Safe-Intelligent Temperature and Attendance Monitoring System for Industries and Educational Institutions

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Abstract:

COVID-19 has become a global threat in the last year. It has made the economy upside down and brought dramatic changes in people's life. Though the treatment for COVID-19 is promising and vaccines are emerging, it is relatively important to take preventive measures. The industries, educational institutions and other sectors have resumed their operations post the initial lockdown periods. It is essential at these places to monitor the temperature of the people at the entry to be cautious and prevent the spread. But, it is cumbersome if the population is high and exclusive personnel is required for this task. Hence, this paper aims to introduce a safe and automatic temperature monitoring system that eliminates the human need and ensures his/ her safety as well. A person is merely expected to stand before the temperature monitoring system. The system will capture the temperature and will show indication based on the threshold temperature. Besides, the system is extended to record the attendance of the person upon reading the face and temperature. This extension would support the industries and educational institutions where temperature monitoring and attendance registry are important. The system effectively uses a temperature sensor, ultrasonic sensor, LCD and face detection algorithm. The outcomes of this system are promising upon the miniature implementation.

Introduction

In the year 2020, COVID-19 has contaminated humankind. To remain safe in the present circumstance, we need to follow various precautionary measures. Washing our hands regularly, wearing veils openly, and trying not to contact surfaces are a few important preventive measures. We can't have the normal, worn-out propensities for eating, travelling, buying or in any event, doing our schedule works. Today, homes have become workplaces and the web is just a savior. During the lockdown, the pattern of requesting on the web and home delivery of different things staple goods, gadgets, books have expanded. Even though online business organizations guarantee that the employees take all security means from cleaning to social separating however when they come to the house, college room entrance and their temperature should be scanned. Also, our Corona fighters like doctors, government authorities need to test the temperature of each person. So, touching surfaces is one we should avoid. As per studies, corona infections stay on surfaces for nearly 24-48 hours.

When our relative or perhaps a visitor comes from outside, we need to check their temperature to check whether it is under 99.6' F. When the temperature is more, we should advise them to look for a specialist or possibly live-in segregated space and will be permitted to visit the house solely after legitimate disinfection is finished. The same applied to educational institutions and industries. But, the complexity of the operation is high in these circumstances due to the high population. It is cumbersome for the security personnel to monitor the temperature for each person and he/ she is also prone to infection. Hence, this paper aims at introducing a system that could eliminate the burden of manual temperature checking as well as register the attendance. They are achieved by using a using a temperature sensor and a face recognition algorithm, respectively.

The remainder of the paper is structured as follows. Section 2 presents the related works. The proposed methodology is discussed in section 3. Section 4 presents the experimental results and the section 5 concludes the paper.

Related Works

This section presents the various recent works carried out to address the pandemic-free operations. The study reveals several interesting factors which paved a path to the proposed system.

Piyush Devikar et. al. [1] introduced a face liveness detection system. The system is developed with an objective to eliminate the limitations of the existing systems which include fake face images, and photograph misread as a real one. It is implemented using Raspberry Pi, OpenCV for face detection and IR temperatire sensor for temperature monitoring. It validates and accepts a face only if is matched by the algorithm and the temperature is more than the set threshold.

M. Krišto et al. [2] developed a face recognition system for the security purpose as a surveillance system. The system aims to gather more information so as to detect the persons with more accuracy. Moreover, the system provides better accuracy even at a poor lighting conditions. It deploys a convolutional neural network for the face detection.

M. Kasiselvanathan et al. [3] proposed an attendance monitoring system using face recognition method. It implements Eigen faces algorithm for face detection. Also, the attendance is calculated by identifying the facial dimensions. The system also detects the facial dimensions under different scenarios. The experimental results are promising with 93-95%.

Venkata Kalyan Polamarasetty et al. [4] presented a system for attendance monitoring. The proposed system is different from the existing systems and deploys a facial model. This system is intended to record the attendance of students in a classroom.

Smitha et al. [5] proposed an automatic attendance monitoring system using face recognition. It involves four stages: creating the database, detecting the face, recognizing the face and updating the attendance. The database contains the student images. Haar-Cascade classifier and Local Binary Pattern Histogram algorithms are used for face detection and face recognition respectively. The live streaming video of the class is used for face detection and the attendance is mailed to the concerned faculty members at the end of the class.

