

Entry Restriction System Based on Identification of Face Mask and Body Temperature

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Abstract: A corona virus is a combination of viruses which points at an infecting the respiratory system. Due to COVID-19 pandemic, we are facing a tough time since it causes body illness such as common cold and cough. It is the most contagious disease that can be easily infected from one to hundreds of people within no time. This virus was initially identified and originated in China. The first COVID case was informed by WHO (World Health Organization) and was treated as an Emergency Public Health Issue (EPMC). Nowadays, work culture has already been changing to meet the current time requirements. Wearing a mask is a major aspect in public place, as wearing a mask provides a highest effect in case of viral spread. Body temperature has also become a major consideration in differentiating, an individual is healthy or not. Based on this scenario, temperature verification and checking of face mask, at each and every location has been the most important and mandatory aspect. This requires a system to be put in place to deal with the present situation. Keeping all these in mind, an entry restriction system is implemented for the identification of face mask and body temperature.

Materials and Methods: Here we have two modules, one is for the detection of face mask and the other one is for temperature detection of human body. Face mask detection identifies a person, whether so and so person is wearing a face mask or not. It reads ultrasonic sensor for the detection of human presence, which is setup, to check each and every second. After the presence of human is detected, then the camera will focus on captured face image alone. Using image processing concept (Neural Network), an identification is done to know whether the person is with or without face mask. If there is no mask, then the person will get a caution till they wear a mask. Next module is detection of temperature of a human body. It involves certain hardware components like microcontroller ESP32, Temperature sensor, LCD Display, Gate servo motor. C Embedded language is used to write a program which runs in Arduino. It senses the temperature of human body, if the person is with normal temperature then the unlock of gate happens. If there is any variation in temperature, then the unlock of gate doesn't happen. The Entry restriction system based on identification of face mask and body temperature is a small vision used to prevent from COVID-19. **Results:** As people are getting back to work again, it is important and mandatory aspect to create a safe working environment. Government of India has provided some guidelines that require people to wear face mask, follow social distancing of at least 2-3m and record temperature while entering the workplace. Face Mask Recognition System with Temperature Detection is a contactless device that fulfils these Government policies. The result declares when a person is with or without face mask and ensures Face Mask Detection for all the staff and students. Measures Temperature of all the staff and students entering inside the premises of campus. If both the conditions are accepted, then the gate will open and close automatically.

Conclusion: This model is a simple but an effective model for the detection of face mask and temperature of body. Although a fairly high detection perfection, precision, and look back on of COVID-19, which does not mean that it is a production ready solution, especially with the finite version available.

Key Word: COVID-19, WHO, EPMC, Corona.

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I. Introduction

COVID-19 (Coronavirus disease 2019) is an infectious respiratory and vascular illness which was first initiated in China, that caused an occurring pandemic. The pandemic enforced governments across all over the world to implement lockdowns from preventing virus transmissions. Entire system will have to undergo change to adjust with consequence of the pandemic. World Health Organization has suggested to follow a social distance of at least 2-3m should be maintained between individuals. Now, in this 21st century prevention has been better to cure and understand certain real-time problems. Due to this strength, work culture is slowly being starting up with the requirements of current time. Procedures are being put in point to instruct the workforce regarding new safety measurements at the working place which helps to decrease the risk of virus spreading. The concept of face detection helps to identify people wearing mask. Hence, an entry restriction application

based on detection of face mask and temperature detection is proposed. The detection of face mask model is the combining form of face mask detection model to determine the existing faces from camera captured and then detecting those faces through a mask detection process. In sequence to train a mask detector, we need to break the project into two major phases those are training and deployment. Based on this building datasets, masked face recognition model is designed as an identity. The development of technologies like embedded generates a major amount of data which conducts to a new process of data. The key entitled an element of embedded is in medical and health care. Embedded devices are used to accumulating, tracking, evaluate and inform the patient.

II. RELATED WORK

This system for detection of face mask and body temperature was inspired by certain works around deep learning approach. These works encourage us to come up with our own ideologies. The existing related work for the present model had been summarized below.

