IOT-BASED COVID-19 SUSPECT SMART ENTRANCE MONITORING SYTEM

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Abstract: The IoT-based COVID-19 suspect smart entrance monitoring system aims to prevent the spread of the virus by detecting potentially infected individuals entering premises such as corporate offices. Utilizing Arduino Uno, IR sensor, temperature sensor, pulse and heart rate sensor, LCD, servo motor, and NodeMCU, the system monitors body temperature, heart rate, and oxygen levels of individuals. If all parameters are within specified ranges, access is granted by displaying a message on the LCD screen and unlocking the door via the servo motor. Conversely, if any parameter indicates potential infection, access is denied. The system offers cost-effectiveness, performance, and ease of implementation while prioritizing public health and safety.

I. Introduction

In the wake of the COVID-19 pandemic, preventing the spread of the virus has become paramount in ensuring public health and safety. One significant avenue for transmission is through contact between infected and uninfected individuals in shared spaces like offices and public buildings. To address this challenge, we propose an innovative solution: the IoT-based COVID-19 suspect smart entrance monitoring system. This system aims to detect individuals potentially carrying the virus before they enter such spaces, thereby mitigating the risk of transmission within the premises.

At the heart of our system lies a combination of sensors and microcontrollers, including Arduino Uno, IR sensor, temperature sensor, pulse and heart rate sensor, and NodeMCU. These components work together seamlessly to monitor key health indicators of individuals approaching the entrance. By analyzing parameters such as body temperature, heart rate, and oxygen levels, the system can identify potential COVID-19 suspects in real-time.

The operation of the system is straightforward yet effective. As individuals approach the entrance, the IR sensor detects their movement, triggering the system to commence health monitoring. Simultaneously, the temperature sensor measures the individual's body temperature, while the pulse and heart rate sensor assess their heart rate and oxygen saturation levels. Based on the gathered data, the system determines whether the individual poses a risk of COVID-19 transmission.

In the event that an individual's health parameters fall within acceptable ranges, access is granted, and the door unlocks automatically, allowing entry. Conversely, if any parameter indicates potential infection—such as elevated body temperature or abnormal heart rate—the system denies access and displays a message alerting the individual of the situation. By implementing this smart entrance monitoring system, we aim to create a safer environment for all occupants by proactively identifying and mitigating the risk of COVID-19 transmission.

II. Existing literature

Existing literature on IoT-based technologies for combating COVID-19 encompasses a diverse range of approaches aimed at various aspects of pandemic management. Garg et al. (2020) present an anonymity-preserving Io-based contact tracing model, focusing on preserving privacy while tracking potential disease spread. Pandya et al. (2020) introduce a smart epidemic tunnel utilizing Io-based sensor fusion for disinfection, emphasizing the importance of innovative technologies in maintaining hygiene protocols. Mohammed et al. (2021) propose a COVID-19 detection system using an Io-based smart helmet, showcasing wearable technology for rapid diagnosis. Nasajpour et al. (2020) conduct an exploratory study on IoT applications for pandemic response, highlighting the potential of IoT in addressing current and future health crises. Agarwal et al. (2020) discuss an Io-based framework for COVID-19 readiness in smart campuses, emphasizing the role of IoT in adapting educational institutions to pandemic challenges. Hossain et al. (2019) address challenges and limitations in implementing IoT-based models for smart campuses, providing insights into practical considerations for IoT deployment in educational settings.

III. Proposed system

Based on the existing literature, we propose an IoT-based COVID-19 suspect smart entrance monitoring system. This system integrates various sensors and microcontrollers, including Arduino Uno, IR sensor, temperature sensor, pulse and heart rate sensor, LCD, servo motor, and NodeMCU. The system aims to detect potentially infected individuals before they enter shared spaces, such as corporate offices or public buildings, by monitoring key health indicators in real-time. By analyzing parameters such as body temperature, heart rate, and oxygen levels, the system can identify COVID-19 suspects and prevent their entry into premises, thus reducing the risk of virus transmission among occupants. The proposed system offers a cost-effective, efficient, and privacy-preserving solution to mitigate the spread of COVID-19 in public settings.

