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Face Mask Detection and Thermal Scanner for Covid Care

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Abstract - *According to the World Health Organization (WHO), the effective protection method is to wear a face mask in public areas. Keeping everyone's safety into consideration, each and everything is expected to be contactless. The model is a Computer Vision based automated system that focuses on real-time face monitoring of individuals to achieve a COVID-free environment. Automatic sanitization is performed when a person is wearing a face mask and their body temperature is within the threshold. If not, a buzzer will be engaged and an alert message will be delivered.*

Key Words: **Face Mask Detection, MobileNetV2, Keras, OpenCV, TensorFlow.**

1. INTRODUCTION

In order to prevent the spread of corona virus (COVID-19), the World Health Organization (WHO) advises all governments to mandate its citizens to wear masks in public. As because majority of positive cases are found in busy and over-packed regions, scientists recommend wearing a face mask in public places to prevent disease transmission. To prevent the spread of virus, it is also necessary to sanitize hands periodically. The system can detect the presence or absence of a face mask in videos using a combination of image classification and video analysis.

COVID-19 infected more than five million people in 188 countries in less than six months. The virus spreads through intimate contact, as well as in congested and overcrowded environments. With the aid of emerging technologies such as artificial intelligence, the Internet of Things, and machine learning, we can combat and anticipate new illnesses. To gain a better understanding of how infection rates may be reduced using our method. Many nations have regulations requiring people to wear face masks in public. These guidelines and legislation were created in response to the rapid increase in cases and deaths in several locations. In public spaces, however, monitoring big gatherings of individuals is getting increasingly challenging. As a result, we'll automate the face detection procedure. We provide a computer vision and deep learning-based facemask detection algorithm in this paper. The suggested model may be used in conjunction with surveillance cameras to block COVID-19 transmission by detecting persons who aren't wearing face masks. With OpenCV and Tensor flow, the model integrates deep learning and traditional machine learning approaches.

There is a need for a device that can assist us achieve social distancing and sanitation in a single step, as this is currently not been archived even after taking precautions. When a mask-wearing face is detected and if the temperature is within the prescribed range, then sanitizer unit will automatically pump out sanitizer, as indicated by an LED. A buzzer will be activated and the message will be sent to the relevant authorities if a model detects a person without mask or when the temperature exceeds the permissible limit.

2. LITERATURE SURVEY

In [1], H. Adusumalli, D. Kalyani, R. K. Sri, M. Pratapteja and P. V. R. D. Prasada Rao proposed a face mask detection system that employs TensorFlow and OpenCV to detect face mask on people. A boundary box is drawn over the face describes a person wearing mask or not, and also detects the name of the person and alert the person through email. In [2], K. Naveen Kumar, S. Surya, S. S. Mohammed Nihaal, A. Manoj Kumar proposed a computer vision-based solution system which monitors real time face mask detection and body temperature using Raspberry Pi 4 Model B to detect face mask with an integrated Pi camera and MLX90614 sensor to monitor body temperature. In [3], M. S. Islam, E. Haque Moon, M. A. Shaikat and M. Jahangir Alam carried out work in three levels: preprocessing of images, cropping the images and classifying the images. This will help us to detect weather a person is wearing a mask or not. CCTV cameras or wen cameras will be used for continuous surveillance. If a person is detected without mask the system will send a security alert. In [4], V. K. Sharma implemented face recognition system based on Viola-Jones object detection algorithm that uses AdaBoost classifier, LBP and Haar features to extract unique features of the face such as eyes, nose, and mouth. The sytem is implemented using Python and OpenCV. In [5], I. M. Sayem and M. S. Chowdhury implemented a model that pairs up Raspberry Pi to a camera module. During the operation, the system will recognize the face among the dataset, if the matching name is found it will grant access, and alternatively photo will be sending an email as warning. In [6], K. Goyal, K. Agarwal and R. Kumar presented an approach for face recognition in three steps: face detection, face extraction and face recognition. Face detection is performed using OpenCV. 5 In [7] Shrutika V. Deshmukh, Dr. U A Kshirsagar

have developed a security access control application based on face recognition. Haar feature is used in face detection and HOG + SVM are used for face recognition. OpenCV is used for high effectiveness and is coded in python programming language. In [8], H. Tang and K. Hung presented a non-contact temperature measuring system to measure student's forehead temperature. The prototype uses temperature sensor, embedded system and database to prevent outbreak of diseases by proper monitoring.