Proposed Methodology

As discussed in the previous sections, to contain the spread of COVID-19 in these tough times, we must first avoid touching surfaces. The suspect victim will get the sickness at intervals every week or when 10-12 days later, therefore for the security of the relations, colleagues, doctors, delivery person touching at the entry purpose may be a downside. Additionally, at the entry purpose of each society, offices, malls, and hospital gates, the

temperature check is required. Therefore, the proposed system introduces a smart entry system, where the human temperature monitoring and also the face recognition system are essential components. The system can be used to detect the person's name and alongside the temperature sensor is use or different entrance it's done automatically. The face recognition part of the proposed system helps to record the attendance at the time of entry. It generates an alarm if an unauthorized person visits or if the measured temperature is unusual. The following are the list of components used in the proposed system:

➢ NodeMCU

➢ MLX90614 Temperature sensor

➢ LCD (liquid crystal Display)

➢ Ultrasonic Sensor

➢ LM2596 DC buck converter

➢ Buck converter

➢ Light Emitting Diode (LED)

➢ Buzzer device

The system uses a controller to process the image for face identification and a non-contact infrared thermometer that measures the temperature without any physical contact. The present design is equipped with NodeMCU, MLX90614 temperature sensor, Ultrasonic sensor, LM2596 DC buck converter, Liquid Crystal Display, Light Emitting Diode, and buzzer device. The NodeMCU enables Wi-Fi and supports RTOS. The LM2596 DC buck device could be a change of magnitude change regulator capable of adjusting the input voltage from 4.5V to 40V and convert it to a variable voltage of our demand endlessly. The MLX90614 infrared thermometer sensor measures the body temperature without any physical contact. The Ultrasonic sensor is employed to measure the object distance. LCD is used to display the reading temperature. The buzzer and LEDs provide confirmation and an alert signal. Only after this process, a person is allowed to enter the gates of offices, mall, house, school entrance and hospitals.

Hardware

NodeMCU Dev Kit/board comprises ESP8266 WLAN enabled chip. The ESP8266 could be a low-priced Wi-Fi chip developed by Express if Systems with TCP/IP protocol. For a lot of info concerning ESP8266, you'll be able to talk to the ESP8266 WLAN Module. The NodeMCU Development Board that typically comes in black colored PCB. For a lot of info concerning NodeMCU Boards out there within the market refer to NodeMCU Development Boards NodeMCU Dev Kit has Arduino like Analog (i.e., A0) and Digital (D0-D8) pins on its board.

The MLX90614 [7] could be a Contactless Infrared (IR) Digital Temperature Sensor that may be wont to live the temperature of a specific object go from -70° C to 382.2°C. The device uses IR rays to live the temperature of the object with none physical contact and communicates to the microcontroller victimization the I2C protocol. The NodeMCU and the IR temperature sensor are shown in Figures 1 and 2.
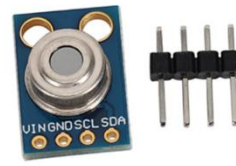
Figure 1. NodeMC ESP8266   **Figure 2.** MLX9064 (IR Temperature Sensor)

Hardware Integration

First the person will go near to the device, ultra-sonic sensor will trigger the temperature sensor to sense the temperature of the person who is nearer to the device and temperature reading will be displayed in the LCD Display. Based on the temperature, LED bulb will glow red and green color. If the temperature of the person is very high the buzzer starts to give an alarm. Figure 3 shows the linkage between the various hardware used.
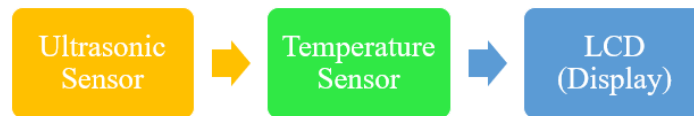

Figure 3. Hardware Integration

Software Part

Deep Learning

Deep learning is a subfield machine learning methods. It is based on artificial neural networks along with representation learning. Deep learning is also called deep structured learning. The learning can be of the following types: supervised, semi-supervised or unsupervised. Deep learning is widely adopted in speech recognition, bioinformatics, computer vision, machine translation, natural language processing, medical image analysis, etc.

Open CV

Open CV (Open supply pc Vision) could be a library for programming functions that establish the objects with 3 channels. Each image is considered as a mix of 3 matrices in RGB (Red, Blue, Green) color schemes [6]. The video can extract multiple frames and every frame is identified by OpenCV. The detected frames area unit known by the origination v3 model. The results of the thing identification are any human within the frames or pictures, then the recording video is notified to the various owner by mail or MMS.

Face Detection

Face detection is a part of computer vision and is a process of locating faces from the images or videos. It finds the face coordinates from the image or video. The detection system will result zero or more bonding boxes congaing the faces. The detected faces are further passed to the face recognition module. The faces should be detected irrespective of the face angle, lighting conditions, makeup, facial color, etc.

