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AUTOMATED FACE MASK AND TEMPERATURE DETECTION SYSTEM USING IOT BASED SMART ENTRANCE

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Abstract:
This article provides an up to date survey on how a global pandemic such as COVID-19 has affected the world of IoT technologies. It looks at the contributions that IoT and associated sensor technologies have made towards virus tracing, tracking and spread mitigation. As a part of safety and kind of filtration and monitoring this smart device is developed for detection of body temperature and various parameters to alert people about their illness. It also collects the data of user to track covid-19 victim & create database.

In this paper, we have revised solutions for many covid-symptoms detecting systems. Nowadays, we can see the thermal infrared guns in the hand of many watchmen, gatemen & guards, and other techniques that are IoT-enabled smart doors for symptoms detection and face mask detection. We have featured this existing system to make it more unique and reliable. With the feature of face-mask detection and temperature detection, we have added the QR scan of public and private ID cards to create a database of victims and entry individuals also; we have added a flash alert system to identify highly symptomatic individuals and restrict them from coming in. This system has optimistic software and hardware solution to a real-world problem. We have used some algorithms to detect face mask and temperature. This system uses raspberry pi as the central processor while Pi cam, infrared sensor, buzzer, and red led works as I/O peripherals.

Keywords– Monitoring, Detection, Algorithm, IoT, QR scan, Database.

I. INTRODUCTION

As we know, various public places like temples, railway stations, airports, universities, colleges, and offices are opening due to decreasing covid patients day-by-day but identifying the symptomatic individuals in crowd, we still use the infrared thermal guns, which require a manual check and human efforts to check temperature and mask. Thus to replace the thermal guns & human actions, we have bought a more featured system through this paper. From other such solutions, we have seen many IoT-enabled door, but this system does not require any internet connection because it creates a local area network to manage and create a database. The project consists of image processing for mask detection and computer vision for QR Scans. The purpose of Raspberry as a processor over any other controller is to process a video and photo frame for image processing.

The internet of things (IoT) is the interconnection between the physical objects or things that are attached with sensors and software to gather and deliver information's among them and primary servers with least human mediation. The IoT system in medical is now in an advance setup that contains so many varieties of mechanism like smart sensors, medical equipment, big data, cloud computing, telemedicine, clinical information system, and many more.

It is a non-contact system through which it will detect the face mask and body temperature according to the preset thresholds. It will also allow the user to later see who entered through the system as it will scan the QR code from any Public or Private ID's, extract the information through the scanned QR and save the information into a database. The system also uses Simple Mail

Transfer Protocol (SMTP) to send emails to those who have high temperatures and those who are not wearing a mask. It will also activate the buzzer to ring if the person in front of the camera is not wearing a face mask or has high temperature so as to detect the harmful accesses.

This system uses Raspberry Pi as a processor which makes this project portable and easily installable and controllable so that we can use it at any entrances. It is also easy to use and maintain. It stores data of the victims and sends email that shows that the system detected a harmful access. The softwares used are Open CV, Darknet Framework, YOLO Algorithm Python programming and Raspbian operating system. To detect the face mask it uses Image Processing, CNN deep learning model and computer vision.

II. LITERATURE SURVEY

Deep learning is a significant advancement in the science of artificial intelligence. It has recently demonstrated significant potential in image analysis for retrieving small characteristics. Due to the COVID-19 outbreak, some deep learning algorithms for detecting patients infected with the coronavirus have been proposed. In earlier days face detection models are implemented using edge, line and center near features and patterns are recognized from those feature. These approaches are used to find binary patterns locally. These approaches are very effective to deal with Gray-scale images and the computation effort required also very less. Viola Jones Detector proposed an real time object model used to detect different classes of objects. It uses 24x24 base window size to evaluate any image with edge ,line and four rectangular features. Harr-like features are like convolutions to check weather given feature is available in the image or not. This model fail to work in when image brightness varies even it exhibits poor performance when images are in different orientations. Convolution networks are mainly used for classification problems there are various kinds of CNN architectures such as VGG-16 this architecture consists of 2 convolution layers with input size 224 kernel (64,3x3) followed by max pool with size 2x2 then again two convolution layers followed by max pool then three convolution layers with max pool again three convolution layers and max pool and three fully connected layers final FC is soft max this architecture works fine when compared to AlexNet[4,7]. Google Net architecture fundamentally using inception method by constructing small convolution layers to reduce number of parameters it having around 22 layers with convolution and max pooling etc it can able to work effectively over Alexnet it can able to bring down 60 million features in Alex net to 4 million features[8]. In this paper Deepnueral networks which adopts residual learning to train the models more deeper around 152 layers are used in this which is 8 times more than VGGnet with minimum complexity. This approach achieved relatively better performance in object detection over COCO data set.

The followed part, we briefly present the existing related works on classification and tracking of face mask. There are several approaches are used for facial masks detection. For instance, used electromagnetic and radiometry techniques for facial masks detection. Employed deep neural networks (ANN) using machine learning techniques in Facial Masks detection. Also comparison was made between ELM ANN and BP ANN based on performance measurements. Neural Networks are used to exacted information from ultrasound to classify the abnormal lesions. An island based model for classification of face mask and distinguishing between various classes of face feature detection using artificial neural network. That artificial neural network to detect the abnormality masks lesions based on edge. characteristics, shape and darkness of a lesion. Ultrasound imaging system in order to reduce the dependency of the operator. Linear Discriminant Analysis to classify the informal face mask feature detection using texture and morph metric parameters. Presented a paper on face detection segmentation by using genetic algorithm and ANFIS classifier for locating face feature detection and made comparative analysis between various classifiers. Presented a face feature detection method based on Ultrasound RF Time series and SVM Classifier. The characteristics curve of 0.86 using support vector machine (SVM) and 0.81 using RF classification algorithm on 22 subjects was determined.

