greater accuracy. A electronic System Integration Bus (SMBus) output is included in the sensor, which is validated and produced at the factory. With an accuracy of 0.15°C, a 10-bit PWN is programmed to continually broadcast the observed temperatures between -19 and 130°C.

3.7 Gear Motor

Gear motors are complete engine results systems that combine an electric generator and a reducing gear train into the single, simple-to-install and-configure unit. The difficulty and cost of developing and producing power tools, machinery, and appliances that demand high torque at the a low operating speed or rotations per minute are greatly reduced (RPM). Low-horsepower motors can generate significant motive power at low speeds thanks to gear motors, which are ideal for elevators, winches, medical tabular, jacks, and robotics. They could be as big as a skyscraper or as tiny as a clock.

IV. METHODOLOGY

4.1 Face Recognition Techniques

There are two primary methods for detecting faces:

- Aspect-Based Approach
- A Visual Approach

Aspect-Based Approach

Objects are usually recognized by their distinguishing qualities. An external bodily component can be recognised from a facial and a range of other objects by a number of qualities. It recognises faces by extracting anatomical aspects like as the face, nose, and eyes and determining whether or not a face is there. As a result, use them to recognise faces. To separate facial recognition software from non-facial recognition, several statistical categories are applied. Human faces have particular textures that make them stand out from other objects. We will construct a feature-based strategy based on just this approach using Open CV.

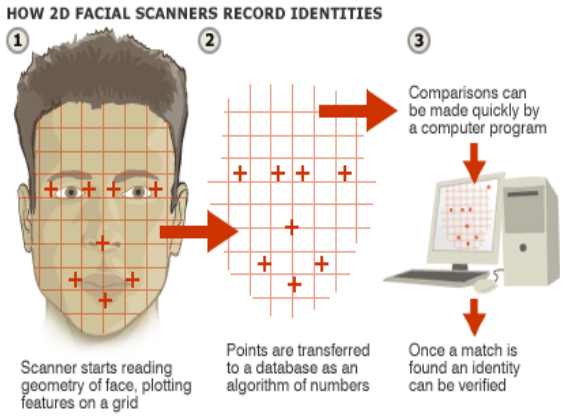

Fig 3 Face detection approach

Image-Based Methodology

To extract relevant information of face and non-facial images, image-based systems involves the use of statistical analytics and machine learning techniques. The learned characteristics are saved as distribution methods or discriminate features, which are then used to detect faces. To recognise faces utilizing MTCNNs, or Sub Cascaded Convolutional Neural Network (CNN), which is a graphics approach to face identification, we use a range of algorithms in our approach, including neural

nets, HMMs, SVMs, and AdaBoost learning. An image-based methodology is less efficient and precise in large sectors than a functionality approach.