3. PROBLEM STATEMENT

There is a need for a product that can help us to obtain social distancing and sanitation in a single time as currently it is not been achieved even after taking measures. So, the task here is to predict whether people are wearing face mask or not and to check the temperature of the person through live streaming.

4. PROPOSED SOLUTION

The solution to this problem is to employ a Raspberry Pi 3 Model B microcontroller to control an automated facemask and body temperature detection system, as well as an automatic sanitization. This configuration has its own camera module that monitors the facemask and a non-contact temperature sensor which measures the body temperature and permits the user to proceed if they meet the COVID-19 protocols or else it alerts the appropriate authorities.

5. DESIGN

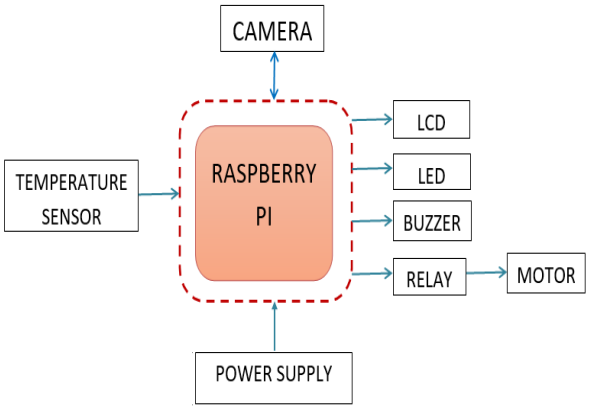

Fig -1: System Block Diagram

The system block diagram is as shown in Fig-1. The connections are done in a similar manner. The Raspberry Pi receives its input via the Pi Camera, which captures a picture of a person and uses a temperature sensor to determine the person's temperature. The temperature readings and mask on or off results will be shown on the Raspberry Pi through LCD. External hardware such as a LED, buzzer and a relay are attached for alerting and sanitizing purposes, respectively.

6. SYSTEM REQUIREMENTS

6.1 Raspberry Pi 3 Model B

Raspberry Pi 3 model B which gives us access to the huge number of libraries. It consists of quad - core CPU with 1.2GHz clock rates and a new Video Core VI 3D graphics core. The on-board memory is 1GB RAM. It features 40 GPIO pins for transmitting and receiving signals. The Ethernet port on the Raspberry Pi allows us to connect to the internet. The system is designed using Python programming language.

Fig-2: Raspberry Pi 3 Model B

6.2 PI Camera

With the Raspberry Pi 3 module B, any USB webcam may be utilized. The PI camera connects directly to the Raspberry Pi's CSI connector. With v1.3, it can provide a crystal clear 5MP image or record 1080p HD video at 30 frames per second.

Fig-3: PI Camera

6.3 MLX90614-ESF Infrared Temperature

A non-contact infrared thermometer MLX90614 ESF is used. It's being used to measure body temperature in this case. It can withstand temperature ranging from -20 to 120 ° C. It measures a person's body temperature and sends the information to a Raspberry Pi.

Fig -4: MLX90614-ESF Infrared Temperature

6.4 16*2 LCD Display

Fig -5: 16*2 LCD Display

Liquid crystal display (LCD) is a word used to describe a display that is made up of liquid It's a type of electronic display module that's found in a wide range of circuits and devices, including mobile phones, calculators, computers, and television sets, among others. Multi-segment light-emitting diodes and seven segments are most commonly used in these displays. The system has a 16x2 LCD, it has 2 rows and can display 16 characters in each row. This LCD module can show up to 8 custom characters in addition to ASCII characters. It's used to display a camera feed from a Raspberry Pi that shows whether or not a person is wearing a mask, as well as his body temperature readings. The primary advantages of utilizing this module are its low cost, ease of programming, animations, and the fact that there are no restrictions on displaying unique characters, special and even animations, and so on.

