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COVID-19 : Face Mask Detection and Temperature Detection

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Abstract: *Data from various sources such as the World Health Organization, Wikipedia, the Government Health Ministries, The New York Times, and other sources indicate that COVID-19 has infected more than 127 million people worldwide and killed more than two million people. Two important principles that must be followed in public places to prevent the spread of the virus are to wear a face mask and follow a safe distance from the community. To create a safe, comfortable environment for COVID-19, we propose a flexible Computer Vision program based on a machine that focuses on real-time human face monitoring for both face mask and body temperature in public places using Raspberry Pi 4 Model B to detect violation of face mask protocol with a built-in Pi camera and body temperature monitor with the help of the MLX90614 sensor. A safety system has been installed that will allow the person to enter while wearing a face mask and their body temperature is in accordance with WHO guidelines. Therefore, the aforementioned program will help the community to save time and also help to contaminate the spread of coronavirus. This can be done in public places such as colleges, schools, offices, shopping malls, etc. to test people..*

Keywords: Deep Learning, Python, TensorFlow, Rasberry-Pi, OpenCv, Covid-19 etc.

I. INTRODUCTION

In many parts of the world many people have been employed in popular public places such as shops, cinemas, supermarkets, schools, colleges, railway-stations etc. to ensure that people wear a mask and check their body temperature. This can be one of the worst and most dangerous activities a person can get into, asking people to wear a face mask and check their body temperature. It may also lead to the transfer of Covid-19 from the general population to the affected person in charge of monitoring face mask and body temperature.

The solution to this problem is to install an automatic facemask and a body temperature detection system powered by the Raspberry Pi. This set has its own camera module that checks the face mask and has an unaffected temperature sensor to read body temperature and allows a person when deleting Covid-19 regulations or will notify reputable authorities.

II. EXISTING SYSTEM

System overview Our solution consists of the following subsystems: 1) temperature measurement subsystem based on 1)Raspberry-Pi 2)Computer vision subsystem for mask detection and social distancing check based on Raspberry Pi 3) server side 4) smartphone application for security guards. First, all people that try to the enter building have to pass contactless temperature check. For that purpose, we rely on Raspberry-Pi Uno equipped with infrared thermometer (such as MLX906148) or thermal camera sensor (AMG88339 for example). Moreover, it uses ESP8266 WiFi module for communication with Edge servers using MQTT protocol. In case that person has body temperature higher than normal, the door is locked and MQTT message sent to server, containing both the temperature value and location where it was recorded. Server receives this message, parses it and forwards to smartphone application used by security guards, so they can arrive to make sure that person does not try to enter the building further. Otherwise, if passenger's temperature is normal, Raspberry-Pi will send signal to open the door. After that, passengers proceed to next step of checking – mask detection. For this task, computer vision subsystem based on Raspberry Pi single-board computer equipped with camera module version 110 revision 3 was used. In case that passenger does not wear mask or it does not cover nose, security

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guards will be informed via MQTT message, so they can provide a mask or warn that person to leave. Otherwise, if the person that is being checked wears mask, the door will be opened. Furthermore, once they enter the building, Raspberry Pi devices check whether social distancing is applied properly or not at given locations. In a similar way, MQTT message will be sent to inform the security guards when social distancing is not applied properly in some of the rooms. On the server side, the MQTT broker and semantic triple store are deployed, while message processing, event logging, reasoning and message forwarding are done. Edge servers receive messages, perform their semantic annotation and reasoning to find the right security guard that will be notified. A simple Android mobile application used by security guards receives MQTT messages from server side and visualizes the data about rule violation and location where it occurred within the building. In Fig. 1, an overview of the proposed IoT-based solution that aims to ensure that COVID-19 safety guidelines are applied properly indoors is given