4.2 Workflow

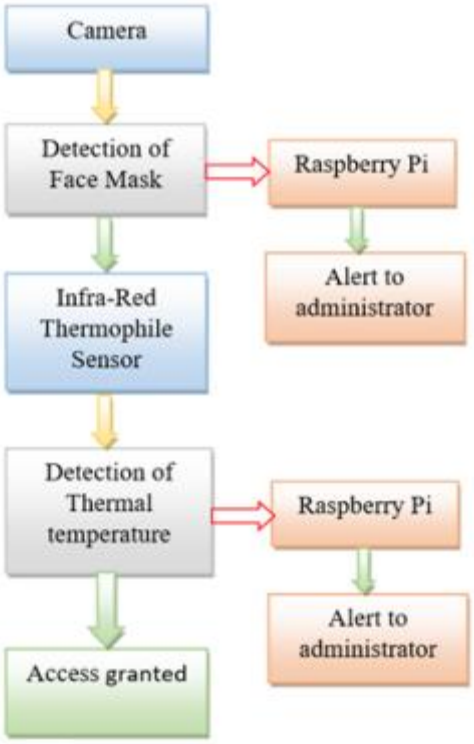

Fig 4 : Work flow Diagram

To classify and analyze the use of face masks, a convolutional neural network computational intelligence technique is used. The image is collected using a camera, and the procured image pixels are fed into the network's input layer as an array. To extract features, hidden layers are used. Because it is utilised to extract characteristics from the gathered image, the max pooling is the most important hidden layer. The image's target object is identified by a fully connected network layer. The input image is represented by an Array. The result array will be formed by multiplying the input array by each component and picture. After that, the final version is added, resulting in a new array. This method is repeated several times till the desired result is achieved. Pooling is required to reduce the convoluted image, which entails sub sampling the input image. While the intricate image's size is reduced, important info must be protected. The input image becomes jumbled as a result of the kernels. The same deep neural network is used for weights and biases. By reducing the number of variables and computations, the supplied picture is compressed. A filled up vector, kernels enabling extracting features, and a featured map or stimulation map make up the convolution layer. By dividing the input images by the kernels for detecting features, the feature map is formed. More exactly, a rectangle array of rows or columns.

To extract the features, pooling works in stages, utilizing convolution just on input data. After then, the output is routed through the graze forward network.

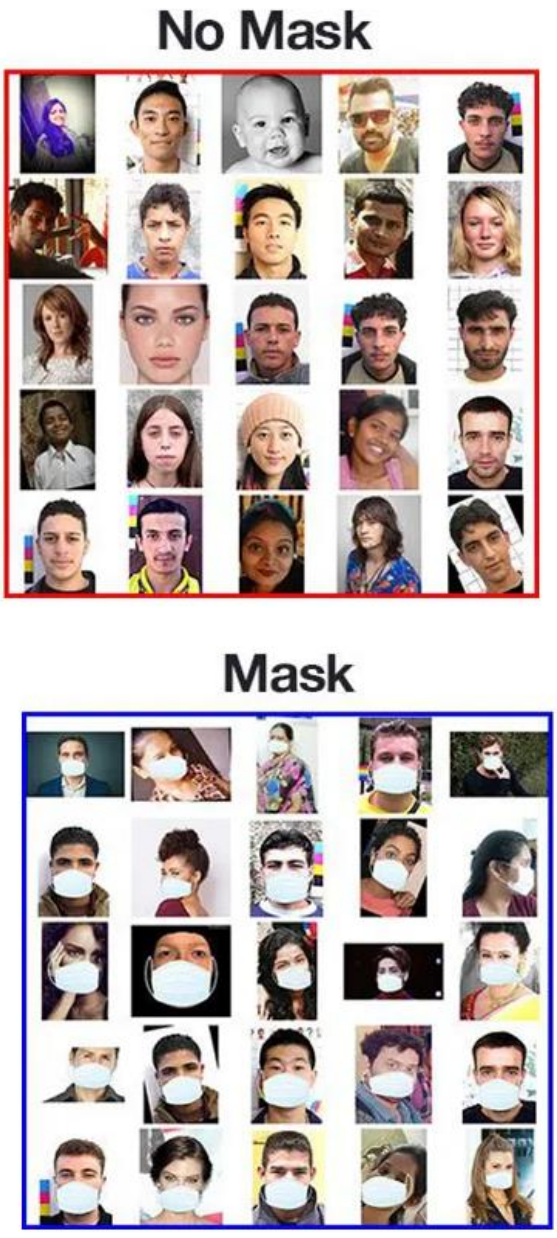

Fig 5 : Face Mask Detection

In our model, the temperature and pulse oxymeter sensor works on the same principle as thermal thermopile sensors for temperature plus pulse measurements, which senses temperature and pulse to determine if indeed the temperature exceeds a predetermined limit? It sends the signal to both the Raspberry Pi if the temperature rises above 97.5°F or the pulses change. The face mask is validated using a Raspberry Pi. The Sensor sends signals to a Raspberry Pi, which is a little device roughly the size of such a credit or debit card. This signal energizes the camera. The Raspberry Pi camera captures the person's image, and the buzzer sounds, yet the door remains shut. Now, a raspberry pi delivers a warning to the user via the mobile app, advising him of such safety precautions he has failed to follow in order to preserve the social well-being of the community.

