

CNN Based COVID-19 Prevention System

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Abstract— In order to effectively prevent the spread of COVID19 virus, almost everyone wears a mask during coronavirus epidemic. This almost makes conventional facial recognition technology ineffective in many cases, such as community access control, face access control, facial attendance, facial security checks at train stations, etc. Therefore, it is very urgent to improve the recognition performance of the existing face recognition technology on the masked faces. Most current advanced face recognition approaches are designed based on deep learning, which depend on a large number of face samples. However, at present, there are no publicly available masked face recognition datasets. Compared to other datasets, Real-world Masked Face Recognition Dataset (RMFRD) is currently the world's largest real-world masked face dataset. Various COVID-19 prevention measures are undertaken such as wearing mask, sanitization, social distancing and temperature monitoring. An artificial intelligent IOT (Internet of Things) system with temperature monitoring, auto sanitization, mask detection is proposed. In this system, the machine is connected to a server by which the admin can monitor everything live from any place. The system also has face recognition feature by which the registered visitors, students can recognize separately and admin can maintain proper student database with temperature, auto sanitization system for door opening and closing system.

Keywords—CNN (Convolutional Neural Network), OpenCV (Open-source computer vision), SARS-CoV-2(Severe acute respiratory syndrome covid2), Artificial Intelligence (AI).

I. INTRODUCTION

The trend of wearing face masks in public is rising due to the COVID19 coronavirus epidemic all over the world. Due to air contamination, public wore face mask prior to Corona Pandemic. Researchers confirmed that wearing face covers deals with blocking COVID-19 transmission [16]. Coronavirus is the most recent scourge infection which leads to the destruction of human wellbeing in the only remaining century [17]. COVID19 has been proclaimed the worldwide epidemic in 2020 because of its quick spread by World Health Organization (WHO). As indicated by [18], in excess of 5,000,000 cases were contaminated by COVID-19 worldwide. Because of lack of social distance in society, the infection spreads rapidly. Corona virus offered the remarkable level of overall logical collaboration. Man-made brainpower (AI) in view of Artificial Intelligence can assist with battling pandemic from various perspectives. AI permits analysts and clinicians

assess immense amounts of information to estimate the conveyance of Corona. In numerous nations people wear mask as per law. These standards and laws were created as an activity to the outstanding development in cases and passings in numerous territories. Be that as it may, the way toward checking enormous gatherings of individuals is getting more troublesome. The checking cycle includes the recognition of any individual who isn't wearing a face cover. The French beginning up Dataka Lab, which built up the product, reports that the objective isn't to perceive or capture individuals who don't wear veils however to deliver unknown factual information that can assist the specialists with anticipating expected flare-ups of COVID-19. Face identification model is presented that depends on profound exchange learning and traditional AI classifiers. SARS-CoV-2 originated in December 2019 which had severe impact on people. Coronavirus prompts mellow, self-restricting respiratory lot sickness to extreme reformist pneumonia, multiorgan failure. Henceforth, certain counteraction measures are created in this undertaking. Machine learning is the study of computer algorithms that improve automatically through experience.

II. LITERATURE REVIEW

Amrit Kumar Bhadani and Anurag Sinha [1] proposed a work that is useful in various organizations to detect COVID-19. Checking of a person wearing mask is compulsory in this system. Various artificial intelligence techniques such as keras, tensorflow, opencv, CNN (Convolutional neural network), FNN (Fast neural network). Face mask detection is carried out with certain accuracy. Raspberry pi interfacing with various sensors is not done here. Whereas in the implemented system, raspberry pi interfacing is done to take the prevention measures.

Adnane Cabani et al. [2] proposed a technique that helped in the prevention of rapid spreading of the novel Corona virus. Masked Face-Net consists of large number of masked face images that produces machine learning models related to the analysis of wearing mask. Here, it mainly checks whether an individual wears mask or not as per law over the detected face images. A pseudocode is given in this paper for the Masked Face-Net generation. Flickr-Faces-HQ3 (FFHQ) is a base of Masked face Net dataset for the generation of standard images in the PNG format with certain resolution. The major drawback of this paper when compared to the implemented work is that raspberry pi is not used.

Mohammad Marufur Rahman et al. [3] proposed a framework to check whether an individual has covered their face with mask or not under the surveillance of Closed-Circuit Television (CCTV) camera in a smart city network using CNN (Convolutional Neural Network) concept.