A. PERSON DETECTION MODELS

Howard et al. proposed another model design called MobileNets dependent on profound clarified idea there are particular entanglements. They explored different notable plan choices chief to a proficient model, then, at that point represented how to develop more modest and quicker MobileNets utilizing goal multiplier by compromising an adequate measure of precision to diminish size and idleness. They had contrasted different MobileNets with most well-known models showing unrivaled size, speed and exactness qualities. They closed by showing MobileNet's proficiency when applied to a different sorts of obligations. As a following stage to help procuring and investigation of MobileNets, they had an idea on delivering models in TensorFlow [1,2].

B. MASK DETECTION MODELS

Shiming et al. introduced the dataset MAsked FAcEs (MAFA) and LLECNNs (Logically Linear Embedding Convolution Neural Network) for face mask detection. They found that masked face dataset is very taxing for existing face detectors, while the method proposed by them achieves the best production in all settings. This may also have an impact that the data-driven structure may be an achievable solution in finding robust and effective features for face mask detection. The dataset can facilitate the development of face mask detectors that can effectively recognizes face mask with occlusions [3,4].

C. MASK DATASETS

With the growth in the significance of wearing face masks during this COVID-19 pandemic, there are an excess of logs and social media posts that will express procedures to the mask detection problem [5]. Most of these procedures do not provide approach to a practicable wide dataset that works for real world. Most of the work available uses smaller datasets with less variability in duration of types of the mask detection (i.e. N-95, surgical masks) or only view at particular basic regional datasets that have been dragged.

D. FACE RECOGNITION SYSTEM

Edwards et al. explains the recent approach of him, in the form of 2 Dimensional or 3 Dimensional recognitions of face in progress, focusing mostly approach based on local, holistic (subspace), and hybrid quality. A comparative work between these approaches in terms of refining time, complexity, discrimination, and fitness will be carried out [6]. They had concluded that local feature methods, which were the best option based on discrimination, rotation, relocation, convolution, and accuracy. They had a hope that this might further encourage researchers in this field to regulate and pay more attention to the usage of local procedures for face recognition systems.

III. Material and Methods

Procedure methodology

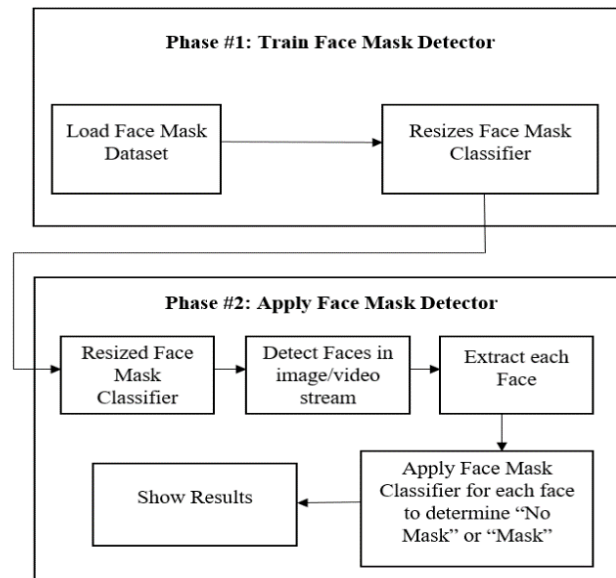


Figure 1: System Design

The flowchart of the proposed face mask recognition design is shown in Figure 1. Live streaming concept starts here i.e. ultrasonic wave frequency are initiated in each and every second, to detect the presence of human. As soon as, the video is on, video streaming reads and stores the loading of face mask dataset. The stored frames resizes the image captured by it, to make a proper frame based on streaming. Later it detects the faces captured in video and it extracts the face region. After extracting, classification is done whether so and so person is with or without face mask. A label is initialized to check the percentage of mask that how much it has been covered. If there is no mask, an alarm is generated till you wear the mask. Based on the constructed datasets, the masked face recognition model is designed and trained for identification of system based on image processing (7).