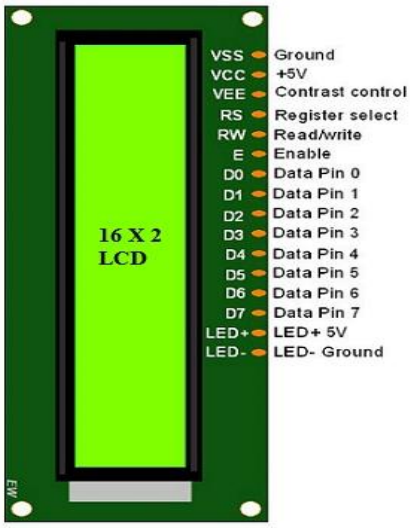

Fig -6: 16*2 LCD Display Pinout diagram

6.5 LED

Two distinct LEDs that emit green and red light were used. The Green LED will illuminate if an individual is wearing a facemask and his body temperature is below the protocol limit. Else, the Red LED will illuminate.

6.6 Buzzer

If the individual is wearing a facemask and their body temperature is below the protocol value, the buzzer will switch off; if not it will beep, notifying the relevant authorities.

Fig -7: Buzzer

6.7 VNC

VNC stands for Virtual Network Computing. It's a cross-platform screen sharing solution that lets us operate another computer from afar. VNC Viewer is used to operate local PCs and mobile devices from a remote location. VNC Viewer software placed on a device such as a computer, tablet, or smart phone may view and control a machine at another location.

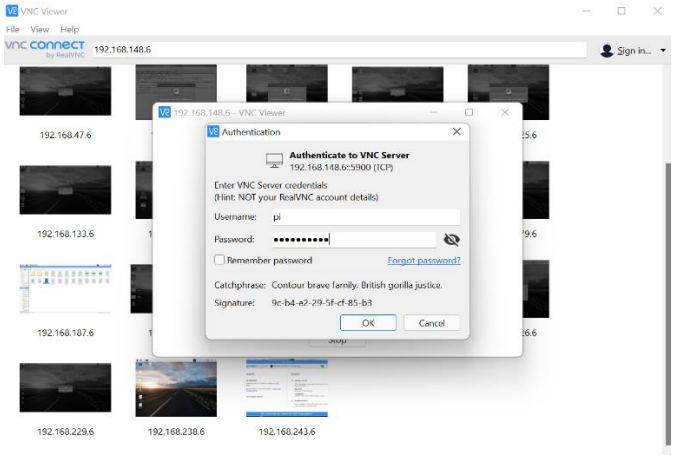

Fig -8: Authentication to VNC server

6.8 Raspbian OS

The official Raspberry Pi OS is included with every Raspberry Pi hardware. It was formerly known as Raspbian and is a Linux-based operating system designed particularly for the Raspberry Pi. Raspbian is a free operating system based on Debian and designed specifically for the Raspberry Pi. An operating system is a collection of apps and tools that enable your Raspberry Pi to function. Raspbian, on the other hand, is more than just an operating system: it includes over 35,000 packages, which are pre-compiled software packages packaged in a convenient style for simple installation on your Raspberry Pi. APT is the recommended package installation programmed by default.