A Sorto et al. [4] developed a system that deals with the software development for temperature registration, facial recognition of patients using Artificial Intelligence (AI). This framework is implemented in various health areas. The main purpose is to decrease the pandemic rate in country like Honduras, using AI technique. As per the result, an efficiency of 72% is achieved. Whereas in the proposed system more efficiency is achieved. Using CNN, face recognition is done. The main limitation is that raspberry pi is not used here. Whereas it is used in the proposed work.

Zhongyuan Wang et al. [5] performed face recognition using machine learning technique. There is no particular dataset for the face recognition. But RMFRD is the better dataset used for this process. Finally, 95% accuracy is achieved. Whereas in the proposed system face recognition is done using CNN with better accuracy.

Mohamed Loey et al. [6] developed a mixture model utilizing AI for the purpose of face mask recognition. This system comprises of two segments. Primarily, Resnet50 is intended for feature extraction. While the subsequent segment is intended for the grouping cycle of face covers utilizing choice trees, Support Vector Machine (SVM), along with troupe calculation.

Samuel Lalmuanawma et al. [7] presented a system that intends to thoroughly survey the job of AI and ML as one critical technique in the field of screening, anticipating, estimating, contact following, medication advancement for SARS-CoV-2(Severe acute respiratory syndrome covid2) and its connected pestilence. Human interface is reduced in this system.

Yinghui Zhu and Yuzhen Jiang [8] proposed face acknowledgment that is a biometric acknowledgment strategy with the qualities of non-contact, cordial and agreeable, which has a decent application prospect in the fields of public security and federal retirement aide. This paper plans to advance the current face acknowledgment calculation, study the face acknowledgment technique driven by huge information, and propose a profound learning multi include combination face acknowledgment calculation driven by large information.

Furqan Rustam et al. [9] proposed ML-based forecast framework for foreseeing the danger of COVID19 flare-up worldwide.

Imran Ahmed et al. [10] proposed physical distancing method depending on Artificial Intelligence technique. In this system, Region Based Convolutional Neural Network is used for human identification whereas in the proposed system opencv and Haar Cascade Algorithm is used.

Xiangjie Kong et al. [11] forward an edge figuring based cover recognizable proof structure (ECMask) to help general wellbeing safeguards, which can guarantee constant execution on the low-power camera gadgets of transports. Video reclamation, face location, and cover recognizable proof are its three principal stages.

Pranav KB and Manikandan J [12] presented CNN based face acknowledgment framework. Most extreme acknowledgment correctnesses of 98.00% are gotten on utilizing this framework. Whereas in the proposed work, 98% accuracy is achieved for mask detection using various machine learning algorithms.

Musab Coşkun et al. [13] proposed face recognition using CNN. CNN comprises of various layers for organization and acknowledgement of images. Finally, better accuracy is achieved.

Zhiming Xie et al. [14] presented face recognition using CNN. Accuracy is enhanced when compared to the traditional methods.

M. Kolhar et al. [15] developed an IoT based face detection framework. It is implemented in various cities that are beneath containment.

III. METHODOLOGY

CNN (Convolutional Neural Network) based COVID prevention System is done. In order to test the proposed framework, various deep CNN models are used. For face recognition also CNN is used. Human interface is replaced by system (Raspberry pi) using Image processing and machine learning algorithm. Fig. 1. is the block diagram of the proposed system. Live temperature monitoring is done here. If it exceeds the threshold, then warning message is generated. Replace IR sensor with ultrasonic sensor to avoid false triggering in automatic sanitization dispenser.

Face mask detection is done using opencv, keras, tensorflow and python. Web page Design and development using php and html is to be done. Admin can login by entering username and password. Login becomes successful, if OTP is generated. Student database has to be created so that their address will be stored in the database to check the status of the student. In various countries also it is possible to track COVID. Tracking of Coronavirus in various departments such as CS, IS, ME and EC can be done.

Face recognition attendance is done using face recognition technology. IOT based temperature detection, Sanitization, mask detection takes place. If an unknown person enters near the door, face recognition doesn't take place and admin alert will be generated. Address and number of students are recorded. As the students enter, login page will be created. Finally name and age of students are recorded. Here, the main thing is server live update of students.

