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RESEARCH ARTICLE

Precautionary Screening for Covid-19

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Abstract

The Internet of Things (IoT) is a field that has been utilized to enable remote monitoring and control of home appliances. Automated system is required to develop to save a life of every individual and to stop spread of disease. In this paper real time implementation of face mask and temperature detection system implemented using Raspberry Pi 3 along with some additional features such as servo motor controlled door opening. For face mask recognition, deep leaning methodology used. The Convolution Neural Network is used for detection of face mask. If a face mask is worn and the temperature is below the designated threshold, the door will be unlocked. Conversely, if a face mask is not worn or the temperature exceeds the threshold, a buzzer will sound. The proposed system successfully achieves the results for precision 98% and recalls 99% values.

Keywords: IOT; Raspberry Pi; Face Mask; Temperature Detection; Door Controlling

Introduction

Since the onset of the COVID-19 pandemic, identifying individuals affected by the virus has become increasingly challenging. While numerous temperature measurement devices are available on the market, most lack the capability to issue alerts or send email notifications to authorities when temperatures exceed predefined limits. Simultaneously, the implementation of mandatory face mask regulations has gained traction worldwide, backed by a growing body of scientific evidence demonstrating their effectiveness in reducing virus transmission. However, resistance to these regulations has emerged, posing risks to those tasked with enforcement, such as store employees, who are as susceptible to infection as any other individuals.

Among the roles facing particular challenges during the pandemic is that of a retail store greeter responsible for enforcing mask-wearing rules. To address this issue more effectively and with less reliance on human intervention, a Raspberry Pi-powered mask detection system can be developed. In tackling this problem, non-contact infrared (IR) temperature sensors, commonly used in temperature measurement devices, can be employed to gauge body temperature without physical contact.

This project aims to interface an IR temperature sensor to obtain body temperature readings while concurrently verifying whether the individual is wearing a mask. The buzzer rings if temperature of any person exceeding the set value. Deshpande et al. used SVM classifier with texture features[1]. Meghana et al. used face mask detection with raspberry pi is implemented in this paper and use of CNN algorithm[2]. V. Balachandar et al. employed a strategy to create three-layered fibrous filtration masks utilizing compounds derived from medicinal plants to deactivate viruses[3]. Ndiaye et al. contain survey of all contact and non-contact devices used in COVID-19[4]. Jarande et al. implemented prototype based on Arduino Uno IOT enabled with temperature sensor LM35[5]. Viola et al. integrated complex classifiers in a "cascade" approach, enabling the rapid elimination of background regions within images, while allocating more computational resources to scrutinize potential object-like areas. This cascade can be interpreted as an object-specific focus-of-attention mechanism, distinct from prior methods, as it offers statistical assurances that the discarded regions are improbable to contain the object[6].

Proposed method

1. IR Sensor takes the input by sensing the infrared object in the vicinity and rolls on the counter until reaching 50 nos..
2. emperature sensor is initiated and detects the temperature of the person and it is noted and compared with already fed temperature value.
3. Camera module captures the image of person standing in front and further sends data for analysing.
4. Using python language Deep learning Algorithm is designed to check the cases of the person wearing mask or not wearing mask on basis of Github database available for photos with mask or not with mask.
5. If conditions are correctly satisfied then the servo motor is initiated and door is opened otherwise on LCD it displays that Precautions are not followed.

System Overview

The system initially determines whether a person is wearing a mask or not. It is trained using the Tensor Flow and Open CV libraries. The outcome is then transmitted to a Raspberry Pi, where the person's temperature is assessed. Based on the temperature reading and the mask detection result, the system takes action to open or keep the door closed. To enhance the accuracy of the image classification model, one approach involves incorporating additional hidden layers and implementing measures to reduce false positives. However, this may demand more computational power, which could exceed the capabilities of a Raspberry Pi 3rd generation, given its specifications. To overcome this limitation, one alternative is to leverage cloud-based services for model training and computation. By offloading the computational demands to a cloud platform, you can access more resources and efficiently train or run the model without straining the Raspberry Pi's hardware. This can significantly improve the overall performance and accuracy of the system.

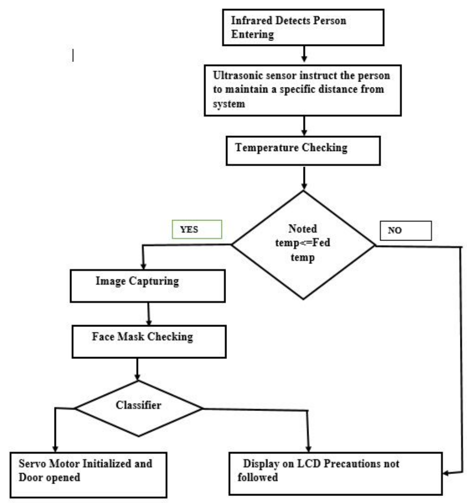

Fig 1. Process Overview

Figure 1 shows the process overview for proposed system firstly Face mask will be detected by the camera module and results will be displayed as mask detected or mask not detected. Now the Temperature will be checked using contactless MLX90614 thermal sensor.