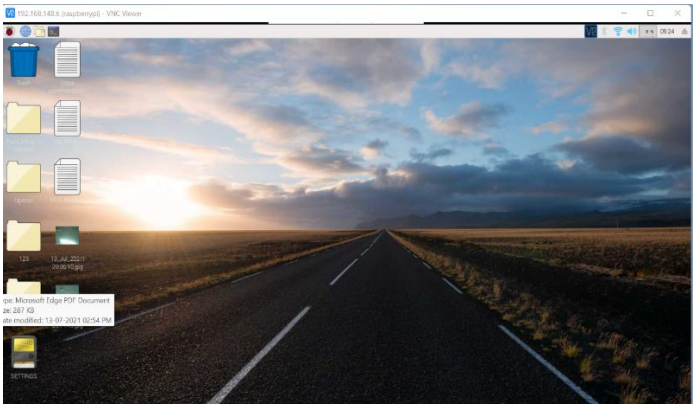

Fig -9: Interface of Raspbian OS

6.9 Programming Language used: PYTHON

Python is a programming language that is common, dynamic, high-level and interpreted. It is easy to learn and offers several high-level data structures. It is a platform independent language with huge standard libraries. The syntax and dynamic typing of Python with its interpreted nature make it a suitable language for the development of scripts and applications. Multiple patterns including object-oriented, imperative, functional, and procedural approaches are supported by Python.

7. METHODOLOGY

7.1 Face Detection

Face detection is done with the help of classifiers. Thousands of photos with and without faces must be used to train a classifier. Haar cascade and AdaBoost is used as the learning algorithm. It selects a small number of key features from a large set and generates highly effective classifiers. A 'cascade' of progressively complicated classifiers is used to eliminate any non-face parts in a picture, allowing more computation to be spent on promising object-like regions. Data (in the form of images) is input into the system after a massive amount of training. Each image's Haar features are extracted first by the classifier and are then stored in a database for further process.

7.2 Mask Detection

This system will recognize people wearing a facemask on an image/video stream using Deep Learning and Computer Vision techniques and libraries such as OpenCV, Keras, TensorFlow, and others. We'll concentrate on loading our face mask detection dataset from disc in this section. The photographs that we downloaded come in variety of sizes and resolutions. So, resize and crop the source image (256 x 256) and then subject it to RGB color filtering.

7.3 Temperature Check

A non-contact infrared thermometer, the MLX90614 ESF is used to determine a person's body temperature. The thermometer feeds data to a Raspberry Pi, which is then displayed on an LCD.

7.4 Face Recognition

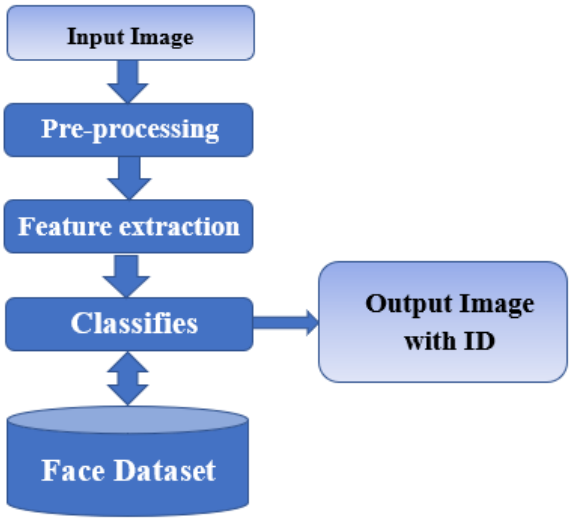

Fig -10: Flow of Face Recognition

Prior to facial recognition a database of diverse people is established by capturing their faces from distinct viewpoints. Then the key features of their face is extracted and save them in a database with the person's name or ID number as the folder name. When the Pi camera takes a person's image, it goes through pre-processing like as cropping, resizing, rotating, and so on. The features from the pre-processed pictures and use them to improve the accuracy of our classifiers. Then we'll compare these features to the ones we've saved in a database. If there is a match, the person's name will be emailed to the appropriate authorities.

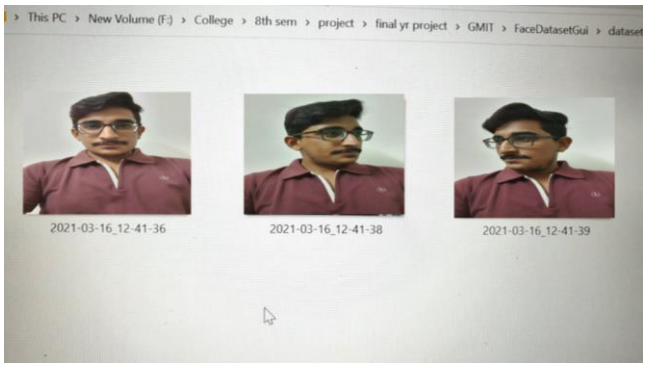

Fig -11: Created Datasets

7.5: Alert System and Hand Sanitization

The green LED will be illuminated if a person is wearing the face mask and their body temperature is below the protocol value, and the relay will trigger the motor to pump the sanitizer into the person's hand. If not, Red LED will be illuminated, a buzzer will be activated, the person's face will be identified and that person's name or ID will be emailed to the appropriate authorities.