Block diagram

Here we have two modules, one is for the detection of face mask and the other one is for temperature detection of human body. Face mask detection steps are shown in Figure 2 which identifies a person, whether so and so person is wearing a face mask or not. It reads ultrasonic sensor for the detection of human presence, which is setup, to check each and every second. After the presence of human is detected, then the camera will focus on captured face image alone. Using image processing concept (Neural Network) [8,9], an identification is done to know whether the person is with or without face mask. If there is no mask, then the person will get a caution till they wear a mask.

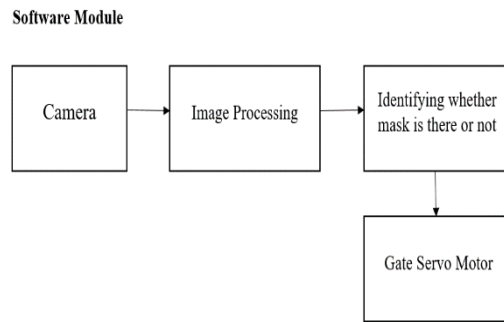


Figure 2: Software Module

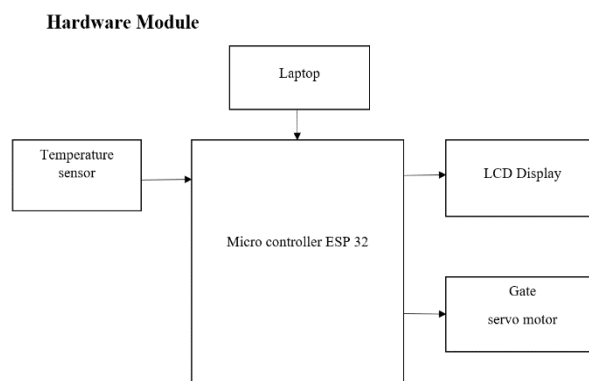


Figure 3: Hardware Module

Next module is detection of temperature of a human body as shown in Figure 3. It involves certain hardware components like microcontroller ESP32, Temperature sensor, LCD Display, Gate servo motor. C Embedded language is used to write a program which runs in Arduino [10]. It senses the temperature of human body, if the person is with normal temperature then the unlock of gate happens. If there is any variation in temperature, then the unlock of gate doesn't happen. The Entry restriction system based on identification of face mask and body temperature is a small vision used to prevent from COVID-19.

Components Required

ESP32

ESP32 is an amazing gadget, joined Wi-Fi-BT-BLE Micro Controller Unit module that pick different kinds of utilizations, which goes from low-power detecting organizations to the different testing of errands, for instance voice encoding, music streaming, and MP3 deciphering. Figure 4 addresses the ESP32S chip, which is ready for versatile just as versatile. There are 2 CPU ports that can be discretely fueled or controlled, and the clock frequencies which are adaptable from 80 MHz to 240 MHz. The client may likewise off the CPU and can likewise utilize low-power coprocessor to relentlessly checking the peripherals for trading of limits. Utilizing Bluetooth, clients can likewise interface with their telephone broadcast which are of low energy shaft from perception. The utilization of Wi-Fi approves an enormous size of actual reach, alongside direct association with the web by means of Wi-Fi switch. It is a genuine material for a wearable electronic or battery-controlled applications. This chip burns-through under 5µA.



Figure 4: ESP32

LCD (Liquid Crystal Display)

A fluid precious stone presentation (LCD) is a uniform instrument board show, electronic apparent showcase, or the video addresses the utilization of light balancing impacts of LCD. Fluid Crystals doesn't deliver the light straightforwardly. LCDs are possible to show discretionary pictures (as in a broad intention framework show) or got pictures which will be introduced or covered up, for instance present words, numbers, and 7-divided that are shown as announced in advanced clock. The use of same essential innovation, then again, actually flighty pictures which have been made of an enormous number of minuscule pixels, while some other relocation have bigger sections.

