Innovations

A Smart Mask and Temperature Detection System with IoT Capabilities

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Abstract

There is a global health crisis due to the COVID 19 pandemic. The best way to protect yourself in public and elsewhere is to always wear a face mask. As a result of the COVID 19 epidemic, government officials everywhere were forced to incorporate shutdowns.Survey findings indicate that the danger of transmission is much diminished when a face mask is worn in public.This article details an Internet of Things (IoT)embedded machine learning door system to track visitors' core body temperatures and identify those wearing protective masks. Any building lobby, whether it be a hotel or apartment complex, can benefit from the proposed model.This led to the creation of a trustworthy and reasonably priced approach to using AI and sensors to establish a wholesome setting.The suggested framework is tested with the help of the TensorFlow software library's implementation of the Face Mask Detection algorithm. The subject's temperature is tracked using a sensor that doesn't require physical touch.Using IoT technologies, this suggested system can detect individuals in COVID 19.

Keywords-*1.COVID-19, 2.Internet of Things, 3.Body temperature, 4.protective masks, 5.TensorFlow*

Introduction

COVID-19, a coronavirus that was first identified in Wuhan, China, has quickly spread to several nations, along with India, which is place of residence to more than 134 billion of people. India has a huge inhabitant, making it hard to prevent the spread of the coronavirus there.Stopping the virus from spreading is a top priority by using protective gear like face masks and hand sanitizers.An infectionprevention strategy, this has been proven to work. Main signs of a coronavirus contagious illness include fever, sore throat, fatigue, impaired sense of smell and taste, and congestion of the nasal passages.Indirectly through surfaces is how it travels the rest of the time. Symptoms may not appear for up to 14 days, and the virus can be transmitted directly through respiratory secretions. Social isolation, mandatory indoor mask-wearing, quarantine, immigration restrictions both domestically and internationally, limiting interaction with each other, and rescinding large social meetups were all measures taken by governments to confine the spread of disease.

Nearly everyone on Earth has been advised by the WHO to stay indoors and use hand sanitizer and face masks (WHO). Being cautious and safe is always the best option. However, as there is now no effective remedy, we must comply with the measures, as disobedience could have dire consequences. The only way to ensure one's safety in the current movement is to take precautions, as there is no access to adequate medical treatment. Droplets produced by an infected person's nasal cavity are the primary vector for virus transmission, when they sneeze or cough, thus wearing a face mask can help prevent the spread of disease. The manager of the building now uses a contactless thermometer to test the body temperatures of visitors. In addition to being inconvenient and risky, physical inspections are inefficient.

This epidemic of COVID-19 has had far-reaching effects, affecting everything from work to social life to sporting events to both live and recorded forms of entertainment. Due to the risk of infection and spread of the virus, those with fevers should be kept out of communal locations; it is recommended that they always wear a mask. All cities, workplaces, shopping centers, and hospital gateways should employ temperature and mask inspections. To solve these problems, we developed a contactless body temperature sensor based on the Raspberry Pi and a technique that can detect whether or not a guy is wearing a mask.

A pre-trained model for facial recognition is available within the Open-Source Computer Vision (OpenCV) framework. The camera sends its facemask data to a Raspberry Pi 3, which then analyses it. Using OpenCV, Keras, TensorFlow, and other libraries, this system will be able to identify people in facemasks in a live video feed. All of the pictures have been labelled as either "mask" or "no mask." Furthermore, when measuring temperature, the MLX90614 sensor will be used.[1].

The content of this article is organized as mentioned. In Section 2, contains a quick overview of the works that are related. Section 3 offers an understanding of the work that is being proposed. Methodology and model implementation are explained thoroughly in Section 4. The findings and results of the model are presented in Section 5. The final part of the study consists of a summary and suggestions for further research.

Review of Related Literature

Using the Raspberry Pi approach, we can discover features in the low-cost Internet of Things, the Haar Cascade algorithm was utilized [2]. This method of security access control is state-of-the-art. It highlights using the OpenCV library's Haar cascade in a machine learning technique for facial identification and detection, with impressive speed and accuracy. Facial recognition is a method of establishing and confirming a person's identity. Changes to the framework are programmed in Python. The positive tone differentiates between a black and white and a colored photograph of the faces. Each person's face recognition success rate in the database is used to determine the framework's efficiency. The results of the suggested technique can be utilized to correctly identify faces even in low-resolution photographs.