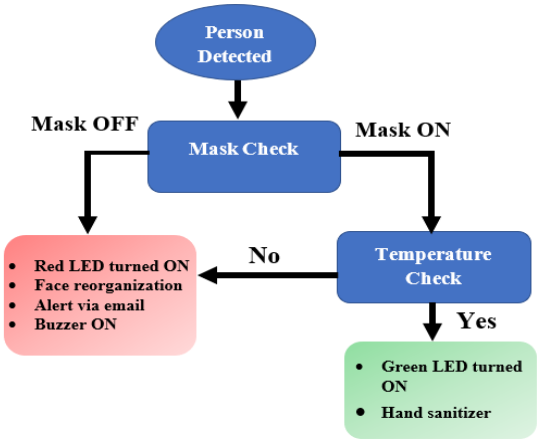

Fig -12: Flow of Alert and hand sanitization

8. RESULTS

The proposed approach determines whether or not the individual is wearing a facemask and feeds that information to the microcontroller. The non-contact temperature sensor measures the person's body temperature, and if both requirements are met, automatic sanitization is initiated. If that does not happen, buzzers will be activated, and the person's name or ID will be emailed to the relevant authorities.

8.1 When mask-on and Temperature below threshold:

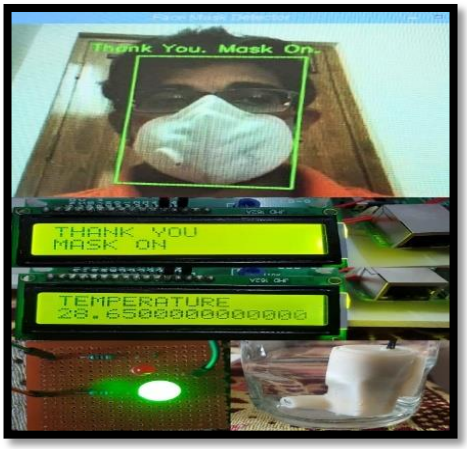

Fig -13: Face Mask detected with Green LED

The individual in the above Fig -13 is wearing a mask and his body temperature is below the threshold level, therefore the green LED illuminates and the relay activates the motor to sanitize the person's hands.

8.2 When Person found with no mask OR temperature above threshold:

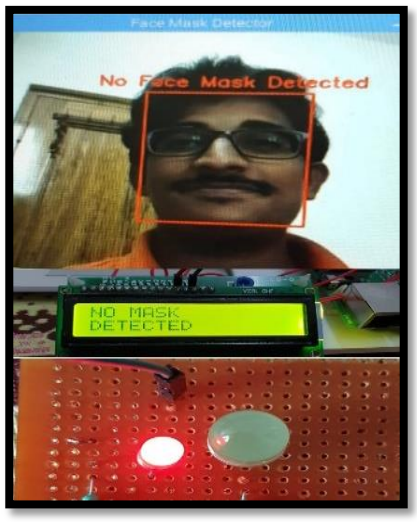

Fig -14: No Mask Detected with Red LED

If Fig -14 the individual is found without a mask OR his body temperature is higher than the threshold value, the red LED will glow and the buzzer will activate. It sends the person's name to the proper authorities as an alert message.

