AI Based Mask Detection with Thermal Scanning and Hand Sanitization

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***Abstract*— The coronavirus COVID-19 pandemic is having an effect on the global health system, hence the World Health Organization advises wearing a face mask in designated regions. In recent years, image processing and computer vision topics such as Face Mask Detection using Thermal Scanning and Hand Sanitization have been popular. To overcome this issue the most successful safety measure is wearing a face mask and following respective safety measures in public places. According to records, wearing facemasks and maintaining good cleanliness while at work significantly minimizes the risk of viral transmission. An efficient and cost-effective method of applying AI to establish a safe environment in a manufacturing environment. A method of applying artificial intelligence to create a healthy working environment that is both reliable and cost-effective in a sustainable setting. For face mask detection, a model that combines deep and traditional machine learning will be proposed. We'll use a Raspberry Pi 3 Model B to detect faces in real time from a live flux from our webcam, Contactless Temperature Sensors for temperature measurement and non-destructive tracking, and other sensors with an automatic hand sanitizer dispenser, and build a model by integrating each of these components. To build a low-cost smart hand sanitizer dispenser that uses a Raspberry Pi-based door controller and an ultrasonic sensor to assist security guards in overcoming hurdles at diverse sites such as hospital gates, school gates, and bank gates. we believe that it is of utmost importance that at crowded residential area, transportation junctions, markets, educational institutions and healthcare areas, it is now very important to set up face mask detector models to ensure the safety of the public.**

Keywords*— *OpenCV; Haarcascade Algorithm; Tensorflow; Raspberry Pi 3 Model B; MLX90614 Sensor; DC Gear Motor; L293D Motor Driver IC; Ultrasonic Sensor; HS Dispenser; Pi Camera; LED; Covid-19.

I. INTRODUCTION

There was no specific evidence to support the use of community masks to decrease the transmission of respiratory diseases prior to the coronavirus 2019 epidemic (covid-19). The mask's purpose is to keep the user from spreading the virus to others (source control). Inhaling respiratory aerosols created by coughing, sneezing, talking, or breathing is the most common way for Covid-19 and other respiratory illnesses to spread. The virus travels to the respiratory tract, where it can cause pneumonia, acute respiratory distress syndrome (ARDS), and death. This respiratory disease has become a daily concern due to ongoing epidemics and rapid emergence. People should use a face mask as part of their safety gear and public health endeavour to avoid the transmission of infection (1, 2). Because of this, the development of a system that can identify people wearing a mask is very important in today's world.

We introduce a mask face detection model based on computer vision and deep learning in this paper. In many respects, artificial intelligence (AI) based on machine learning and deep learning will aid in the fight against Covid-19. COVID-19 can't find people who aren't wearing a face mask if the proposed model is used in conjunction with the viewing cameras.

Our project's goal is to make an infrared thermometer, which is a device that measures the output power of an object's surface. Infrared thermometers are commonly used in medicine, industrial, and small towns. We discovered that there are three types of infrared thermometers. Signal conditioning, which filters, amplifies, and utilises analogue signals, is a stage of hearing that turns infrared light into electrical signals., as well as a digital output platform for converting analogue to digital signals

Hand sanitizers are typically considered the gold standard for hand sanitation in hospitals, health care facilities, and other settings. The COVID-19 epidemic, as we all know, wreaked devastation on the world and changed our way of life. In this circumstance, alcohol and hand sanitizers are both necessary fluids, but they must be used carefully. If infected hands come into contact with alcohol containers or disinfectants, the virus will spread to the next person. We will build and test a smart hand sanitizer kit that uses an ultrasonic sensor to detect the

presence of a hand, activate the first gear motor to pour liquid into the hand, and exhaust electromagnetic radiation before sending a signal to the second gear motor to open the entry door immediately in this research paper.

II. LITERATURE REVIEW

We found many face detectors, hand sanitizers, and a thermal scanning system in the literature, each with a different technique and solution.

- On paper, A. Kaur, M. Kumar, and A. Kumar [5] presented a simple acquisition approach for facial masks as well as a low-cost device. This paper discusses deep structured learning.
- Hurriyatul Fitriyah [7] suggested a hand-washing machine. As a result, everyone can wash their hands outside the machine for touch and maintenance.
- N. H. Leung [10] proposed wearing a horizontal face mask to prevent the virus from entering the mouth and causing respiratory problems. On paper, it was suggested that you wear a face mask.
- Thermal cameras for thermal screening were introduced by Gade R, Moeslund [14].

III. HARDWARE REQUIREMENTS AND SOFTWARE REQUIREMENTS

➢ *Hardware Requirements*

A. Machine Learning

Machine learning (ML) is the study of computer algorithms that improve over time or learn from their failures. Artificial intelligence is a subset of this. Machine learning approaches use training data to create a model that can make predictions or make decisions without being explicitly programmed. Computer-assisted instruction Statistics are used in a variety of situations. It's difficult or impossible to build multiple algorithms to execute the essential functions, such as email filtering and computer view. Machine learning is on the horizon, and it is related to mathematical computations that are focused on computer forecasts. Machine learning benefits from mathematical improvement research because it gives methodologies, theory, and application fields. Uncontrolled reading analysis of experimental research data is focused on data mines, a related research area. Machine learning is sometimes known as predicting statistics when it is applied to solve business challenges.