V. CONCLUSIONS AND DISCUSSION

This project makes use of a Raspberry Pi 3 Model V. It's a little, low-cost USB gadget that connects to the internet. The Raspberry Pi is connected to the laptop through a LAN wire. The first IR sensor's VCC pin is connected to the R pi's second pin, the Ground pin to the R pi's 34th pin, as well as the output to the R pi's 40th pin, which really is a general-purpose I/O pin commonly known as a GPIO pin. VCC is linked to the 17th pin, GND to the 13th pin, and the dc output to the R pi's 38th GPIO pin on the second infrared sensor. The servo motor's VCC pin is linked to the second pin, the 5V input, the GND pin is connected to pin 39, and the signaling pin is connected to the positive terminal 37, which is the R pi's GPIO pin. The MLX90614 temperature sensor's VCC pin is connected to the first pin on the R pi, the GND pin to pin 16, and the sensor's HCL and HDL pins to the 2nd and 3rd pins on the R pi, respectively. The camera port on the R pi is connected to a R pi camera.

5.1. Quantitative Analysis using a variety of test cases

Optimization approaches adjust the weights as well as learning speed of neural networks in order to reduce training losses. Because the analysis includes optimization aspects, validity accuracy diagrams are presented in relation to consistent and loss of validity, rather than loss of training. Adding more hidden units results in a much more comprehensive analysis model on the one hand, while each new layer raises processing complexity on the other.

Furthermore, increase in the number of nodes in hidden layer raises the processing cost. To enhance the number of data samples, zoom, which was before, shear, and other picture augmentation characteristics are commonly used. Deep learning model building generates pictures with these qualities whenever these parameters are applied. When picture patterns were generated via image augmentation, the rate of current data samples increased threefold to fourfold. However, this is impossible also because model would be extremely biassed and would fail to generalise adequately.

The gathering of all input combinations is referred to as an epoch. The weight values are re-adjusted as well as tested against by the subsequent loop simulation of same dataset, just as they are after each epoch (called next epoch). It is expected that the complete dataset is in system memory when this is run. Because keeping the complete dataset on system memory at various moments in time for huge datasets is impracticable. Each batch is imported into primary memory and run sequentially, even with results accumulated and presented as an average output.

CNN's main advantage over its immediate predecessor is that it able to detect important features instantaneously and without the need for human intervention. As a consequence, CNN is a great solution for picture categorization and computer vision challenges. To use an alternative approach, picture features should be generated first, then input into a classification method like SVM, KNN, or regression models. These automated systems have a large learning rate when compared to CNN.

The main goal of the system is to keep COVID-19 from spreading in public places like malls and offices. The technology can detect face

masks as well as monitor a person's body temperature. The number of people in the room is indicated when the unnecessary roughness detector model is loaded. Only if the house's occupancy is less than what the stated limit does the IR sensor progress to next level when a person moves by it. The temperature sensor monitors their pulse, because if it is less than that of the predetermined limit, the Pi camera turns and checks to see whether they are wearing a costume. The door automatically opens and the count advances by one if the mask is detected; otherwise, the person is not permitted and the count remains static. If another person passes, their core temperature and pulse rate are also taken. If they fulfill all of the requirements, their count is raised by one and they are given permission.