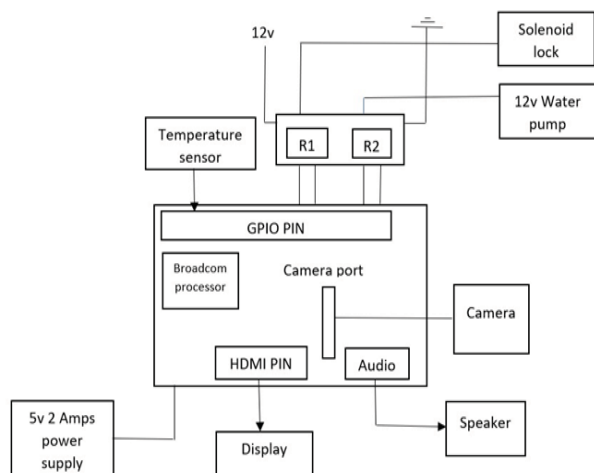


Fig. 1. Block Diagram of the system

IV. IMPLEMENTATION

A. Hardware Implementation

The following hardware components are used: Raspberry pi model 4B 2GB RAM, Pi Camera, Temperature sensor MLX90614, Ultrasonic sensor, Micro SD Card, 2 channel 12V Relay, Jumper Wires, 5V 2 Amps power bank, 12V 1amp power adapter, Solenoid Valve, Aux speaker, Solenoid switch/lock, Single stud wire. Fig. 2 shows the interfacing of Raspberry pi with temperature sensor, two channel 5v relay and ultrasonic sensor.

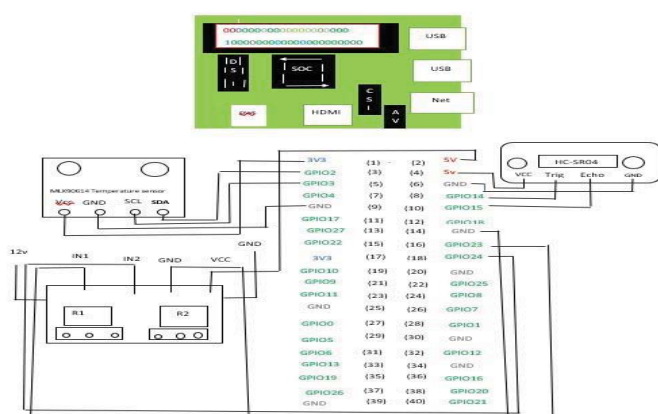


Fig. 2. Interfacing of Raspberry pi with temperature sensor, two channel 5v relay and ultrasonic sensor

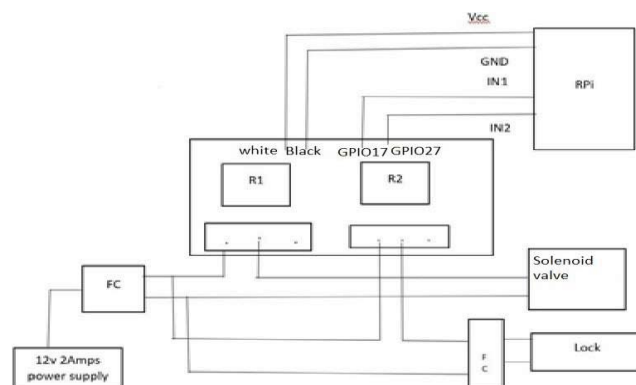


Fig. 3. Interfacing of Raspberry pi with solenoid valve, lock, 2 channel 12 v relay

Fig. 3. is implemented for autosanitization system for door opening and closing.

B. Software Implementation

OpenCV (Open-source computer vision) primarily aimed at real-time computer vision which is a library of programming functions. Intel developed OpenCV. The artificial intelligence approaches such as Tensor Flow, Torch/PyTorch and Caffe is reinforced by OpenCV. Here Keras is used as an open-source library that provides a Python interface for artificial neural networks. It is an interface for the TensorFlow library and is mainly easy to use, particular, and extensible. Francois Chollet, a Google engineer is the founder. Keras mainly comprises of various executions of generally utilized neural-network building blocks. Also, TensorFlow is used which is a free and open-source software library for dataflow and differentiable programming across a range of tasks. It's useful in neural networks which is a part of machine learning.