8.3 When person found with no mask AND temperature above threshold:

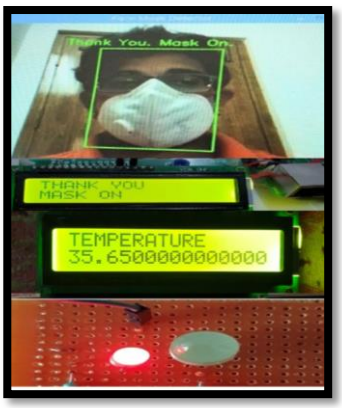

Fig -15: Mask Detected but temperature high with Red LED

The person in the above Fig -15 is found without a mask and his body temperature is above the threshold limit, so a red LED is illuminated.

8.4 Alert message sent to the authorized person:

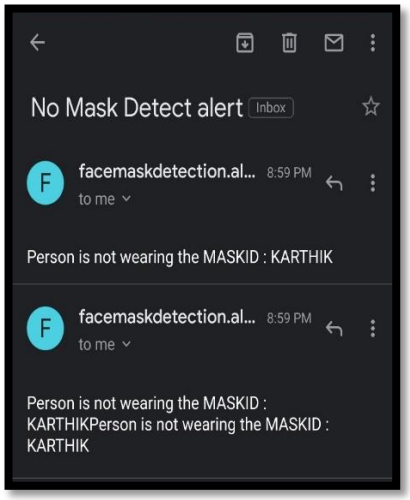

Fig -16: No mask alert message via E-mail

In Fig -16 an alert mail is sent to the appropriate authorities, indicating that the person was found without a mask and that his body temperature was above the threshold limit.

9. CONCLUSION AND FURTHER ENHANCEMENTS

With the aid of this model, an automated solution is accomplished, and no human intervention is required to monitor COVID -19 procedures. Facemask detection accuracy can be improved by training the module with a larger dataset. As a consequence, our suggested method will help society by saving time and by reducing Corona virus transmission. This model may be used to check individuals in places like colleges, schools and other organizations that have huge gatherings.

Further research will focus on detecting other forms of masks, such as face shields and transparent masks, as well as identifying the faces from various perspectives.

REFERENCES

[1] H. Adusumalli, D. Kalyani, R. K. Sri, M. Pratapteja and P. V. R. D. P. Rao, "Face Mask Detection Using OpenCV," 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), 2021, pp. 1304-1309, doi: 10.1109/ICICV50876.2021.9388375.

[2] K. Naveen Kumar, S. Surya, S. S. Mohammed Nihaal, A. Manoj Kumar, “Automatic Covid-19 Face Mask and Body Temperature Detection with Deep Learning and Computer Vision,” International Journal of Creative Reasearch Thoughts (IJCRT), 2021.

[3] M. S. Islam, E. Haque Moon, M. A. Shaikat and M. Jahangir Alam, "A Novel Approach to Detect Face Mask using CNN," 2020 3rd International Conference on Intelligent Sustainable Systems (ICISS), 2020, pp. 800-806, doi: 10.1109/ICISS49785.2020.9315927.

[4] V. K. Sharma, "Designing of Face Recognition System," 2019 International Conference on Intelligent Computing and Control Systems (ICCS), 2019, pp. 459-461, doi: 10.1109/ICCS45141.2019.9065373.

[5] I. M. Sayem and M. S. Chowdhury, "Integrating Face Recognition Security System with the Internet of Things," 2018 International Conference on Machine Learning and Data Engineering (iCMLDE), 2018, pp. 14-18, doi: 10.1109/iCMLDE.2018.00013.

[6] K. Goyal, K. Agarwal and R. Kumar, "Face detection and tracking: Using OpenCV," 2017 International conference of Electronics, Communication and Aerospace Technology (ICECA), 2017, pp. 474-478, doi: 10.1109/ICECA.2017.8203730.

[7] Shrutika V. Deshmukh, Dr. U. A. Kshirsagar, “Face Detection and Face Recognition Using Raspberry Pi,” International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), 2017.

[8] H. Tang and K. Hung, "Design of a non-contact body temperature measurement system for smart campus," 2016 IEEE International Conference on Consumer Electronics-China (ICCE-China), 2016, pp. 1-4, doi: 10.1109/ICCE-China.2016.7849773.