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SmartPresence: Event Attendance System Using Mask and Temperature Detection and QR Code Based Validation

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Abstract: As the world is slowly recovering from the pandemic, there is an emerging need for innovative solutions to ensure the safety and security of people at public events. The proposed project, SmartPresence (an IoT-based Event Attendance System) offers an efficient and contactless solution for attendance tracking and management. The system is engineered to streamline the process of recording attendance by using a contactless temperature sensor to detect the user's temperature. If the temperature matches the threshold value, the user's QR code is scanned, and attendance is marked. However, if the temperature exceeds the limit, the user is notified of fever and not admitted to the event. The system also includes mask detection technology, ensuring that attendees wear masks while attending the event. With itseasy-to-use and efficient design, the system offers a simplified automated attendance management process. This approach eliminates the need for physical contact and close proximity, ensuring the safety of all attendees while maintaining proper sanitation measures. Additionally, the system generates accurate and reliable attendance reports, enabling organizers to monitor attendance and ensure regulatory compliance. Theproposed project has great potential to enhance the safety and security of public events. It's an easy-to-use design, coupled with its accurate and reliable attendance management capabilities, can simplify the event management process, streamline attendance tracking, and improve safety measures. As the world continues to navigate the post-pandemic landscape, the IoT-based Event Attendance System can play a crucial role in ensuring the safety of attendees at public events andgatherings.

Keywords: *IOT, SmartPresence, Sensors, Temperaturesensor, Mask detection, QR Code, Attendance tracking.*

1. Introduction

The coronavirus disease, or COVID-19, which spawned primarily in Wuhan, China, has rapidly spread to several countries, including India, the world's second-most populous country with a population of more than 134 billion people [1][2][3]. The pandemic has brought about a new reality, withthe need for safety measures in public events and gatherings becoming more crucial than ever [1][4]. The epidemic has an impact on everything from work activities to social connections, all sports activities, as well as off-screen and on- screen leisure [5]. In response to this, SmartPresence was developed, an IoT-based event attendance system to address the emerging need for innovative solutions that ensure the safety and security of people at public events. Since there is always a growing demand for contactless, efficient, and reliable event attendance management systems, SmartPresence was designed to meet this demand and provide an easy-to-use, contactless solution for attendance tracking and management.

Face mask detection has achieved major advancements in the domains of computer vision and facial recognition [6]. Face detection models were built using a range of methods and algorithms. The proposed research uses TensorFlow, Keras, OpenCV to recognize face masks. Finding new methods to safeguard and encrypt information is necessary given the ever-rising significance of information as a resource in today's society. The QR serves as the option for one sort of representation of encoded data. A QR code is a type of data carrier that can hold embedded text data and the extra information needed for mobile device software to decode it [7].

The main principle behind the development of SmartPresence is to streamline the process of recording attendance at public events. Traditional attendance management systems [8] often involve physical contact and close proximity, which pose health and safety risks, particularly in the wake of the pandemics [9]. The proposed solution eliminates the need for physical contact and close proximity, ensuring the safety of all attendees whilemaintaining proper sanitation measures.

The system utilizes a touchless temperature sensor, the MLX90614 which gets the temperature reading of an entity without coming into contact with the object using both emissivity and radiation as a means of measurement [10]. If the temperature matches the threshold value, the user's QR code is scanned, and attendance is marked. If the temperature exceeds the limit, the user is notified of fever and not admitted to the event. The system also

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includes mask detection technology, ensuring that attendees wear masks while attending the event. The combination of these technologies and automated attendance management capabilities simplifies the event management process, streamlines attendance tracking, and improves safety measures.

Additionally, the system generates accurate and reliable attendance reports on the provide dashboard made using streamlit, enabling organizers to monitor attendance and ensure regulatory compliance. The data generated by the system can be used for planning future events, managing resources, and assessing attendance trends, making it an invaluable tool for event organizers.

2. Literature Survey

The paper gives a system that detects the temperature of multiple people without physical contact and identifies the possibility of the COVID-19 virus. The proposed system uses an infrared (IR) sensor camera to detect the temperature of individuals and a machine learning algorithm to analyze the collected data. The system works by capturing the images of individuals' faces and IR radiation from their forehead. The captured images are then processed using the machine learning algorithm, which detects the temperature and determines whether the person is has with Corona or not. The results showed that the system achieved an accuracy of 92.3% in detecting the temperature of individuals and 93.4% in identifying COVID-19 infected individuals. [11]. P. Ulleri and other proposes a hands-free employee governance system that integrates mask detection and body temperature measurement using TensorFlow. The proposed system uses a camera and an IR sensor to detect the body temperature of employees and a machine learning algorithmto analyze the collected data. The system works by capturing the images of employees' faces and IR radiation from their forehead. The captured images are then processed using the machine learning algorithm, which detects the temperature and determines whether the employee is wearing a mask or not. The results showed that the proposed system achieved an accuracy of 95.6% in detecting the temperature of employees and 93.8% in identifying the absence of masks. [12]