Public use of face masks has increased since the Coronavirus transmission all around planet [3]. Prior the development of Covid-19masks were commonly used to protect themselves from the negative effects of air pollution. Some of them are so self-conscious about how they look that they choose to hide their actual feelings behind masks. Protect yourself from COVID-19 with a face mask, advise the experts. Human health has been threatened most recently by the influenza virus COVID-19 appeared in the modern era. In 2020, the rapidity with which it spread prompted the World Health Organization to declare a global epidemic. There were over 5 million COVID-19 infections in 188 countries in under 6 months. As the coronavirus pandemic spread, scientists from around the world collaborated like never before. AI with a focus on machine learning and deep learning is invaluable for fighting Covid-19. Machine learning provides an early warning system for pandemics and identifies communities at risk by analyzing huge amounts of data, which can aid researchers and medics in formulating predictions regarding the spread of COVID-19.

Using a deep learning approach with CNN, we have implemented facemask detection with alert systems for physical separation [4,5]. The study's authors unveiled a semantic segmentation-based, fully convolutional-network-based facial-mask-detection technique with great accuracy. Producing pulse oximetry kits with IoTtech allowed for remote monitoring of covid-19 patients via cellphones, adhering to physical and social distance protocols.

It is impossible to overstate the value of taking a patient's temperature as part of a clinical evaluation and treatment plan [6]. Low measurement accuracy and a lengthy measuring interval are two downsides. It is challenging to automatically and timely monitor a patient's body temperature using the artificial measurement methods now in use. They proposed a decentralized monitoring system for taking temperature readings to solve the aforementioned issue. Many temperature sensors were attached to a person and their readings were analyzed by the SCM AT89C52, which was used to keep track of the person's core body temperature. such as the DS18B20. Their USB adaptor, the PDIUSBD12, uses the nRF905 transceiver chip to transmit data wirelessly between the higher PC and the lower, slave station. Apparently wireless communication devices are preferable was demonstrated by this system and satisfies the clinic's medical standards well because the calculated temperature decreased number of mistakes than plusmn0.1degC. The modularity of system allows it to be translated to a different industry, in this case the greenhouse environment intelligent monitor.

Design

1. Raspberry Pi

Raspberry Pi runs on a chip with a central processing unit, a graphics processing unit, and random access memory built-in entirety. The chip receives power from a 5 V DC supply. An assortment of programmable input/output (GPIO) pins is also included.LEDs and buttons, servos and motors, power relays and a wide variety of sensors are just some of the devices with which these can communicate. It also contains a connector for connecting a particular camera. The Raspberry Pi is highly adaptable due to its ability to connect via Ethernet as well as wireless (Wi-Fi and Bluetooth). The Raspberry Pi is meant to run computer language applicationsautomatically and has all of the functionality of a standard computer.

Fig. 1. Raspberry Pi

2. Raspberry Pi Camera

High-definition video can be recorded using the Camera Module in addition to static photographs. It supports still photography as well as the video formats 1080p30, 720p60, and VGA90. A lace connection measuring 15 centimeters in length links it to the CSI port on the Raspberry Pi.The camera consists of a flexible ribbon cable connecting a tiny (25mm x 20mm x 9mm) electrical board housing the camera to the Camera Serial Interface bus connection on the Raspberry Pi. The image sensor in the camera can take pictures at a maximum of five megapixels with its pre-mounted lens with a constant focal length.

