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COVID-19 Authorized Entry with Face Mask Detection using Raspberry Pi

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Abstract: *There are no effective face mask detection applications in the current COVID-19 scenario, which is in great demand for transportation, densely populated places, residential districts, large-scale manufacturers, and other organizations to ensure safety. In addition, the lack of big datasets of photographs with mask has made this task more difficult. With the use of Python programming, the Open CV library, Keras, and tensor flow, this project presents a way for recognizing persons without wearing a face mask using the facial recognition methodology. This is a self-contained embedded device that was created with the Raspberry Pi Electronic Development Board and runs on battery power. We make use of a wireless internet connection using USB modem. In comparison to other existing systems, our proposed method is more effective, reliable, and consumes significantly less data and electricity.*

Keywords: PIN (Personal Identification Number), thermal tracking, eye detection, eye-tracking, Blinking ratio

I. INTRODUCTION

Due to the COVID-19 outbreak, there is a widespread desire to develop a system that detects persons who are not wearing masks and alerts those who need to take action to reduce COVID-19 mortality. This method will improve everyone's safety at home, at work, and on any institution.

This suggested system will use digital photos acquired by a camera to identify a person. We used Intel's OPEN CV library, which is a well-known PC vision library.

The cross-stage library focuses on consistent image handling and includes patent-free implementations of the most recent PC vision calculations. We employ deep learning techniques, as well as Tensor Flow and Keras, a key open-source framework, to design and train machine learning models.

No morphed masked pictures dataset is used in our face mask detector. Because we employ the MobileNetV2 architecture, the model is precise and efficient, making it easy to deploy to embedded systems like the Raspberry Pi. Because of the deaths caused by the COVID-19 pandemic, this system is employed as a real-time application that requires face-mask detection for safety purposes.

The system's basic flow is as follows: first, the camera captures a picture, then our trained model is used to determine whether or not the person is wearing a mask.

If the individual is wearing a mask, then actuator is engaged, as well as the relay is turned on, allowing the door to open. If the person arriving does not put on the mask, the doors will not open, the buzzer will sound, and an image of the person who is not wearing the mask will be captured and sent to the concerned person's email address.

Existing System: The Raspberry Pi is an open-source electronics prototyping platform that includes schematics and flexible development kits for users who want to create interactive objects or surroundings. Raspberry Pi may be used to sense the environment by reading and interpreting inputs using different transducers, motor control or data transfer are two examples. In today's world, there has been substantial progress in the field of security, and there is no way to prevent persons who are not wearing masks from entering, which could result in COVID-19 casualties.

II. LITERATURE SURVEY

- 1) Alice Buffi, Dept. Bernardo Tellini. Energy, Systems, Territory and Construction Engineering University of Pisa, Italy, Andrea Motroni, Paolo Nepa Dept. Information Engineering University of Pisa, Italy: This paper presents a phase-based method for the classification of UHF-RFID tags in gate access control systems. The proposed system uses only a single reader antenna and multiple phase samples collected during the tag movement. Experimental results in real indoor scenarios show the ability of the method to discriminate incoming, outgoing, and passing tag actions. The method can be used at any identification point equipped with a COTS UHF-RFID system with a software/firmware implementation without the need for additional hardware.

