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Automatic Face Mask and Body Temperature Detector

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ABSTRACT: The COVID-19 pandemic has brought a new set of challenges for public safety and hygiene. In the current situation, it is essential to maintain proper precautions and follow health protocols to reduce the risk of infection. One of the most effective methods of reducing the spread of the virus is to wear face masks and monitor body temperature. The automatic face mask and body temperature detection system is a computer vision-based solution designed to detect the presence of a face mask and measure body temperature accurately in real-time.The system utilizes advanced image processing techniques to analyze the thermal and visual images captured by a camera and detect if an individual is wearing a mask or not. Additionally, it also measures the temperature of the individual accurately using an infrared temperature sensor. The system is highly efficient, reliable, and can be deployed in various public spaces such as airports, schools, hospitals, and offices, where large numbers of people gather. The automatic face mask detection system uses a deep learning-based approach to detect face masks.System also ensures that a place where system is mounted is not getting overcrowded.

KEYWORDS: deep learning, CNN, Sensors.

I. INTRODUCTION

The automatic detection of face masks and body temperature has become crucial in maintaining public health and safety, particularly during the COVID-19 pandemic. This paper presents an overview of an automated system that utilizes advanced technologies, including computer vision and temperature sensors, to detect the presence of face masks and measure body temperature accurately. The system is based on the Raspberry Pi platform, a versatile and affordable single-board computer. By combining image analysis and temperature sensing, the system can quickly and efficiently identify individuals without face masks and detect abnormal body temperatures. The system also ensures that place where system is active is not getting overcrowded. The proposed system offers a cost-effective and scalable solution that can be deployed in various environments, such as public spaces, workplaces, and transportation hubs, to ensure compliance with mask-wearing regulations and facilitate early identification of potential health risks.

Reports show that keeping social distance and using face masks at work decreases the chance of transmission significantly. Research investigations suggest that 91% and 68% of N95 operating masks are efficient in stopping viral transmission. Using these masks efficiently disrupts airborne viruses, which prevents them from reaching the respiratory system of a human being and is cost-effective in reducing deaths and breathing problems. However, facing masks have usually been decreased in the public because of insufficient usage of facemasks in preventing the transmission of illness. A smart system to control if a face mask is present and the temperature should be below 99.1°F (37.3°C) to 100.4°F (38°C) is needed.Our aim is to stop increasing covid-19 chain by checking ones body temperature, face mask and also ensures that place is not getting overcrowded.

II. PROBLEM STATEMENT

In the context of public health and safety, there is a growing need for effective measures to prevent the spread of contagious diseases, such as respiratory infections. Two critical preventive measures include the proper use of face masks and regular temperature screening. However, manual enforcement and monitoring of these measures can be time-consuming, inefficient, and prone to human error. Therefore, there is a pressing need for an Automatic Face Mask and Temperature Detection System that can accurately and efficiently detect whether individuals are wearing face masks and measure their body temperature in various settings, such as airports, schools, workplaces, and public spaces.Social distancing is also necessary to stop covid-19 chain, our system also ensures that place where our system is mounted is not getting overcrowded.

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III. LITERATURE SURVEY

[1], discusses the development of a deep learning-based model for automatic face mask detection using convolutional neural networks (CNNs). It focuses on the application of mask detection in public spaces during the COVID-19 pandemic.
[2], presents an automated system that combines face mask detection and body temperature measurement using a thermal imaging camera and deep learning techniques. It aims to enhance safety measures during the COVID-19 pandemic.
[3], proposes a system that combines face mask detection and body temperature measurement using deep learning algorithms. It focuses on real-time monitoring in public spaces to ensure compliance with safety measures.
[4], presents a system that integrates face mask detection and temperature measurement using deep learning techniques. It provides a comprehensive solution for monitoring individuals' compliance with mask-wearing regulations and identifying potential health risks.
[5], a similar system incorporating the usage of smartphones for remote temperature monitoring using Arduino Uno was presented.