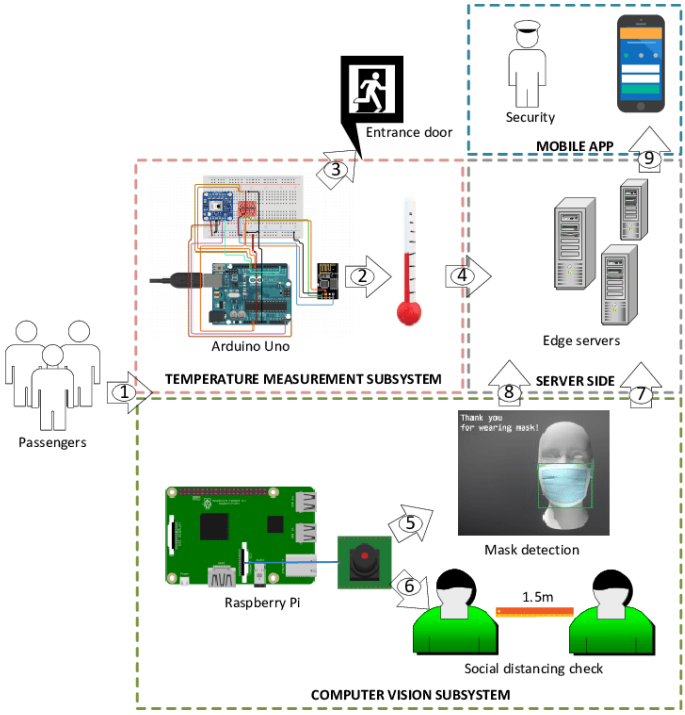

Fig.1.Existing System

III. PROJECT MODULES

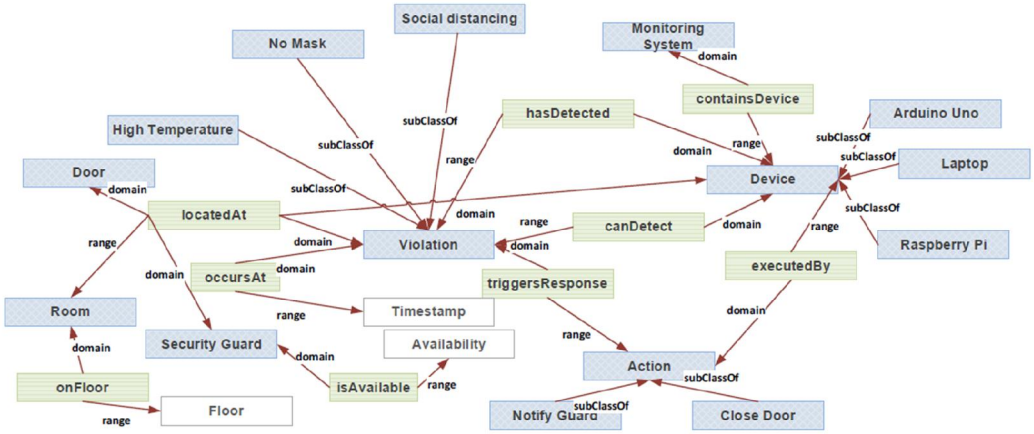

Fig. 2. An excerpt from COVID-19 Indoor Safety Monitoring Ontology.

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The highest-level concept in this ontology is Monitoring System. It consists of heterogeneous Devices, such as Raspberry Pi, Arduino Uno and conventional laptop. Each device is equipped with different sensors and is able to detect different types of safety rule Violations. Several types of safety rule violations are considered: Social Distancing, No Mask and High Temperature. In case that some violation occurs, then the corresponding Action is taken as a response, such as closing Door or notifying Security Guard. For both the physical objects (Device, Door, Security Guard) and Violation events, the Room where it resides or occurs is relevant. Each Room is located on a Floor. This way, it is enabled to find the available Security Guard from the same Floor where Violation occurred and send him/her notification. Otherwise, the first guard that is available is selected. In Fig. 4, an excerpt from the described ontology is given.

Scenario	Device	Frame size [W x H]	Frame rate [fps/mps]	Accuracy
Mask detection	RPi 2B	640x480	0.48	84-91%
		320x240	1.71	
	RPi 3	640x480	0.76	
		320x240	2.83	
	Laptop	640x480	11.94	
		320x240	38.46	
Distancing check	RPi 2B	640x480	0.72	65-73%
		320x240	2.65	
	RPi 3	640x480	1.12	
		320x240	4.29	
	Laptop	640x480	16.77	
		320x240	61.17	
Temperature sensing	IR	1	8	0.5°C
	Thermal camera	8x8	2	2.5°C

Fig. 2. Evaluation Table

IV. RESULT AND DISCUSSION

The system can provide the below listed outcomes once successfully implemented training as well as testing phase

1. System get background data that improve training data set
2. System can able to detect person's wearing mask or not and also detect temperature below threshold
3. Fast and easy to implemented
4. With the help of system we can keep people safe from pandemic.

The main purpose of the developed system is to avoid the spread of COVID-19 in public places such as shopping malls, offices, and so on. The system can monitor an individual's body temperature and can perform face mask detection.

V. CONCLUSION

According to the achieved results, the proposed solution is usable for its purpose under certain performance limitations (such as number of processed frames or measurements per second). Moreover, it relies on both open hardware and free software, being definite and desirable advantage for such systems.

In future, it is planned to experiment with various deep learning and computer vision frameworks for object detection on Raspberry Pi in order to achieve higher framerate. Moreover, we would like to extend this solution with environment sensing mechanisms for adaptive building air conditioning and ventilation airborne protection in order to reduce the spread of coronavirus indoors especially during summer. Finally, the ultimate goal is to integrate the system presented in this paper with our framework for efficient resource planning during pandemic crisis in order to enable efficient security personnel scheduling and mask allocation, together with risk assessment based on statistics about respecting the safety guidelines and air quality.

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