- 2) *Mrinal Kanti Bhowmik, Priya Saha , Anu Singha , Debotosh Bhattacharjee, Paramartha Dutta:* By reducing the gaussianity, Independent Component Analysis (ICA) behaves robustly in segregating individual signals of non-skewed characteristic from a mixed composite signal. In this article, we present a next-generation variant of ICA, especially applicable in the skewed composite signal scenario, applying the Logarithmic transformation on basic ICA, named as Log-ICA. This approach is capable of decreasing overlapping probability densities of the composite signal, which, in turn, extracts more independent components because of reduced gaussianity. Here also we use two different architectures Log-ICA I and Log-ICA II corresponding to two variants of ICA architecture (ICA I and ICA II). We justify the effectiveness of the proposed technique on five separate benchmark face datasets using five classifiers. Out of five face datasets, two datasets contain both visible and thermal face image Experimental results show that Log- ICA II performs better than Log-ICA I and two variants of ICA for original face images and noise-induced face images.
- 3) *Anil J Dept. of Electrical & Electronics Engineering Nooral Islam Centre for Higher Education Kumaracoil, Kanyakumari District, Thuckalay, Tamil Nadu, India:* Face Expression Recognition (FER) has become a very interesting and challenging area in the computer vision field due to its wide application possibilities. Mental state Recognition, Human-Computer Interaction, Human behaviour understanding, etc. are some of its applications. Because of its wide application possibilities Face expression recognition has attained a very crucial role in the area of facial image processing. In this paper, some of the tailor-made face expression Recognition algorithms are presented. This paper also gives a brief insight into the feature extraction method of these face expression recognition techniques. The features extraction technique plays a crucial role in the efficiency of these algorithms. In this paper, a few Face Expression Recognition techniques like Patched Geodesic Texture Transform, Curvet Feature Extraction, Bag of Words Method, Local Directional Number Patterns Regional Registration Technique, Gradient Feature Matching, etc. which are used to recognize the facial expression are presented.
- 4) *Vivek Kumar Bhanse, M.Tech Mechatronics, Production Engineering College of Engineering Pune, India, Dr.M.D.Jaybhaye, associate Professor, Production Engineering College of Engineering, Pune, India:* Image Processing is nowadays used as a piece of various applications. Confront area and its following are some of the basic frameworks used as a piece of the uses of image processing. In this paper, we have shown an application for the improvement of the auto applications with the help of face revelation. The paper shows the examination of how the assurance of the camera impacts the edge each second and respectably the perfect open door for stand-up to acknowledgment. The image processing using Open CV for face detection, face tracking, and its recognition for automotive application is done here. We have used a processor controller and common USB camera for controlling the electric motor which in this way controls the motorized auto application. The viola-jones estimation for stand structure relies upon AdaBoost computation and changed works faces hair like highlights in the item part we have used python vernacular with OpenCV reinforce for the face distinguishing proof using haar course records gave by intel open source. We have shown the results on layout consistently impact on stand up to distinguishing proof.
- 5) *Xiao Han College of Software, Shenyang Normal University, Qingdong Du College of Software, Shenyang Normal University:* Deep learning in different areas of success, beyond other methods, starts a new wave of neural network development. The concept of deep learning originated from the artificial neural network, in essence, refers to a class of neural networks with deep neural networks. Structure of effective training methods [1].As a powerful technology for the realization of artificial intelligence, deep learning has been widely used in digital recognition, dimensional simplification, speech recognition, image comprehension, machine translation, protein structure prediction and emotional recognition. This paper focuses on research on face-recognition hotspots based on in-depth learning in the field of biometrics, combined with relevant theory and methods of in-depth learning, face-recognition technology, along the lines of in-depth learning based on the depth of face-recognition learning, face-recognition application to start research.

III. METHODOLOGY

The embedded system is supposed to operate as a safety device that protects an individual in public places such as malls, offices, and campuses by preventing anyone who are not wearing the mask from entering.

We construct a machine learning model that recognizes the individual who is not wearing the mask using deep learning techniques with Keras and tensor flow, as well as the open-cv library.

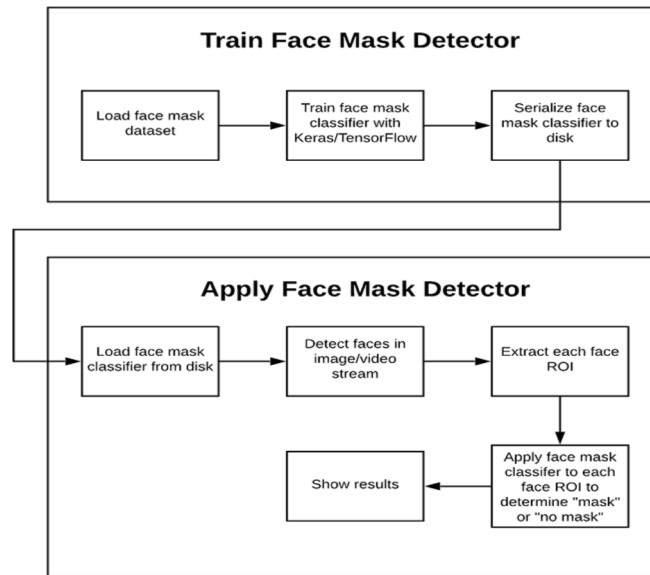


Fig 1: The Training and Deployment Model

To train a model, we divide the process into two phases, as shown in Fig 1:

- 1) *Training:* We'll focus on loading our face mask detection dataset from disc, training a model on it (using Keras/TensorFlow), and serializing the face mask detector to disc in this section.
- 2) *Deployment:* Now that the face mask has been trained, we may load the mask detector, which performs face detection and then categorizes each face as having or not having a mask.