Face Recognition

Face recognition [8] could be a technology capable of finding the faces of human in an exceedingly image or video or from video frames. There are several ways to spot faces in the object, however ancient observe of finding the faces was done by examination the given face expression with the obtained pictures to seek out faces. Biometric Artificial intelligence is that

the technique of finding the faces in pictures exploitation the patterns primarily based on facial textures and shapes.

Experimental Results

A 5V Supply is given to Ultrasonic sensor and NodeMCU from the Ultrasonic Sensor the signal is generated and that is converted in the distance by the coding and controller system, is attached to digital pin number 9.

MLX90614 temperature sensor is connected to Ground and 3.3V input provide for sensing the temperature from the body, it's connected with the RGB light-emitting diode, on the controller board and internally within the code the parameters are given relating to the temperature values high and low. Buzzer is connected to Ground and digital PIN number 9 wherever it'll follow the signal reading from the ultrasonic sensor and it'll begin buzzing. RGB light-emitting diode is connected to digital pin number 7,8. It will blink inexperienced if temperature of person is below 37.6 degree Celsius and can blink red if temperature is above 37.6 degree If the temperature is high the red light is blow and display screen is connected to NodeMCU by Ground and 5V input provide. Ultrasonic sensor operates once in range of 1 foot.
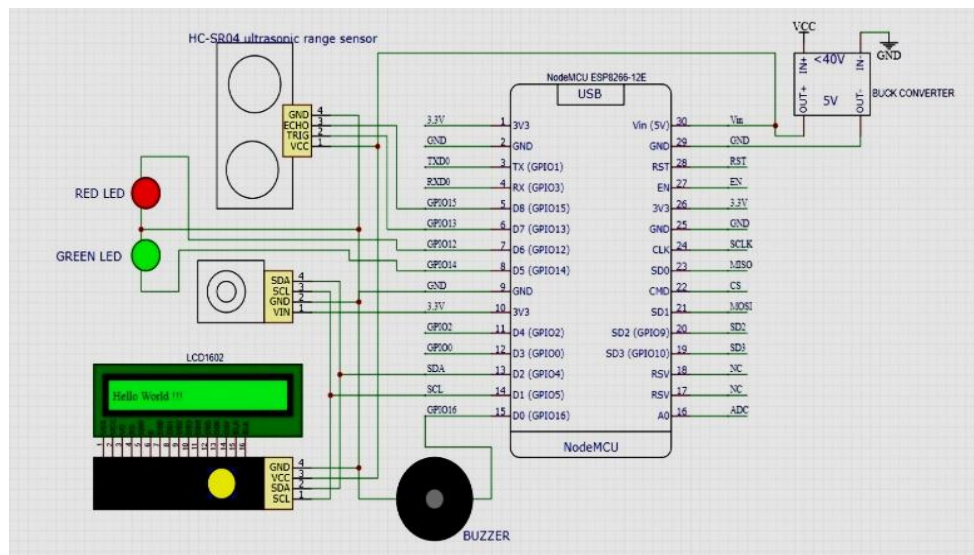

Figure 4. Circuit diagram

For Example, if our device is set in the classroom entrance when the students are entering the class room, our device start the process first it identifies the person's name then it checks the temperature of the student with entering time and, it is showing the LCD display and the details is stored the excel format. All this process is run automatically.

| **5 (a) Trained Image** | **5 (b) Result when the object is closer** | **5 (c) Temperature displayed on LCD** |

	A	B	C	D
1	Name	In-Time	Temperature	
2	Hari Navaneeth S K	18.12.02	97.47	
3				
4				

5 (d) Recording temperature and attendance

The automatic capture of the image from the camera, face detection and the face recognition methods help reducing the manual work. Further, it enhances the safety and security. The decision is made from the face recognition module. Once the faces are detected and recognized, the attendance is registered automatically, based on the input database. It reduces the time required, reduces the manual work and enhances the safety of the personnel. In addition to the attendance, it record the temperate as well. Moreover, the abnormal temperature is given an alarm.

Conclusion

Combating COVID-19 has become a routine. It is an essential safety measure to check the temperature before allowing the person in. This paper proposed a mechanism to measure the temperature of a person without the need of a personnel. In addition, the system detects a person by face recognition and registers the attendance. The system serves two purposes. This device can be used at every possible entry point to check the body parameters, it is mainly used in offices and crowded places where maximum number of people are visiting in a single day. The device can also be used at the apartment entrance because temperature check is needed, where some time it is the most important product which is very useful. It can also be put in at the society entrance gate and therefore rules of social distancing are going to be followed. Thus, this device is easy and safe to use. Moreover, the attendance system is useful for the academic institutions. It is an easy and effective mechanism to take attendance and check the student temperature.

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