In the updated scenario, when a person wears a face mask and their temperature is below the specified threshold, a servo motor will be activated to open the door. However, if the person is not wearing a face mask or their temperature exceeds the threshold, the system will respond as follows:

1. Red light will be turned on to visually indicate the issue
2. A buzzer will sound once and continue buzzing for 10 seconds to audibly alert about the problem.

Results and Discussion

Initial Simulation results are obtained using raspberry pi simulator interfacing of contactless temperature sensor for detecting a temperature of human body, servo control mechanism for door opening system , IR sensor for detecting human entry and counting and camera module for face detection

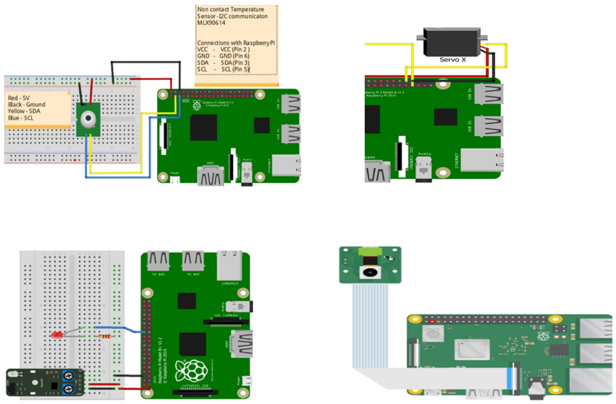

Fig 2. Simulation results using Raspberry pi simulator. a: MLX90614 (contactless temperature) Module b: Servo Motor c: IR Sensor module d: Camera module connected with 16 line ribbon pin

is done and simulated once the results are satisfactory then actual implementation of the model is done the Figure 3 shows implementation of mask detection on raspberry pi.

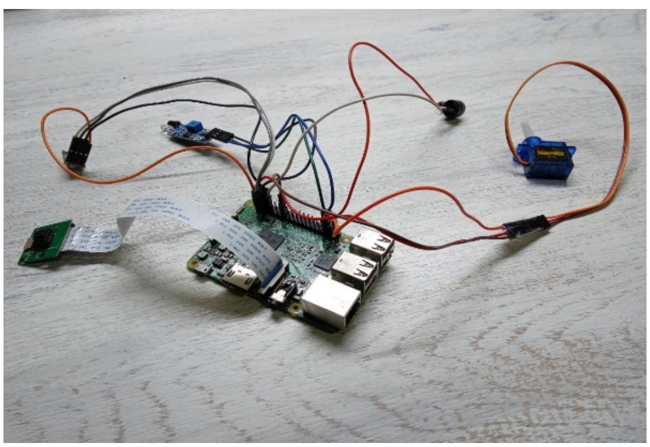

Fig 3. Hardware System on Raspberry pi 3 Model

Table 1. Performance Results for Mask detection

Sr. no	Precision	Recall	F1-Score
With Mask	0.98	0.99	0.98
Without Mask	0.99	0.97	0.98

As shown in Table 1 result is obtained for precision, recall and f1-Score; which shows the prominent accuracy for all parameters. Figure 4 shows the graph for training and validation which gives the better insight into how the learning performance changes over the number of epochs and helped for solving problem of proposed system.

Fig 4. Training and validation accuracy

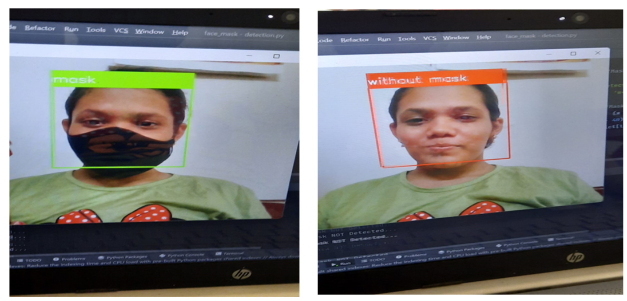

Fig 5. Result for face mask detection software
a. With Mask b. without Mask

Testing Results shown in Figure 5 are obtained if the person is not put on mask the warning is given in the form of message the person is without mask and if wears mask the second level temperature test is done for that person. If both test are passed door will be opened. Figure 4 shows Hardware for mask and contact less temperature detection system.

Conclusion

In this project, we have successfully developed a prototype for a door lock system based on face mask and body temperature detection. This real-time system has practical applications in settings with substantial gatherings, such as schools and entertainment venues. By utilizing a contactless temperature sensor, the need for a dedicated personnel presence is eliminated. Furthermore, the temperature sensor can be upgraded for enhanced accuracy and extended range.

The integration of face masks and body temperature detection serves as an effective measure to discourage large congregations of individuals without masks, thereby mitigating the risk of infection. This technology can contribute significantly to maintaining public health and safety in crowded environments.

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