A Raspberry Pi circuit is used to power this system. A camera, relays, an actuator, and a Current Load are all included on the Raspberry Pi circuit board, which is powered by a battery. When someone walks up to the door, it detects their face and opens the door if they are wearing the mask; if they are not wearing the mask, it raises an alert and takes a picture, which it sends to the registered email address. Our model, which is developed using deep learning techniques, is used to make the recognition.

IV. BLOCK DIAGRAM

The connections of the hardware equipment in our project are explained in Fig. 2.

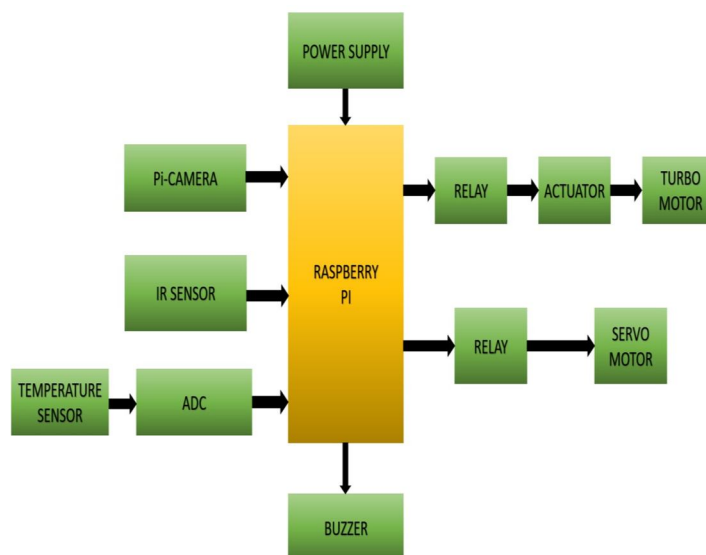


Fig 2: Face Mask detection Block Diagram

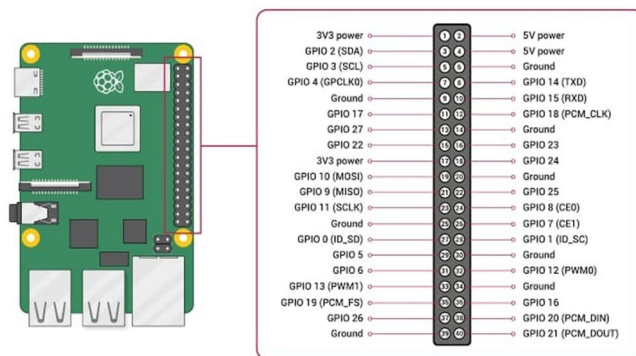


Fig 3: Pin Configuration Of Raspberry-Poi Board

In the Raspberry-Pi board, we basically use 18 pins. , and the connections from and to the pin are as follows:

- 1) The emitter (Buzzer) is attached to Pin 2 of the Raspberry-Pi board
- 2) GPIO 2-SDA is connected to ADC-SDA (Pin 3).
- 3) The Power Distributor's positive terminal is connected to a 5V power source (Pin 4).
- 4) GPIO 3-SCL is connected to ADC-SCL (Pin 5).
- 5) The Power Distributor's Negative is linked to Ground (Pin 6).
- 6) GPIO 17 is connected to the Servo Motor (out) (Pin 11).
- 7) GPIO18-PCM CLK is linked to the Ground Base (Buzzer) (Pin 12).
- 8) GPIO 23 is connected to the IR Sensor (out) (Pin 16).
- 9) GPIO 24 is connected to the relay (Pin 18).

V. RESULT

We successfully created an embedded system utilizing Raspberry-Pi that uses a Pi-Camera to determine if someone is wearing a mask. The concerned individual is then notified by a buzzer at the entrance to the premises. In addition, an e-mail will be sent to the individual concerned. A photograph of that person without the mask will be taken and saved. That person who didn't wear a mask will have avoided entering the premises.

Our proposed system will also automatically dispense sanitizer and record the temperature. Our method functions as a safety device, preventing COVID-19 casualties.

VI. OUTPUT WITH MASK

When a person wearing a mask walks in front of the Pi-camera, the simulation output is presented in fig. 4. The Pi-camera recognizes the mask-wearing face and displays a green frame around it with the percentage of accuracy above it.