VI. CONCLUSION

The introduction of innovative models to help rising countries satisfy their needs is compelled by technological advancements and the accessibility of smart technologies. The goal of this project is to create an Internet of Things-enabled smart door that can monitor body temperature, pulse, and detect face masks to encourage greater safety. This will significantly minimize human resource requirements while also adding another level of safety against the spread of Covid-19 infection. To identify face masks, measure temperature, pulse, and count the number of people present at any given time, the model uses a real-time profound learning system enabled by a Raspberry Pi. In terms of temperature measurements, pulse rate detection, and mask detection, the gadget performs brilliantly, with the trained model obtaining a 97 percent accuracy. The test results show that detecting individuals using and not employing facemasks, as well as producing monitored and recorded alarms, is extremely accurate. There are also a number of ways for improving performance and, as a result, rising results

REFERENCES

1. Priyanka, J.S., Kiran, M.S., Nalla, P. (2022). A Secured IoT-Based Health Care Monitoring System Using Body Sensor Network. In: Marriwala, N., Tripathi, C.C., Jain, S., Mathapathi, S. (eds) Emergent Converging Technologies and Biomedical Systems . Lecture Notes in Electrical Engineering, vol 841. Springer, Singapore. https://doi.org/10.1007/978-981-16-8774-7_39
2. A. Rosebrock, "COVID-19: Face Mask Detector Using OpenCV, Keras/TensorFlow, and Deep Learning," PyImageSearch, May 4, 2020, https://www.pyimagesearch.com/2020/05/04/covid-19-face-mask-detector-using-opencv-keras-tensorflow-and-deep-learning/. Google Scholar
3. A. Hidayat, Subono, V.A. Wardhany, A.S. Nugroho, S. Hakim, and M. Jhoswanda, "Developing an IoT-based Independent Pulse Oximetry Kit as an Early Detection Tool for Covid-19 Symptoms ", 2020 3rd International Conference on Computer and Informatics Engineering (IC2IE). Google Scholar Carlo Alberto Boano
4. Lasagni, Matteo Romer, Kay Lange, Tanja. "Using Body Sensor Networks to Accurately Measure Temperature for Medical Research". Google Scholar scholar
5. Cristina S.C, B-P BUTUNOI, and Calin C, "IoT-Enabled Intelligent Building Applications in the Context of the COVID-19 Pandemic," 2020, 10.1109/ISETC50328.2020.9301124. Google Scholar
6. Yahaya, F.H., Yusoff, Y.M., Abidin, H.Z., and Rahman, R.A. Development of a wireless sensor node based on a PIC microcontroller leveraging XBEE technology International Conference on Information Management and Engineering (IEEE International Conference on Information Management and Engineering) (2010) Google Scholar
7. Gayatri Deora Ramakrishna Godhula and Dr. Vishwas Udpikar, "An Investigation of the Masked Face Detection Approach in Video Analytics," IEEE Conference on Advances in Signal Processing (2016) Google Scholar

8. https://www.electronicwings.com/arduino/servo-motor-interfacing-with-arduino-uno/servo-motor-interfacing-with-arduino-uno. Google Scholar
9. https://www.robocarstore.com/products/raspberry-pi-4-model-b-board-with-1gb-lpddr4-sdram. Google Scholar
10. K. Baskaran, P. Baskaran, N. Kumaratharan, and Rajaram V., "IoT-Based COVID Preventive System for the Work Environment," Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics, and Cloud) (I-SMAC), IEEE Xplore Part Number: CFP20OSV-ART; ISBN: 978-1-7281-5464-0. Google Scholar
11. M.G. Lim & J.H. Chuah (2018). Recognize Durian Varieties Using Deep Learning Techniques The 9th IEEE Control and System Graduate Research Colloquium will be held in 2018. (ICSGRC). doi:10.1109/icsgrc.2018.8657535. Google Scholar

AUTHORS

K SUNNIHITHA received B.Tech from JNTU HYDERABAD. Now she is Pursuing M. Tech in Embedded Systems at Vardhaman College of Engineering, Hyderabad, TS, India.

Mrs J SWETHA PRIYANKA working as Assistant Professor in the Department of Electronics and Communication Engineering at Vardhaman College of Engineering, Hyderabad, TS, India.