IV. SYSTEM DESCRIPTION

- Raspberry Pi Board: Raspberry Pi(3b) board as the central processing unit for the system.
- Camera Module: We have Connect a compatible camera module to the Raspberry Pi board to capture real-time images. The camera has a suitable resolution for accurate face detection.
- Temperature Sensor: We have Integrate a temperature sensor with the Raspberry Pi board to measure body temperature accurately. We have used MLX90614 temperature sensor which is contactless and have higher efficiency for detecting body temperature.
- Display Unit: We have connected a display unit as an LCD screen to the Raspberry Pi for displaying system output, including temperature readings, crowd status and mask detection results.
- Power Supply: Ensure a stable power supply for the Raspberry Pi and its connected components.
- Software and Libraries: Necessary or vital software and libraries on the Raspberry Pi board installation is carried out. This includes the Raspbian operating system, Python programming language, OpenCV computer vision library, stmplib, TensorFlow, imutils and matplotlib.
- Face Mask Detection Algorithm: We have Implement a suitable face mask detection algorithm on the Raspberry Pi using computer vision techniques. This involve utilizing pre-trained machine learning models like Haar cascades for accurate mask detection.
- Integration and Communication: We have established the necessary connections and communication protocols between the camera module, temperature sensor, display unit, Raspberry Pi board and GPIO (General Purpose Input/Output) pins, I2C, or other interfaces.
- Crowd detection: IR sensor plays a vital role to monitor crowd and if place becomes overcrowded then it send necessary alert to administrative.

V. SYSTEM BLOCK DIAGRAM

This project aims to develop an intelligent system that combines automatic face mask and body temperature detection using a Raspberry Pi, MLX90614 temperature sensor, LCD, and an IR sensor for crowd monitoring. The system will detect the presence of face masks, measure body temperature, monitor the entry and exit of individuals using the IR sensor. Raspberry Pi board as the central processing unit for the system. It provides computational power and interfaces to connect and control the various components. MLX90614 infrared temperature sensor is connected to the Raspberry Pi to measure the body temperature of individuals accurately and non-contactless. Camera module is connected to raspberry pi to detect, whether person have worn face mask or not. IR sensor is connected to raspberry pi which is used to detect the entry and exit of individuals in the monitored area and it will help estimate the crowd count and trigger appropriate actions of sending alerts to the administrative team when the crowd count exceeds the defined threshold via mail. LCD display unit is connected to the Raspberry Pi to provide real-time visual feedback. It will display temperature readings, mask detection results, and crowd monitoring information. If all three condition (facemask, temperature and space) is satisfied then servo motor will turn on, which will act like gate.

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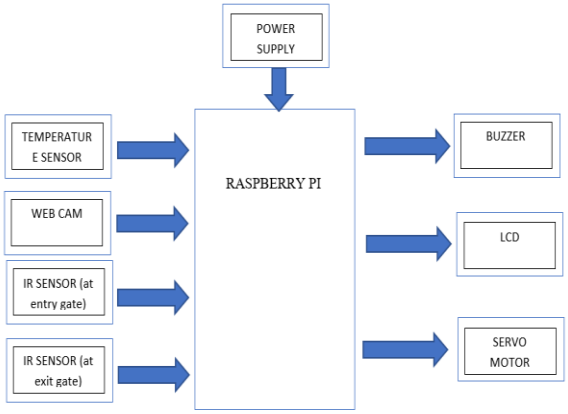

Fig 1: Block diagram

Flow chart:

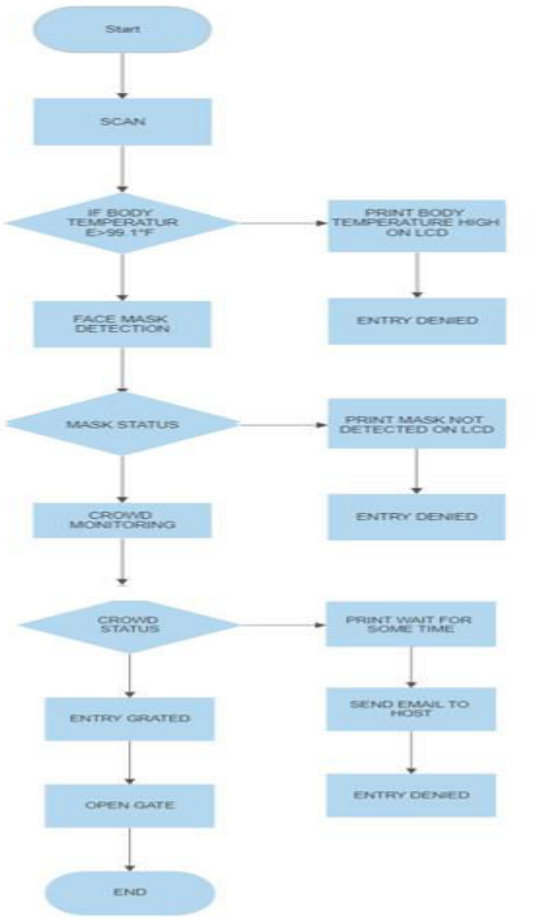

Fig 2: flowchart

System workflow:

- Capture Video: The camera module captures real-time video frames.
- Face Detection: Apply face detection algorithms from OpenCV to locate faces within the video frames.

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- Mask Detection: Utilize the trained machine learning model or pre-trained models to detect the presence or absence of face masks.
- Temperature Measurement: Read temperature data from the sensor using the MLX90614 temperature sensor.
- Crowd monitoring: IR sensor is mounted to entry gate and exit gate it is used to count number of persons entering and leaving the place and if crowd increases beyond the threshold, then alert is generated.
- Threshold Validation: Compare the measured temperature with predefined thresholds to identify abnormal readings.
- Alert Generation: Trigger visual/audio alerts and mail notifications if the temperature exceeds the defined thresholds or if masks are not detected.
- Display and User Interaction: We have Present real-time video feed, detection results, temperature measurements, and alerts on the display unit. Provide interactive elements for user configuration.
- Data Storage: Store detection results, temperature measurements, and associated metadata in a database or log file for analysis and reporting.
- Networking and Remote Monitoring: Enable remote access to monitor the system and receive alerts through network connectivity.
- Power Management: Ensure power efficiency and implement mechanisms to handle power interruptions or backup power sources.

Circuit diagram:

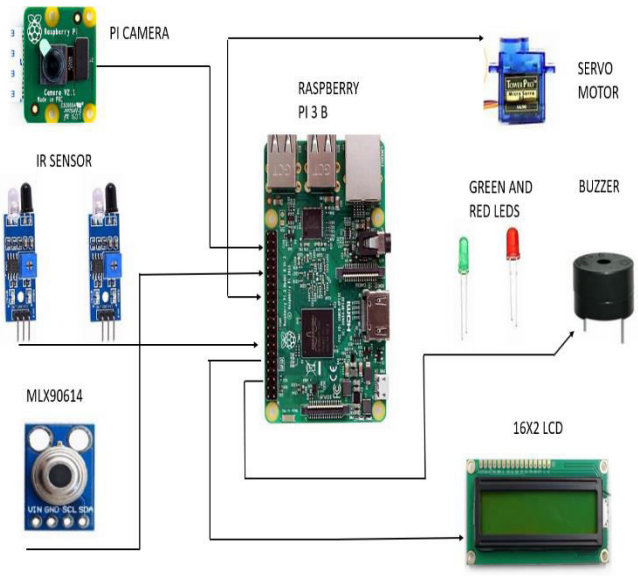

Fig 3 circuit diagramI

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VI. RESULT AND PREDICTION

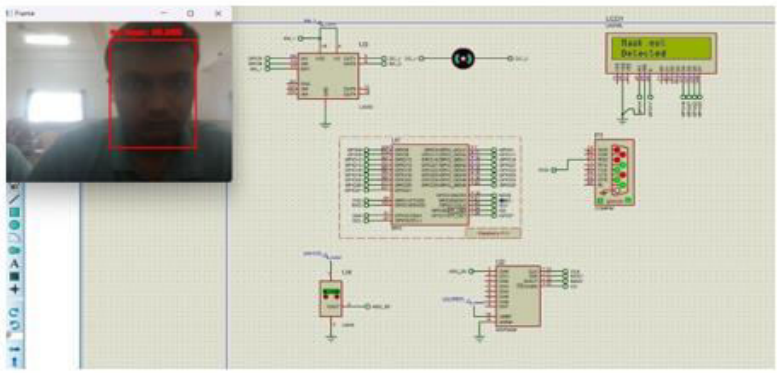
```
[INFO] evaluating network...
              precision    recall  f1-score   support

   with_mask       0.98      0.99      0.98       433
without_mask       0.99      0.97      0.98       386

    accuracy                           0.98       819
   macro avg       0.98      0.98      0.98       819
weighted avg       0.98      0.98      0.98       819

[INFO] saving mask detector model...
```