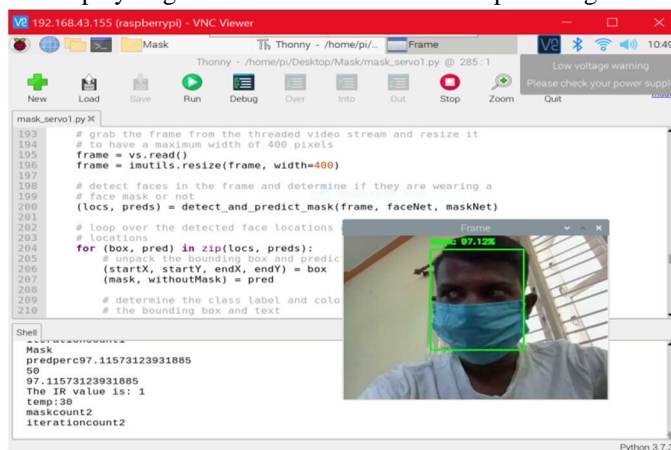


Fig 4: Output With Mask

VII. OUTPUT WITHOUT MASK

When a person without a mask walks in front of the Pi-camera, the simulation result is presented in fig. 5. The Pi-camera recognizes a mask-wearing face and displays a red colored frame around it with the percentage of accuracy above it. As a result, this person will not be able to enter via the door.

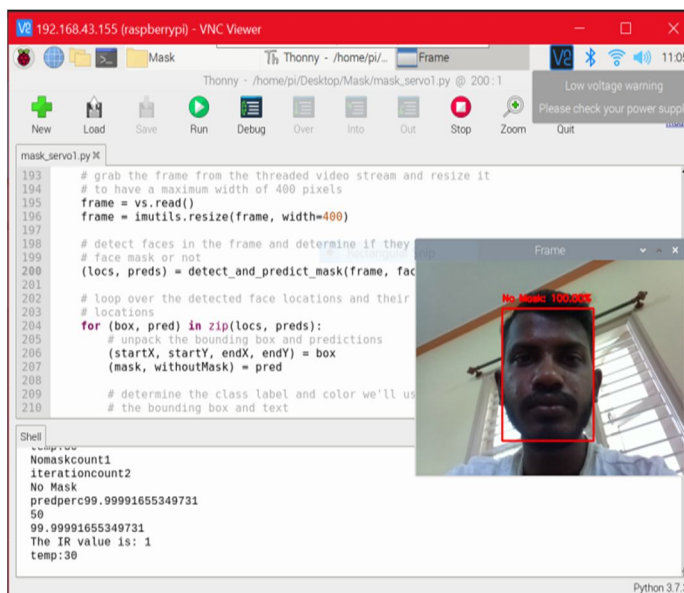


Fig 5: Output Without Mask

VIII. OUTPUT OF E-MAIL WITH THE MESSAGE

The e-mail notification with the photo of the individual who is not wearing the mask is shown in fig 5.3 below. This e-mail message can be sent to the person or authority in charge, instructing them to take the appropriate actions.

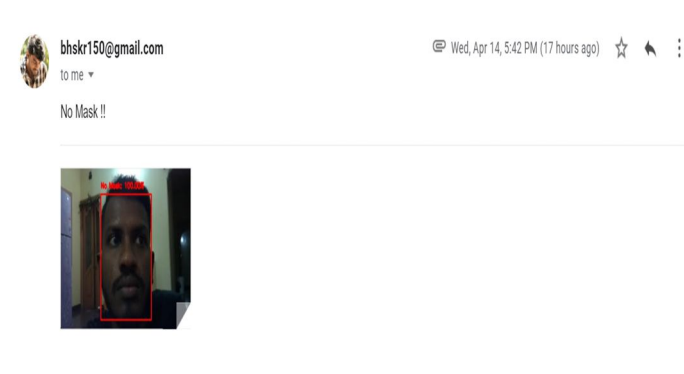


Fig 6: Output of E-mail with the message

IX. CONCLUSION AND FUTURE WORK

The goal of this study is to look at how a face mask can be detected and how an automatic door sensor system can open automatically when a person wears a mask. Enhanced facial identification, facial detection and tracking utilizing Raspberry Pi image processing, and deep-learning facial recognition were among the technologies examined in this analysis. It may be inferred that a face-recognition system based on Raspberry Pi is more effective than a face-recognition system based on ICA (Independent Component Analysis) and deep learning, since the ICA methodology is built on lowering gaussianity, but the perfect Gaussian source cannot be separated, and deep-learning face-recognition can only learn to collect more accurate data, but the current Gaussian source cannot be separated, and As a result, it can be stated that a face mask or face detection using Raspberry Pi is preferable.



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