Preetha P S presents the development of a contactless temperature sensor that can calculate the temperature of individuals without any physical contact [13]. The proposedsystem uses an infrared (IR) sensor to detect the IR radiation emitted by the human body and convert it into a digital signal. The signal is then processed using a microcontroller unit (MCU) and displayed on an LCD screen. The authors also present the calibration process of the IR sensor to ensure accurate temperature measurement. The authors of this paper Varshini B and others have suggested an "Auto Temperature and Mask Scanning Entry System" that can be used to detect people's body temperature and face masks at the entry point of a public place, such as an office, school, or mall [14]. The system consists of a temperature sensor, a camera, a display screen, and a microcontroller. When a person approaches the system, the sensor captures their temperature and displays it on the screen. The camera then captures the person's face and validates if mask is present or not. If the temperature is between a normal range and they are wearing a mask, the system allows them to enter the place; otherwise, an alert is raised, and the person is not allowed to enter.

The research paper titled "STM32-Based Contactless Temperature Measurement and Identification Device" presents the development of a contactless temperature measurement and identification device based on the STM32 microcontroller. The device is designed to measure the temperature of a target object without making physical contact, and it uses an infrared temperature sensor and an RFID reader for identification [15]. The STM32 microcontroller is used to control the overall operation of the device, and a graphical user interface (GUI) is developed for user interaction. The paper proposes a student attendance system that uses QR codes to streamline the attendance-taking process. The system consists of a mobile application that generates a unique QR code for each class session, which is displayed ona projector or printed out and posted in the classroom. Students use the same mobile application to scan the code and register their attendance [16].

The paper describes the design and implementation of the system, including the hardware and software components. The system consists of a web-based application and a mobile application that communicate with a database and a microcontroller [17]. The web-based application is used by administrators to manage attendance data, while the mobile application is used by students or employees to mark their attendance.

The Reference [18] discusses the use of QR codes for attendance tracking in educational settings. The author argues that traditional attendance tracking methods, such as taking attendance sheets, are time-consuming and prone to errors, whereas QR codes can provide a more efficient and accurate solution.

Reference [19] describes a method for measuring room and object temperature using an infrared temperature sensor(MLX90614) and an Arduino microcontroller. The authors explain the principles of infrared temperature measurement and the specifications of the sensor used. They then detail the hardware and software setup for the Arduino, including the code used to read and display temperature data. The authorsconduct experiments to test the accuracy and precision of the sensor and find that it

performs well in measuring both room and object temperatures. They conclude that the setup is a low-cost and effective way to measure temperature for various applications. Adusumalli and others describes a method for detecting face masks using OpenCV, a popular open-source computer vision library [20]. The authors explain the need for mask detection in the context of the COVID-19 pandemic and outline the steps involved in their approach, which includes face detection using the Haar cascade classifier and mask detection using image processing techniques such as thresholding and contour detection. The authors evaluate the performance of their approach using a dataset of masked and unmasked faces and report high accuracy and precision in detecting masks. They conclude that their approach can be applied to various settings, such as public places, to enforce mask-wearing policies and promote public health.

3. Methodology

The system architecture involves using a NodeMCU microcontroller along with MLX90614 module to monitor temperature of attendees with opencv detecting the mask for mask detection component. Overall system comprised of thefollowing components:

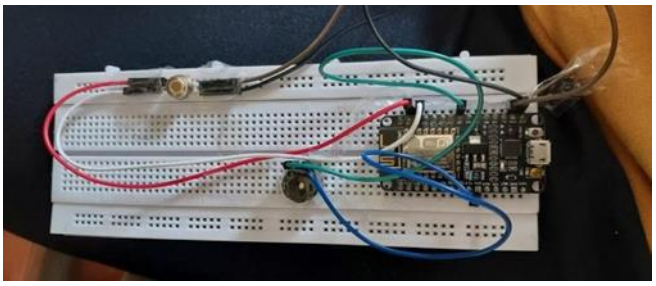

Fig 1: Circuit Diagram for The System

A. NodeMCU *Microcontroller*

An opensource IOT platform is NodeMCU. It consists of software written in an external scripting programming language and artificial system on Chip ESP8266. NodeMCU is also appropriate for the project because it has an embedded ESP8266 wifi IOT microcontroller [21].