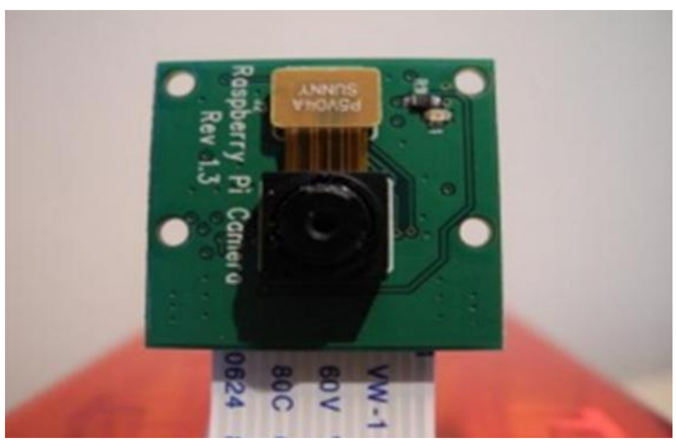

Fig. 2. Raspberry Pi Camera

3. Temperature Sensor

In order to function, the MLX90614 infrared sensor must first convert the infrared radiation signal into electrical signals, then send into a converter after the amplifier has amplified the signals and removed any noise, then convert the electrical signals to digital signals. Internal memory is used to keep track of the processed signals andtransfer the data to the SCM command center. The MLX90614 IR temperature sensor uses the SPI bus for its data transmissions. Using the serial output pulse signals from the sensor and the RXD serial input port on the microcontroller, temperature data may be sent from the sensor to the microcontroller. The TXD on the SDA serial output port sends temperature data to the microcontroller.

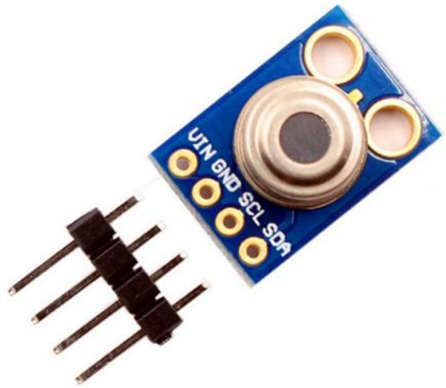

Fig. 3. Temperature Sensor

4. Servo Motor

The main door operations of opening and closing are demonstrated using a Servo Motor. At a certain voltage and current, it produces speed and torque. In addition to its open-loop roles, receiving torque and velocity orders from the servo controller and closing the loop with a feedback device.

Fig. 4. Servo Motor

5. LED

LEDs are solid-state semiconductor devices having a single p-n junction, or the intersection of an n-type layer with mobile electrons carrying current and a p-type layer with positively charged holes carrying current. An electrical current must travel in the direction of electron movement from the n-region to the p-region. The electrons and holes then unite once more to form light photons. The energy of electron-hole pair recombination is typically emitted by an LED in a certain wavelength range. Recombination happens in semiconductors at an energy level that is about equivalent to their band gap energy.

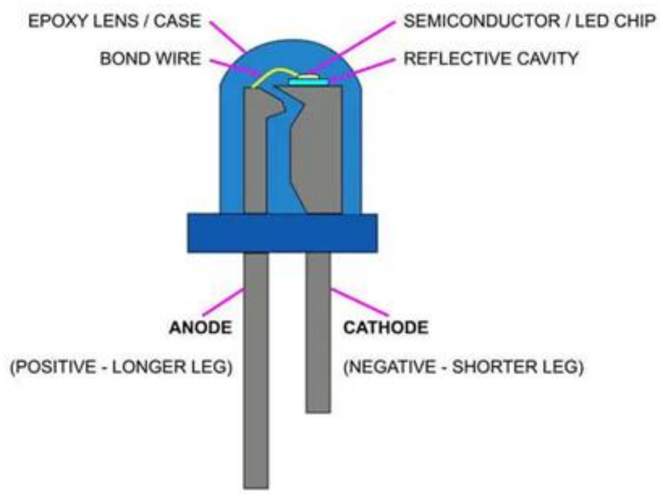

Fig. 5. LED

6. Buzzer

This auditory signaling device, like the Siren or beeper, can be electromechanical, piezoelectric, or mechanical in design. The basic role of the signal is to transform audio to sound. It is frequently powered by direct current (DC) and is found in timers, alarm clocks, printers, computers, and other electronic equipment. Depending on the design, it can emit a range of sounds such as alarm music, bells, and sirens.