Here, face detection can consider a substantial part of face recognition operations. The strategy for face recognition in pictures is confounded due to fluctuation present across human faces, for example, pose, demeanor, position and direction, skin tone, the presence of glasses or beard growth, contrasts in camera pick up, lighting conditions and picture goal. The subsequent stage is to utilize Haar-Like cascade algorithm, which is proposed by Viola and Jones for face discovery. The haar-like calculation is likewise utilized for highlight extraction of an article in a picture, with the assistance of edge discovery, line recognition, focus identification for identifying eyes, nose, mouth and so forth in the image. It is utilized to choose the fundamental highlights in a picture and concentrate these highlights for face identification. Face Mask Detection is done using OpenCV, Keras or TensorFlow along with Deep Learning concept. Python script plays a major role for mask detection in detecting Corona virus. Python is mainly used here which is an interpreted, high level, general-purpose programming language.

Mainly face recognition is done using CNN. A technology which is capable of matching a human face from a digital image or a video frame against a database of faces is facial recognition system. This framework incorporates Detection of Face, Pre-handling of Facial Nodal Points along with Face Recognition. Detection of face, feature extraction and face recognition are the three primary stages of this system. By means of the nodal points on the face, features are linked with each face in the database. The design of the System comprises of three modules, specifically: Enrolment Module, Data set, Identification Module. Various methods are developed by scientists in which these systems work. A Convolutional Neural Network (ConvNet/CNN) is a machine learning algorithm which takes an input image, allocate position to several objects in the image and be able to differentiate one from the other.

V. RESULTS AND DISCUSSION

As shown in the Table 1, comparison between previous and present work is done. In this proposed system Raspberry pi 4 Model 2GB Ram is used. Face mask detection is done with 98% accuracy.

Machine learning based Face Mask Detection, Temperature detection, autosanitization system for door opening and closing is implemented by which covid-19 pandemic is prevented. Firstly, show face in front of camera and keep hand below sanitizer outlet in the range 5-7 cm of ultrasonic sensor. Mask is detected with 98% accuracy. If temperature is below threshold, then it will allow the person to enter. Finally, sanitization takes place. Then door will open.

Table. I. Comparison Table

SL NO	Title	Year	Result
1	A hybrid deep transfer learning model with machine learning methods for face mask detection in the era of the COVID-19 pandemic, <i>Elsevier</i>	2020	Development and use of AI systems for COVID- 19 and any future pandemics. Raspberry pi is not used in this paper. Accuracy of mask detection is less when compared to the proposed system.
2	Proposed system: CNN Based COVID-19 Prevention System	2020	Accuracy is more when compared to [6]. Accuracy of mask detection is 98%. Raspberry pi is used in this system.
3	Convolutional Neural Network based Face Recognition, <i>IOP</i>	2019	In comparison with the conventional methods, this face recognition method using CNN has high accuracy.

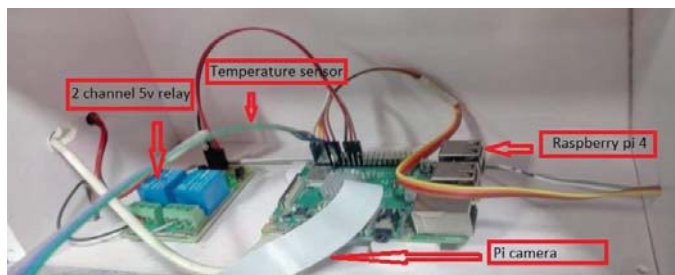


Fig.4. Sketch of raspberry pi interface with Ultrasonic sensor, 2 channel 12v relay, pi camera, temperature sensor MLX90614

Fig. 4. shows the Sketch of raspberry pi interface with Ultrasonic sensor HCSR04, 2 channel 12v relay, pi camera, temperature sensor MLX90614.

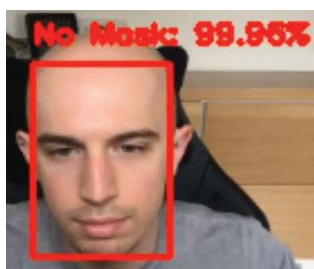


Fig. 5. Mask is not detected

In Fig. 5, mask is not detected. As shown in the above figure when a person doesn't wear mask properly, then an alert message stating "Hello, please wear mask covering both Nose and mouth" is generated.

