Smart Office Room

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Abstract

Employee health plays a vital role in maintaining workplace productivity. In response to the challenges posed by the COVID-19 pandemic, this study proposes the development of a Smart Office Room system designed to foster a safe and healthy working environment. Leveraging IoT-based automation and powered by Raspberry Pi, the system integrates various components, including cameras, thermal scanners, infrared sensors, and motion detectors. Key features include automated door access, touchless sanitizer dispensers, and social distancing monitoring mechanisms. The system permits entry only to individuals who comply with health protocols, such as wearing masks and maintaining normal body temperature. This affordable solution aims to enhance workplace safety while streamlining health monitoring processes.

Keywords:

PIR sensor, raspberry Pi, ESP8266, AMG8833, IR sensor

1. INTRODUCTION

The global outbreak of COVID-19 drastically altered daily routines and continues to pose a significant health challenge. The virus primarily spreads through close contact between individuals, making measures such as social distancing, wearing masks, and frequent hand sanitization essential to minimize the risk of transmission. Maintaining a six-foot distance from others, avoiding crowded spaces, and using face coverings in public are recognized as key preventive strategies.

In workplace settings, consistent adherence to these health protocols can be challenging, often leading to unsafe environments. To address these concerns, this paper presents a Smart Office Room system that integrates IoT-based automation to ensure a safe and healthy office environment. The proposed system grants access to employees based on two primary conditions:

- Wearing a face mask.
- Having a normal body temperature.

Additionally, an automatic hand sanitizer dispenser minimizes the risk of contamination by eliminating the need for direct contact. This feature also helps enforce hygiene practices. To maintain safe social distancing, the system continuously monitors and ensures a gap of at least six feet between individuals.

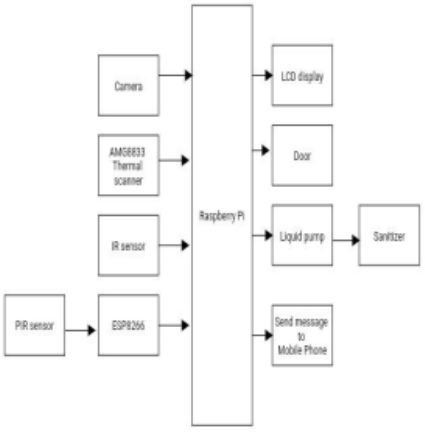
The Smart Office Room utilizes Raspberry Pi technology alongside cameras, thermal scanning sensors, IR sensors, and PIR sensors to provide a comprehensive solution. These components enable mask detection, body temperature scanning, human presence detection, and object recognition. The system is designed to be cost-effective, making it a viable and affordable solution for organizations aiming to safeguard the health of their employees while maintaining operational efficiency.

2. SYSTEM ARCHITECTURE

The entire system work in three mode.

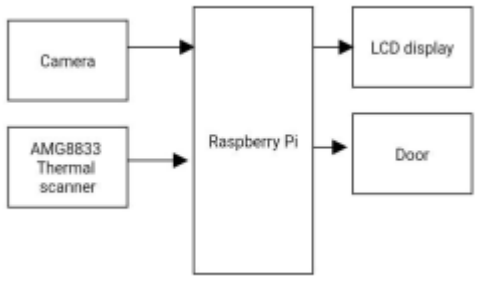
- Mask detection and temperature scanning.
- Automatic sanitizer dispenser
- Human presence detection

This system contains input block and output block. Camera, AMG8833, IR sensor, PIR sensor are the input blocks. Liquid pump, Sanitizer, Mobile Phone, door are the output blocks.



TEMPERATURE SCANNING AND MASK DETECTION

This mode incorporates a camera, AMG8833 thermal sensor, Raspberry Pi, LCD display, and a door system. When an employee approaches the door, the camera detects the presence of a mask and verifies the face, while the thermal sensor measures the employee's body temperature. Entry is granted only if both conditions—mask detection and normal body temperature—are met, ensuring that only healthy individuals wearing masks can access the office. The employee's image and temperature are displayed on the LCD screen. Alerts, such as abnormal temperature, missing mask, blacklisted individuals, or unrecognized faces, are also generated as necessary. The mask detection is achieved through image processing techniques using the camera



HUMAN PRESENCE DETECTION

This mode utilizes a PIR sensor, Raspberry Pi, mobile phone, and ESP8266 module. Each employee is assigned a PIR sensor, which connects to the ESP8266 device, integrated with the Raspberry Pi. Through IoT connectivity, the Raspberry Pi communicates with employees' smartphones. The PIR sensor detects human presence within a six-foot range and sends a push notification to alert the employee via their phone. Push notifications function as instant messages that appear on the smartphone. The Raspberry Pi acts as the central controller, while the PIR sensor identifies human presence. The built-in Wi-Fi capabilities of the Raspberry Pi make it an ideal choice for IoT applications.

WORKING OF PUSH NOTIFICATIONS

Push notifications are delivered to Android devices using specific servers like Google Cloud Messaging (GCM), Microsoft Push Notification Service (MPNS), or Apple Push Notification Service (APNS). The process for Android devices is as follows:

1. The Android device registers with the GCM server using a sender ID and application ID.
2. Upon successful registration, the server issues a unique registration ID to the device.
3. This registration ID is sent to the application server for storage in its database.
4. Whenever a push notification is required, the app server sends a message along with the registration ID to the GCM server.
5. The GCM server uses the registration ID to deliver the message to the respective mobile device.
6. To host push notification services, platforms like Pushetta, Pushsafer, or PushBullet can be used. PushBullet, in particular, is user-friendly and free, with prebuilt Python libraries that make integration with the Raspberry Pi straightforward.

AUTOMATIC SANITIZER DISPENSER

This system integrates an IR sensor, Raspberry Pi, liquid pump, and sanitizer to create a touch-free dispenser. When the IR sensors detect the presence of a hand, the pump is activated to dispense sanitizer. The system operates based on the following truth table:

IR Sensor 1	IR Sensor 2	Output
True	True	Two drops of sanitizer
True	False	One drop of sanitizer
False	True	One drop of sanitizer
False	False	No sanitizer

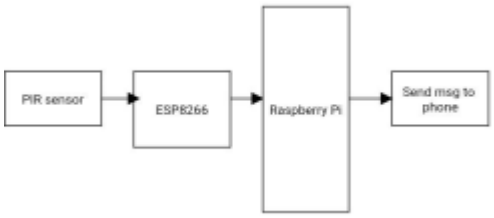
PIR SENSOR AND ESP8266 MODULE

PIR Sensor:

The PIR sensor detects motion within a range of approximately 5–12 meters, with an average detection distance of 10 meters. It features a three-pin configuration for power (up to 5V), ground, and signal. The PIR sensor outputs digital signals, making it easy to interface with a microcontroller.

ESP8266 Module:

The ESP8266 is a standalone system-on-chip (SOC) with an integrated TCP/IP stack, enabling any microcontroller to connect to Wi-Fi networks. It can function as a host for applications or handle all Wi-Fi networking tasks for another processor, making it a versatile choice for IoT applications.



3. CONCLUSION

The Smart Office Room system integrates advanced techniques like human presence detection, mask detection, temperature monitoring, and an automatic sanitizer dispenser. Compared to earlier systems, it is both cost-effective and efficient. Unlike traditional methods that rely on cameras for presence detection, this system utilizes PIR sensors for a more affordable and reliable approach. Additionally, it accurately identifies objects such as masks, ensuring compliance with health protocols.

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