Fig. 6. Buzzer

7. LCD Display

Information is shown via an LCD display. A 16x2 or 20x2 LCD attached to one of the many microcontrollers is extremely common. This translates to 16 characters over 2 lines and 20 characters across 2 lines. The LCD needs 4 or 8 I/O lines for the data bus and 3 control lines. A 4-bit data bus or an 8-bit data bus can be used to power the LCD, and the user can make that decision.

Fig. 7. LCD Display

Methodology

The Pi camera module is attached to a Raspberry Pi to record live video. It can tell if the person in front of it is unmasked or not by scanning their face. In addition, the Raspberry Pi has a temperature sensor hooked up to it. The temperature can be taken without even having to talk to the person. A buzzer and LED lights are permanently installed as an alarm system. The LCD screen, which shows the notifications, is also nearby.

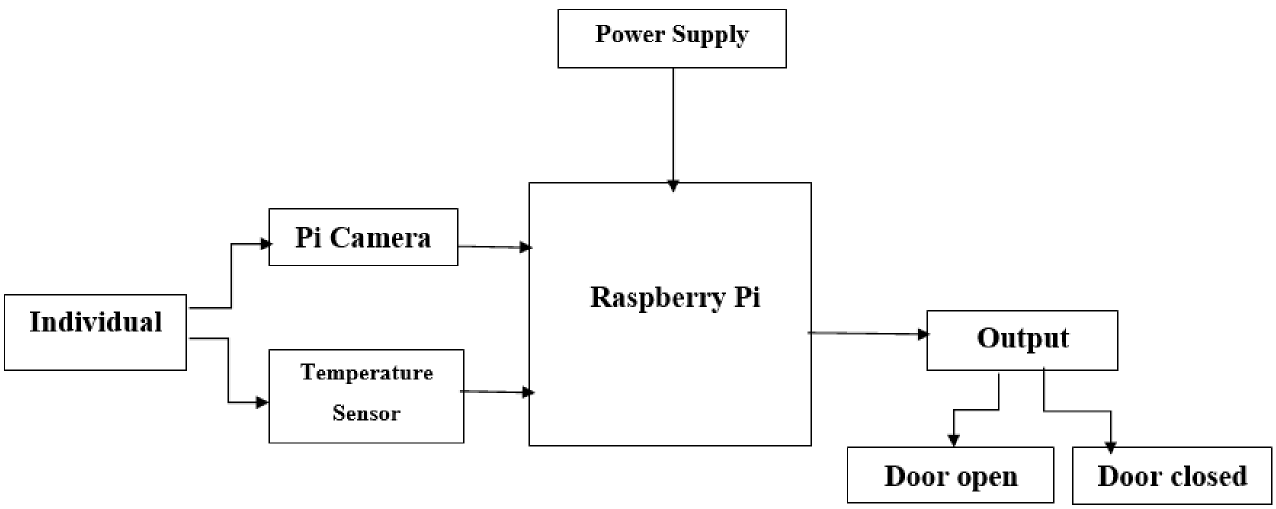

Fig. 8. System Methodology

To that goal, this study addresses an autonomous system that takes into account a wide range of factors, including contactless temperature monitoring and mask identification, in an effort to make entering Covid-19 safer. It relies only on digital processing and storage. The extreme temperatures necessitate the use of face masks; thus no one is allowed to enter without one. The alarm will go off if a failsafe condition is detected. In the beginning, a person is recognized based on how they move. A temperature sensor measures the person's temperature and triggers an alarm if it rises above a predetermined threshold.

When the temperature is normal, the camera will take a picture simultaneously. OpenCV and tensor flow are used to confirm the identification of a person's mask status. This method is applicable in a wide variety of settings, including commercial and public buildings, transportation hubs, financial institutions, sports arenas, theatres, restaurants, and other entertainment venues, and neighborhoods with high population densities. By helping to slow the development of COVID19, this system hopes to benefit society as a whole. Now that the embargo has been eased and public gatherings, shopping centers, church meetings, and school reopening are all viable options, the system will function as intended. This fully automated control reduces the need for human intervention during assembly inspections and is immediately deployable.