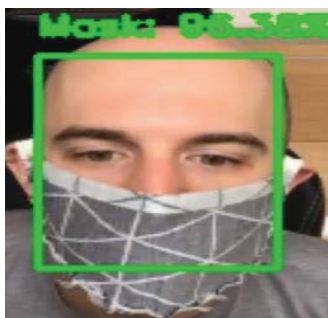


Fig. 6. Mask is detected

As shown in Fig. 6, Mask is detected.

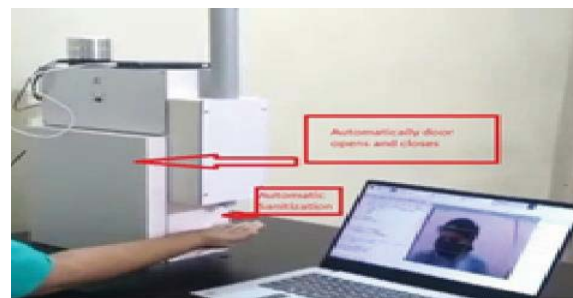


Fig. 7. Machine learning based Face Mask Detection, Temperature detection, Auto sanitization system for door opening and closing

The above figure gives the pictorial representation of the overall system. Fig. 8. shows the flow chart of the proposed system.

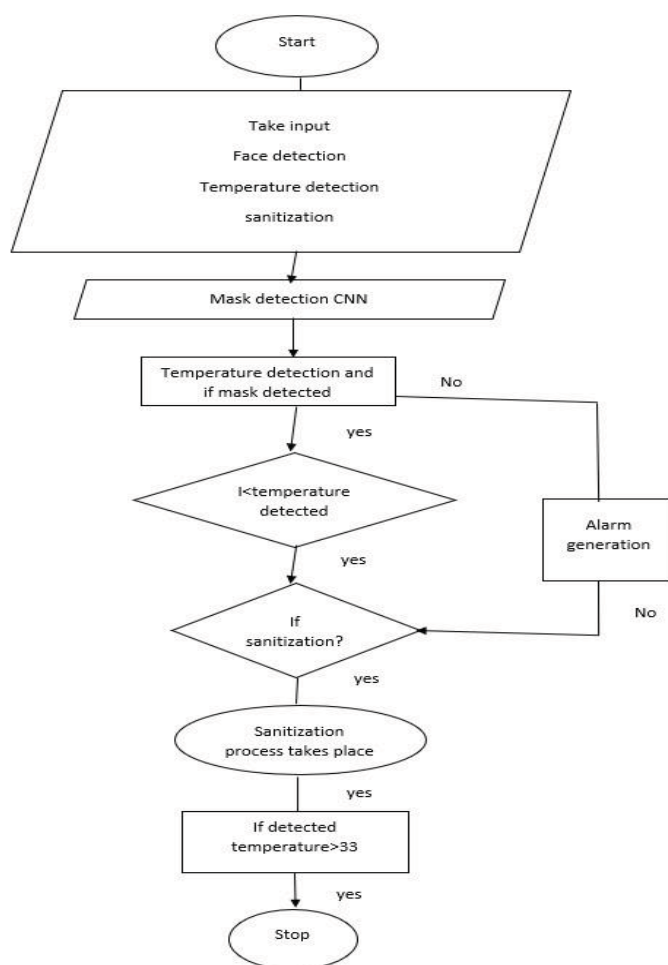


Fig. 8. Flow Chart of the proposed system

vi. CONCLUSION

The novel Coronavirus designated SARS-CoV-2 (Severe Acute Respiratory Syndrome) appeared in December 2019 to initiate a pandemic of respiratory illness known as COVID-19. It is necessary to take various prevention measures such as wearing mask, temperature check, sanitization and social distancing. These COVID-19 safety measures are implemented in the proposed system. In order to implement the system, temperature sensor MLX90614, Ultrasonic sensor HCSR04, 2 channel 12v relay, solenoid valve, solenoid lock is interfaced to Raspberry pi model 4B. Finally, mask is detected with 98% accuracy. If mask is not detected, an alert message is generated. Auto Sanitization system for door opening and closing is also implemented. Using machine learning algorithm, face mask detection is done. In addition to it, face recognition is also done.

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