Fig 4: test result

Fig 5: test result

CONDITIONS:-

1. DETECTING THE PERSON WHO IS NOT WEARING MASK:-



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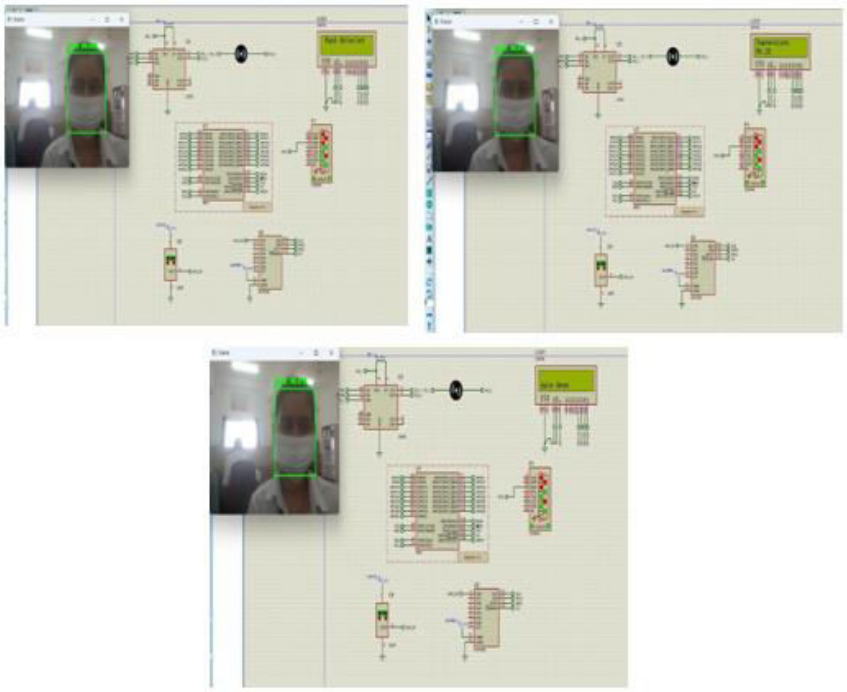
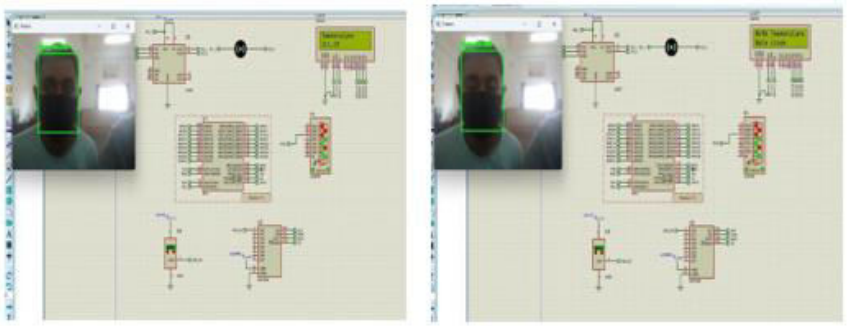
2. DETECTING THE PERSON WHO IS WEARING MASK WITH APPROPRIATE BODY TEMPERATURE :-



3. DETECTING THE PERSON WHO IS WEARING MASK BUT HAVING HIGH TEMPERATURE:-



VII. CONCLUSION

A system has been created for automatic identification of whether the person is wearing a face mask or not and to check the body temperature which this is a preventive step of COVID-19. Eeffort has been inspired by those who break rules required to stop the spread corona virus. There is a mask-search in the system architecture in which there is a face mask deep learning was explored with algorithms. In adding to the temperature monitoring module with IR temperature sensor, the project includes unexplored functionality in previous literature. It also includes a speech output function which is again an advantage person with visual impairment. This project is carried out with raspberry pie, also known as credit card size to complete the computer portability feature. This project needs good power situation which is even higher reliable and precise, so that other sensors ones described above can be further improved.

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