A LCD displayed in Figure 5, is a slight, uniform instrument removal gadget working of quite a few monochrome pixels gathered before the light beginning. It is presumably utilized in battery-controlled electronic apparatuses on the grounds that it uses low scope of electric force. Every segment of LCD ordinarily comprises of a surface of particles going between two translucent terminals, and two confined channels, the ending of correspondence, which are (in nearly cases) opposite to one another. With no fluid precious stone associating the secluding channels, light advancing by means of first sifter would be hindered continuously parcel.

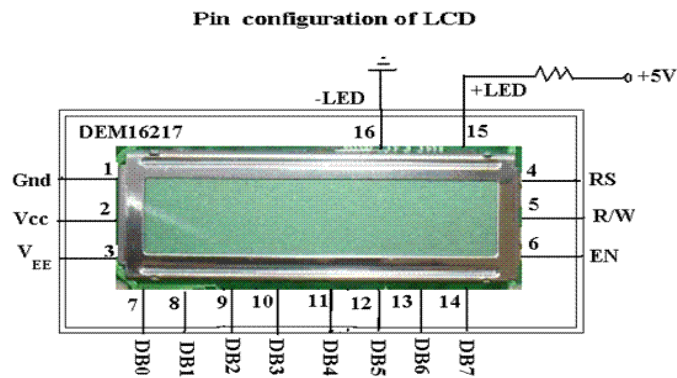


Figure 5: LCD

The parts of the cathodes that are in closeness with the fluid gem substance are dealt with to run the fluid gem pieces a specific way. This treatment regularly includes of a slight polymer layer that is unidirectional scoured, a coagulation is a model for this. The heading of the fluid precious stone arrangement is then indicated by the bearing of scouring. Pin subtleties are shown in table 1.

Table1: LCD Pin Details

| Pin No | Name | Function |
|--------|------|--|
| 1 | VSS | Ground voltage |
| 2 | VCC | +5V |
| 3 | VEE | Contrast voltage |
| 4 | RS | Register Select 0= Instruction Register 1= Data Register |
| 5 | R/W | Read/Write 0= write mode 1= read mode |
| 6 | E | Enable 0= starch to latch data to LCD character 1= disable |
| 7 | DB0 | Data bit 0 (LSB) |
| 8 | DB1 | Data bit 1 |
| 9 | DB2 | Data bit 2 |
| 10 | DB3 | Data bit 3 |
| 11 | DB4 | Data bit 4 |
| 12 | DB5 | Data bit 5 |
| 13 | DB6 | Data bit 6 |
| 14 | DB7 | Data bit 7 (MSB) |
| 15 | BPL | Black Plane Light + 5V or lower (optional) |
| 16 | GND | Ground voltage (optional) |

Temperature Sensor

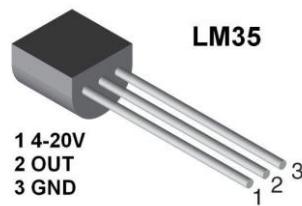


Figure 6: Temperature Sensor

LM35 is an Integrated Circuit Temperature sensor is displayed in Figure 6, where the yield voltage contrasts, contingent upon the temperature around it. It is an extremely little and more affordable IC which will be utilized to register temperature somewhere around - 55°C to 150°C. By controlling the IC of engaging a synchronized voltage like +5V to the information and associating the ground pin to the ground of a specific circuit. Presently, processing the temperature in type of voltage as displayed in Figure 7.

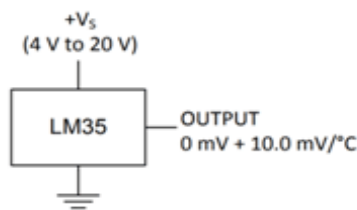


Figure 7: Grounding the circuit

On the off chance that the temperature is 0°C, the yield voltage will be 0V also. There will be increment of 0.01V (10mV) for every single degree Celsius expanded in temperature. The voltage can be changed into temperature utilizing condition (1).

$$V_{OUT} = 10 \text{ mV}/^{\circ}\text{C} \times T \text{ ----- (1)}$$

where,

V_{OUT} is the output voltage

T is the Temperature in °C

Algorithms

Appearance Based Algorithm

Appearance based algorithm build on recording various statistical of pixels which is utilized within the face image. This algorithm is geometric feature based method where the facial elements are drawn out to build a featured vector that simulates the face configuration. In appearance established algorithm, image filtering process are applied to entire face or particular regions in the face of a particular image to establish a featured angle.