B. MLX90614 Temperature

The MLX90614 sensor is a contactless temperature sensor, meaning it doesn't need to make physical touch with an object to determine its temperature. To measure the temperature of an object, you simply put the MLX90614 sensor at it [22].

C. Breadboard

A breadboard serves as the foundation for building electronic prototypes. The majority of electrical components are assembled by placing them according to their terminal holes and then providing the connections through cables. The breadboard is made up of several metal strips below and holes above. It is divided into four portions, each with vertical and horizontal pins [23].

D. Jumping Wires

Jumper wires, sometimes referred to as jump wires, are available in jump wire sets and are used for solderless breadboard connections. For bigger circuits, the latter may turn into a laborious task. Jumper wires are available in a variety of qualities, some of which have a few tiny plugs attached to the wires' ends. Through the holes on the breadboard, the jumper wires assist in connecting the LEDs with the Node MCU [24].

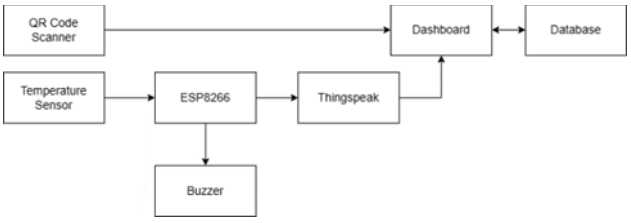

Fig 2: Data Flow diagram for the system

Process Flow:

The flow starts with temperature sensor, MLX90614, detecting the user's temperature by measuring the infrared radiation emitted by the user's body. The sensor is highly accurate and can detect temperature changes in the range of 0.02°C, further mask detection technology using OpenCV and a pre-trained mask detection model, identifies whether the attendee is wearing a mask or not. OpenCV is an open- source computer vision library that analyzes the video feed from a camera and processes it to detect the presence of a mask. NodeMcu is then used to

receive data from the temperature sensor and mask detection module, process it, and transmit it to the cloud server platform that is ThingSpeak for storage and analysis. The external camera isused to scan the QR code which is on the user's ID card andmark their attendance. Finally, attendance recording process is streamlined by scanning the attendee's QR code, and if thetemperature is within the threshold limit, attendance is marked. If the temperature exceeds the limit, the attendee is notified of fever and the event authorities would not admit him/her to the event.

Computation of ambient and object temperatures

1. Computation of ambient temperature:

$Ta[°K\ ] = Tareg\ \ 0.02\ , or\ 0.02°K/LSB$

where, Ta is the sensor die absolute temperature.

2. Computation of object temperatures:

$To[°K] = Toreg\ \times\ 0.02\ , or\ 0.02°/LSB$

where, To is the absolute object temperature.

4. Results and Discussions

The system has shown promising results in providing a contactless and efficient system for attendance tracking and management at public events. The use of advanced technologies such as the temperature sensor, MLX90614, andmask detection technology using OpenCV and a pre-trained mask detection model have been successful in accurately detecting temperature and mask usage, respectively. The system recording process was streamlined with the use of QRcode scanning, and if the temperature was within the threshold limit, attendance was marked. If the temperature exceeded the limit, the attendee was notified of fever and not admitted to the event. The system generated accurate and reliable attendance reports, which could be accessed in real- time by organizers.

Fig 3: Graphical representation of ambient temperature

Fig 4: Graphical representation of object temperature

Fig 5: Dashboard Monitoring of SmartPresence at event.

The project has demonstrated the potential to improve attendance management processes while maintaining proper sanitation measures and ensuring the safety of all attendees. However, further improvements can be made to the system, such as implementing additional features like social distancing monitoring and contact tracing.

5. Conclusion

The capacity of SmartPresence to monitor people's body temperatures without any physical touch is one of its notable characteristics. This lowers the possibility of viral transmission. Additionally, the system makes use of state-of-the-art mask detection technology to confirm that everyone entering a facility is donning a mask, minimizing the possibility of airborne virus dissemination. With a touchless and quick input method made possible by the QR code scanning capability, the attendance procedure is significantly simplified.

By combining these features, SmartPresence improves safety and hygiene while also making it easier to track attendance in workplaces, public places, and educational institutions. In addition to its present pandemic uses, SmartPresence has the potential for wider usage. Its multifaceted approach to safety precautions may prove invaluable in future health emergencies or develop into a standard component of protecting public health. Finally, SmartPresence emphasizes safety and cleanliness as the two most important considerations, and it represents a substantial leap in attendance tracking.

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