Results and Discussion

The Raspberry Pi controls the mask and temperature system. Once all the appropriate plugs are made and power is restored, the system will automatically begin the initialization process for each of the ports. The temperature gauge and camera will both be activated. Then the LCD Screen displays a welcome message.

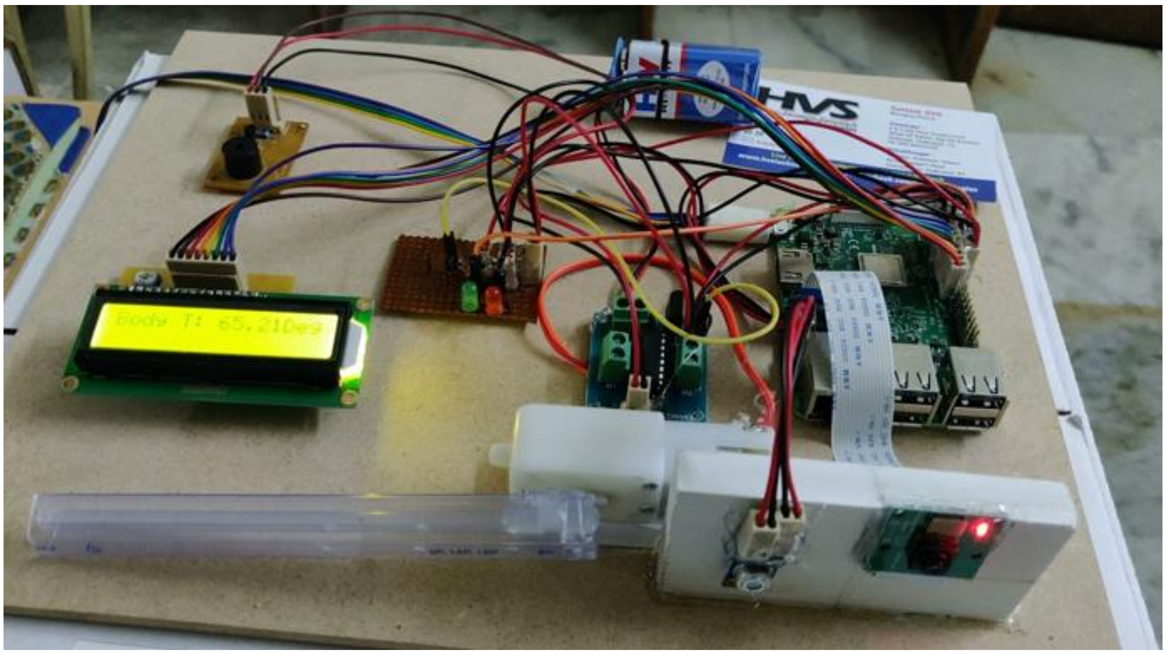

Fig. 9. Smart Mask and Temperature Detection System

Figure 10 depictsan unmasked human being in front of the intelligent system. If no mask is detected, the system will not let the person through the gates.

Fig. 10. A person without mask

As shown in Fig. 11, if a person wearing a mask stands in front of the entrance gate and the system verifies that they are wearing a mask, it will proceed to determine the temperature and open the gate accordingly.

Fig. 11. A person with mask

Once the mask is recognized and the user's temperature is determined, the messages shown in Fig. 12 appear on the LCD panel.

Fig. 12. Display Messages

Conclusion

As a result of recent innovations and the widespread availability of smart technologies, new models are being developed to better serve emerging nations. This research involves the creation of an Internet of Things-enabled smart door that can track visitors' core body temperatures and identify concealed identities like masks. There will be fewer people needed to keep the spread of the deadly Covid-19 virus at bay thanks to this measure. The model makes use of a Raspberry Pi-based deep learning system to recognize face masks and temperatures in real time. The gadget is highly effective at detecting masks and measuring temperatures. The results show that the system can accurately identify those who are and are not wearing facemasks, and that it can also create alarms that can be recorded and monitored. As an added bonus, there is a plethora of methods to boost performance and consequently, outcomes. Future work will focus on increasing these processes' precision through the integration of several aspects, boosting performance, and creating a user-friendly monitoring app for mobile devices. This will allow officials to respond quickly in compliance with pandemic protocols.

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