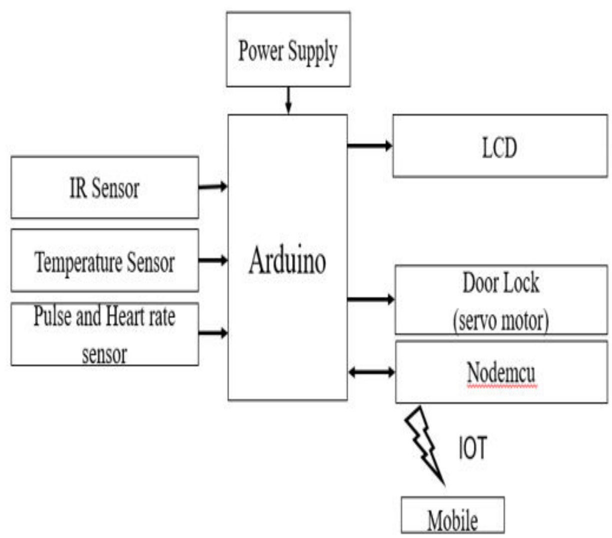

Fig 1. Architecture of the proposed system

IV. Components used and description

Arduino Uno: Arduino Uno serves as the main microcontroller of the system. It processes data from various sensors, controls the servo motor for door locking/unlocking, and manages communication with other components.

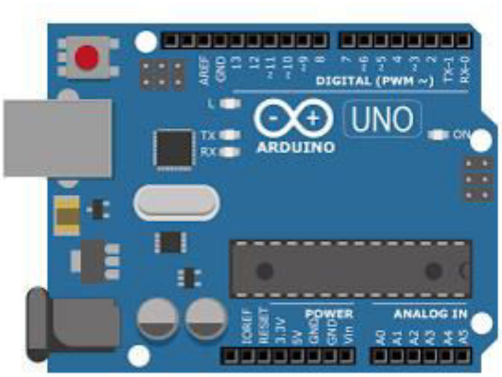

Fig 2. Arduino uno

IR Sensor: The IR sensor detects movement to determine when an individual approaches the entrance. It triggers the system to start monitoring the individual's health parameters.

Fig 3. IR sensor

Temperature Sensor: This sensor measures the body temperature of individuals. It provides crucial data for identifying potential COVID-19 suspects, as fever is one of the primary symptoms of the virus.

Fig 4. Temperature sensor

Pulse and Heart Rate Sensor: The pulse and heart rate sensor measures the heart rate and oxygen levels of the person. Abnormal heart rate and oxygen saturation levels may indicate potential COVID-19 infection, prompting further evaluation.

Fig 5. Heart beat sensor

LCD: The LCD (Liquid Crystal Display) screen displays messages/alerts generated by the system. It communicates information to individuals approaching the entrance, such as granting or denying access based on health parameters.

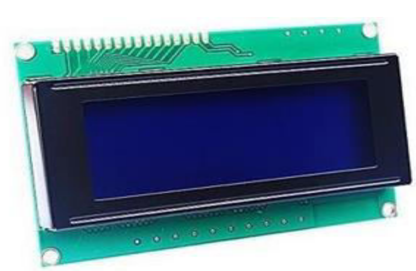

Fig 6. LCD

Servo Motor: The servo motor controls the door lock mechanism. It unlocks the door automatically when access is granted based on the individual's health parameters and locks it otherwise.

Fig 7. Servo motor

NodeMCU: NodeMCU provides connectivity features, allowing the system to incorporate internet connectivity or remote monitoring capabilities if desired. It facilitates communication between the system and external devices or networks.

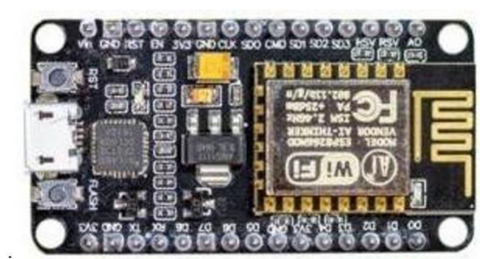

Fig 8. Node MCU Wi-Fi module

V. Working flow of proposed system

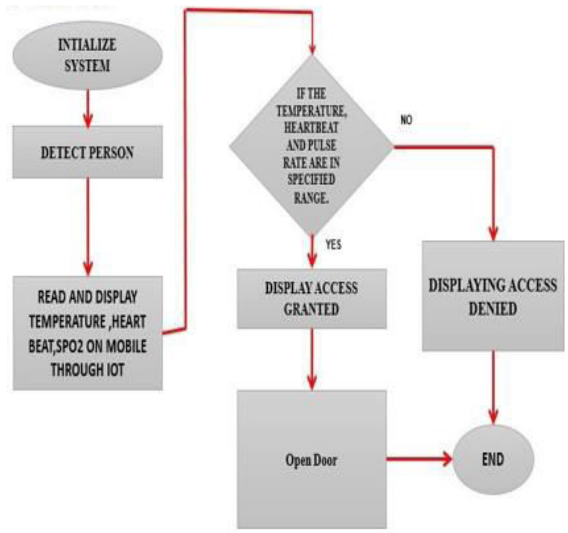

Fig 9. Flow chart of proposed system

VI. Working algorithm

Initialization: Start the system and initialize all components, including Arduino Uno, sensors, LCD, servo motor, and NodeMCU.