Active Appearance Algorithm

Active appearance Model (AMM) is a computer innovation algorithm, which are constructed during a training phase. In face identification application exact face sequence has determinative outcome. It is one of the most deliberate method for accurate locating objects. Then we use a set of points to demonstrate face shape, so face shape can be represented by the coordinates.

Support Vector Machines (SVM)

Support vector machines are supervised machine learning algorithm which will be used for multiple selected categorization or regression challenges. SVM is a machine learning model that is able to discover between two various classes if the set of specific data is provided in the training set of algorithm.

Bayesian Model Algorithm

Naive Bayes analysis are a group of classification algorithms related over Bayes theorem. It is a family of algorithms, not a single algorithm, where everyone shares a same principle, that is each and every pair of characteristic being confidential is independent of each other. Naive Bayes is a type of classifier that are used as Bayes Theorem. It anticipates membership for conversion of every class such as the chance which is a given documentation or data point referring to a peculiar class [11].

Deep Learning Neural Network (DLNN)

Deep learning is role of an extensive family of machine learning systems which builds on artificial neural networks (ANN) with the learning of presentation. Learning can be directed, semi-directed or non-directed. Deep Learning make use of a Neural Network to emulate animal observation. Three set of layers i.e. the Input Layer that collects a signal, the Hidden Layer which activates it, and Output Layer makes a determination regarding input data. Connections between neurons are correlated with a weight, dictating the importance of the input value [12,13].

Objective

- The facial recognition with face mask and temperature detection, and allows only those who are with mask and normal body temperature of a person to pass through.
- The highly advanced Temperature Screening System works on touchless technology and manages bulk-data.

IV. Result

As people are getting back to work again, it is important and mandatory aspect to create a safe working environment. Government of India has provided some guidelines that require people to wear face mask, follow social distancing of at least 2-3m and record temperature while entering the workplace. Face Mask Recognition System with Temperature Detection is a contactless device that fulfils these Government policies.

- When a person is without face mask is shown in Figure 8.
- Ensures Face Mask Detection for all the staff and students as shown in Figure 9.
- Measures Temperature of all the staff and students entering inside the premises as shown in Figure 10.
- If both the conditions are accepted, then the Gate will open and close as shown in Figure 11 and 12.

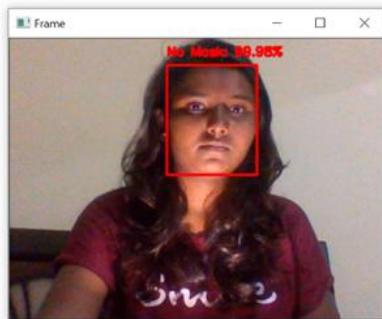


Figure 8: Without Face Mask

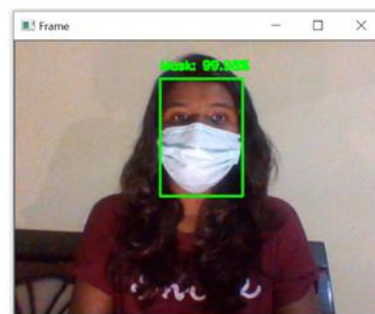


Figure 9: With Face Mask



Figure 10: Temperature Detection



Figure 11: Without Face Mask



Figure 12: With Face Mask

V. Conclusion

In this model, it is a simple but an effective model for the detection of mask and temperature. Although a fairly high detection perfection, precision, and look back on of COVID-19, which does not mean that it is a production-ready solution, especially with the finite version available. The objective of this work is a small try to reduce the spread of COVID-19. The system collects information like temperature updates and automatically control the gate for opening and closing.

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