B. Raspberry Pi

The Raspberry Pi Model B is a credit card-sized single-board computer that is the third iteration of the Raspberry Pi. it has Quad Cortex A53 CPU and 1GB RAM and its operating frequency is 1.2GHz.

Pin Configuration: It has 40 pins among 40 pins, On the Raspberry Pi, there are four power pins, two of which are 5 volts and the other two are 3.3 volts. Apart from the power pins, there are eight ground pins that are all connected to each other, and there are 28 GPIO pins ranging from GPIO 0 to GPIO 27 that can be programmed to be output pins or input pins, allowing us to set output pin values and read input pin values. Some of these pins are also dual-purpose. Pin 3 (GPIO 2), for example, can be used as an I2C pin.

C. Ultrasonic sensor

It's an electronic system that uses ultrasonic to measure distance. It sends out a high-frequency sound pulse and then calculates the distance based on the time it takes the echo signal to return after reflecting from the desert target.

The output of the ultrasonic sensor is digital. it has four pins, among 4 pins two are for supplying power to it, one is for sending echo signature to it and the other is for getting output from it.

Features: Operating Voltage - 5V (DC), Operating Current - 15mm, Operating Frequency - 40KHz, Maximum Range - 4mm, Minimum Range - 2cm, Ranging Accuracy - 3mm, Measuring Angle - 15°.

D. MLX90614 Contactless Sensor

The MLX90614 is a Contactless Infrared (IR) Digital Temperature Sensor that can measure an object's temperature between -70 to 382.2 degrees Celsius. The sensor measures the temperature of an object without physical contact using infrared radiation and communicates with a small controller using the I2C protocol.

TABLE I. MLX90614 PINOUT CONFIGURATION

Pin No.	***Name***	***Definition***
1	Vdd (Power Supply)	A Vdd can be used to power the sensor, usually using 5V
2	Ground	Metal can also serve as ground
3	SDA (Serial Data)	PIN of serial data used for I2C Communication
4	SCL (Serial Clock)	The serial PIN of the serial used for I2C Communication

E. DC Gear Motors

A direct current (DC) motor is a spinning electrical device that converts direct current electrical energy into mechanical energy. When DC voltage is given to the DC motor's terminal, an inductor coil inside the DC motor produces a magnetic field that causes the rotary motion.

Geared motors increase rigidity and resistant to dynamic forces. Therefore, compared to standard motors, geared motors are less subject to problems caused by torque fluctuations. High stability and accuracy of position can be expected even in the presence of load fluctuations.

F. Motor Driver

Motor drivers act as an interface between the motors and the Raspberry Pi (control circuits). here we used L293D IC, which is a typical motor driver IC that allows the dc motor to drive in any direction.

The L293D IC receives signals from the microprocessor and sends motor-related signals. It has two voltage pins, one for drawing current and the other for applying power to motors during L293D operation.

G. Pi Camera

The Pi Camera module is a high-definition camera that can capture images and videos. The Raspberry Pi Board's CSI (Camera Serial Interface) interface allows us to attach the Pi Camera module directly. This Pi Camera module is connected to the Raspberry Pi's CSI (Camera Serial Interface) connection via a 15-pin ribbon cable LED.

H. LED

A light-emitting diode (LED) is a semiconductor device that emits light when electricity is applied to it. When the current passes through the LED, the electrons reassemble the holes that emit light in the process. LEDs allow the current to flow forward and prevent the current from looking backwards.

Diodes that emit light p-n junctions are highly doped. Based on the amount of semiconductor used and the amount of doping, the LED will emit a colored light with a certain spectral length if it is biased forward.

➢ *Software Implementation*

A. OpenCV

Fig. 1. Detection of "Mask" and "No Mask"

The Open Source Computer Vision Library (OpenCV) is a free software library for computer vision and machine learning. OpenCV is a shared computer programming framework that aims to speed up the application of machine perception in commercial applications. Businesses can simply utilise and change code thanks to OpenCV's BSD licence.

It is an open-source library that can be used to perform computer vision tasks like face detection, objection tracking, landmark detection, and so on.

Features of OpenCV: Read and Write images, Capture and Save video/image, and detect specific objects such as faces, eyes, cars, etc in the video or images.

IV. PROPOSED SYSTEM

To recognise a person wearing a face mask in a photo or video stream, the proposed system employs an OpenCV-based computer vision and machine learning method. The majority of the images were enhanced with OpenCV. When OpenCV detects the person is wearing a mask then the picture will be labelled as "mask is on thank you" and when detects the person is not wearing a mask then the picture will be labelled as "mask is not detected". The photos were of diverse sizes and forms, and were most likely acquired from a variety of sources or equipment (cameras) with varying resolutions. The "Haarcascade Algorithm" will be used to compute and solve these resolutions.