Movement Detection: Continuously monitor the IR sensor to detect movement near the entrance.

If movement is detected, proceed to health monitoring; otherwise, continue monitoring.

Health Monitoring: Activate the temperature sensor to measure the body temperature of the individual.

Activate the pulse and heart rate sensor to measure heart rate and oxygen levels.

Retrieve data from sensors and store it for analysis.

Data Analysis: Compare the measured values of body temperature, heart rate, and oxygen levels with predefined thresholds or ranges.

If all parameters are within acceptable ranges, proceed to grant access; otherwise, deny access.

Access Decision:

If access is granted:

Display a message on the LCD screen indicating permission to enter.

Activate the servo motor to unlock the door.

If access is denied:

Display a message on the LCD screen indicating denial of entry.

End of Process:

Once access decision is made and communicated, wait for the individual to enter or leave.

After a set period or when no movement is detected, return to the movement detection phase.

VII. Results and discussion

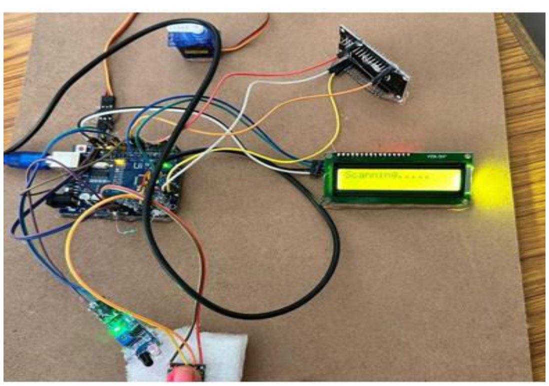

Fig 10: Prototype of the IoT-based COVID-19 Suspect Smart Entrance Monitoring System

The developed prototype showcases the integration of various components, including Arduino Uno, sensors, LCD, servo motor, and NodeMCU, into a compact and functional unit. The prototype demonstrates the feasibility of implementing the proposed system for real-world applications in monitoring and controlling access to premises.

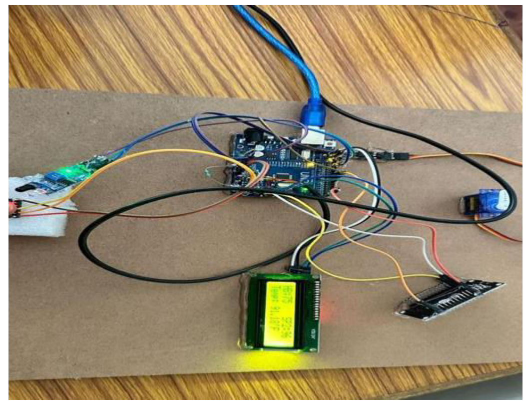

Fig 11: Health Monitoring Parameters Displayed on LCD

The LCD screen provides real-time feedback on the health monitoring parameters, including body temperature, heart rate, and oxygen levels. Individuals approaching the entrance can easily view their health status, facilitating informed decision-making regarding access to the premises. This visual representation enhances transparency and ensures adherence to safety protocols in mitigating the spread of COVID-19.

The prototype of the developed model is presented, highlighting its functionality and feasibility for real-world deployment. Additionally, the display of health monitoring parameters on the LCD screen demonstrates the system's capability to provide real-time feedback to individuals approaching the entrance, contributing to effective infection control measures.

VIII. Conclusion

In conclusion, the IoT-based COVID-19 suspect smart entrance monitoring system presents a promising solution for mitigating the spread of the virus in shared spaces. Through the integration of various sensors and microcontrollers, the system effectively monitors key health indicators of individuals and regulates access to premises based on predefined thresholds. The prototype demonstrates the feasibility and potential of the proposed system in enhancing public health safety measures, paving the way for further research and development in leveraging IoT technology for pandemic management.

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