The tensorflow model is used to recognise face masks. There is a lot of discussion on methods based on deep structured learning of individual acquisitions. As a result, we created our own problem-solving algorithm. Our work on face mask identification is still ongoing, and it entails gathering data to determine the most common forms of face masks used by personnel. The face mask detection model also includes a face detection model that recognises the camera's current face feed by model for obtaining a mask that processes that face.

The device is equipped with an MLX90614 contactless temperature scanner and a mask indication. The scanner is

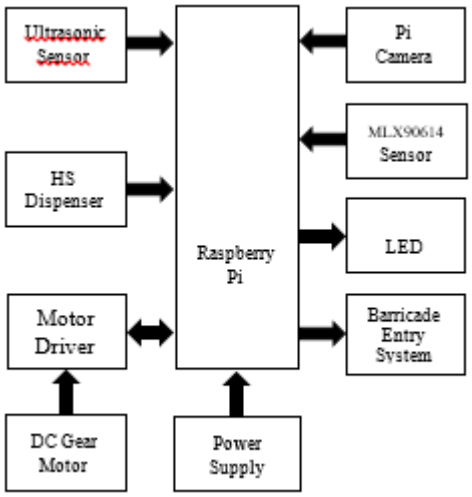

Fig. 2. Block Diagram of Module

directly connected to the human barrier, which restricts admission from the gate, if the temperature is excessive or there is no mask visible. No one will be allowed to enter if the temperature is too high and no mask is found. Only those who meet both of the prerequisites can agree. The device employs a temperature sensor and a camera attached to a Raspberry Pi system to monitor the entire operation.

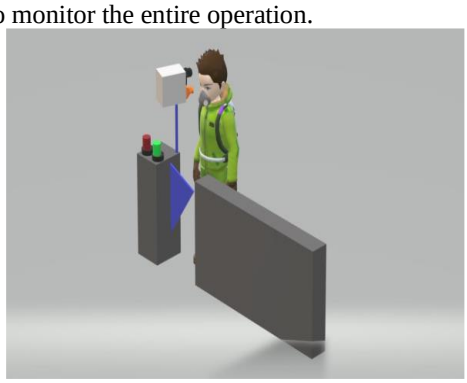

Fig. 3. Imagination of Module

To look for a mask, a camera is employed, and a temperature sensor is used to determine how hot the forehead is. Sensor data is used by the Raspberry Pi to determine whether or not a person is permitted. In this case, the device activates the gear motor, which opens the barrier gate and allows the user to pass. The device activates a red light and prevents someone from entering if they are recognised by the high temperature system or are not wearing a mask.

An ultrasonic sensor is used to detect the presence of a hand. He starts the first servo motor, which rotates from 0 to 180 degrees to drain the liquid off the hand, when he detects a hand that is less than 10cm away. It will revert to 0 degrees after two (2) seconds. After the electromagnetic key returns to 0 degrees, a second servo motor opens the entry door, followed by the words "Entrance Door Open" on an LCD panel. A six-second delay has been added to enable the electromagnetic key, as well

as a two-second delay to reset the device. A Raspberry Pi is used to monitor all linked components around an external electrical device in this system, which includes an ultrasonic sensor, servo engine, LCD display, and LEDs. The power supply provides the necessary voltage and current for modern gadgets to function effectively.

V. ADVANTAGES

- The Face Mask Detection System can be used to establish staff safety standards on-premises.
- It keeps track of employees who aren't wearing masks and reminds them to put them on.
- It puts people at risk Smart Warnings.
- Easy Launch.
- No New Hardware is Required.
- Face detection will help track down criminals and terrorists.
- Health security is also improved as there is nothing when hackers steal or alter, such as passwords.
- Easy to assemble.
- Face detection and face recognition technology are easy to integrate.

VI. DISADVANTAGES

- Heavy load of data storage. Face detection requires strong data storage that may not be available to all users. in order to overcome this, we have used the cloud computing process to reduce the storage burden.
- The facial ability to help the government track down criminals creates significant benefits; However, the same would allow the government to look after private citizens.

VII. APPLICATIONS

- At airports, the face mask detection technology can be used to identify travellers who aren’t wearing masks.
- In Shops, open their doors to the public with certain rules. In most cases, guests will be required to wear a mask when entering or communicating with staff.
- The Face Mask Detection System can be used by hospitals to check if its employees are wearing masks while travelling. If a health worker is found without a mask, a notice will be sent to remind them to put one on.

VIII. CONCLUSION

Anyone who enters the building must complete our module. We used a PI camera, an open CV to see whether people were wearing a face mask, and a module where it was tested with real-time video streaming on top of the module mounted on the building's door.

The MLX90614 sensor, which is attached to the Raspberry Pi and transforms low-temperature electric current data to degrees Celsius, is used to measure body temperature.

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