III. COMPONENTS USED

1. Pi Camera

Fig.1 Pi Camera module

- 5-megapixel native resolution sensor-capable of 2592 x 1944-pixel static images.
- Supports 1080p30, 720p60 and 640x480p60/90 video.
- Camera is supported in the latest version of Raspbian, Raspberry Pi's preferred operating system.
- For raspberry pi zero/zero W/Zero WH kindly use a different camera cable.

2. RGB LED Module

Fig.2 LED

The KY-016 is an Universal LED for use with general indicating purposes.

3. MLX90614 IR Temperature Sensor

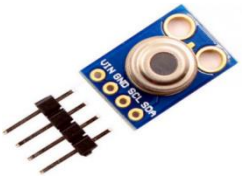

Fig.3 MLX90614 IR Temperature Sensor

This sensor works on Stefan-Boltzmann law which explains power radiated by a black body in terms of its temperature. In simple terms, any object emits IR energy and the intensity of that will be directly proportional to the temperature of that object.

- Operating Voltage: 3.6V to 5V
- Ambient Temperature Range: -40°C to +125°C
- Object Temperature Range: -70°C to +382.2°C
- Resolution/Calibration: 0.02°C
- 17-bit ADC.
- I2C communication.

4. Raspberry Pi

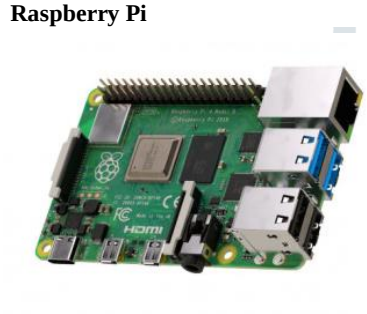

Fig.4 Raspberry Pi 3B

The Raspberry Pi 4 Model B gets a boost of speed and performance. It comes with a Broadcom processor - BCM2837B0, Cortex 64-bit SoC at 1.4GHz
2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2/BLE
Faster Ethernet (Gigabit Ethernet over USB 2.0, maximum throughput of 300Mbps)
64-bit SoC processor running at 1.5 GHz, RAM 8GB, 2 USB 3.0 ports, Gigabit Ethernet and dual 4K micro-HDMI ports.

5. Buzzer

Fig.5 Buzzer

The buzzer is the simplest module to produce a sound of about 2 kHz.

In hardware section we have connected the Pi camera module to the Raspberry Pi through 2-lane MIPI CSI camera port. The Raspberry Pi is connected through the Gigabit Ethernet port to the computer to communicate with the Raspberry Pi. 5V DC via USB-C connector we given the power supply to the Raspberry Pi.

IV. METHODOLOGY

BLOCK DIAGRAM

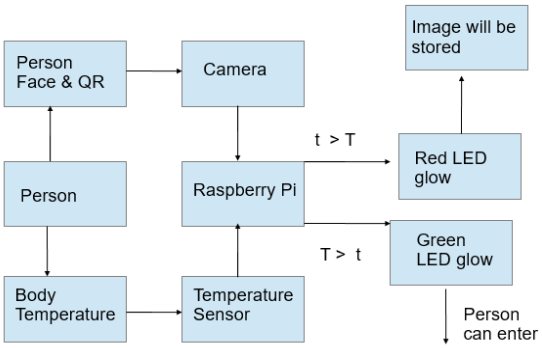

Fig.6 Block Diagram

The Functionality of this system is mainly categorized in following steps.

a. To capture the real time video of the person using camera module connected to the Raspberry Pi.
b. Detect the face mask present in the captured images.
c. Recognize the face mask of the person using algorithms.
d. Detect the temperature of the person using temperature sensor.
e. Comparing the captured temperature according to thresholds.
f. Scanning QR code using pi camera.
g. Extracting the data from the captured QR code.
h. Storing the data of person in the database through LAN.
i. Allow the person to enter or not.

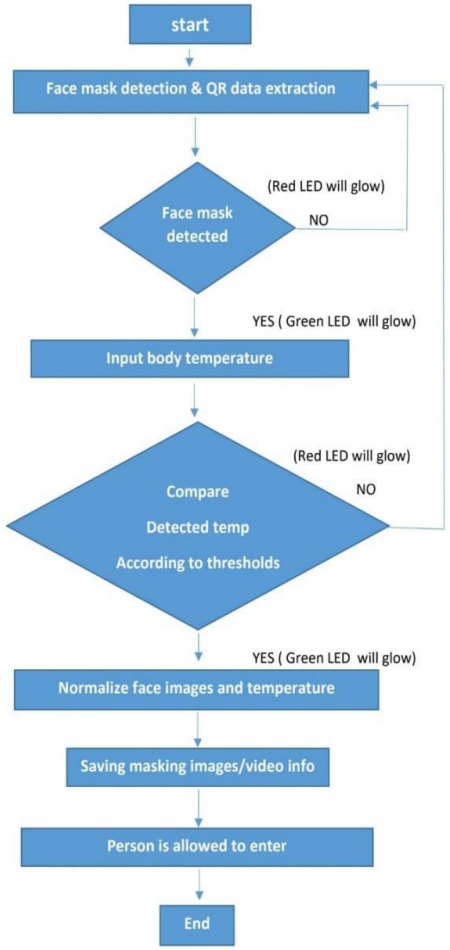

Fig.7 Flow Chart

Hardware used

- Raspberry Pi 3
- Raspberry Pi Camera
- MLX90614 Infrared Temperature sensor
- Red LED
- Buzzer

Software & Programming

- Python programming
- YOLO algorithm
- Darknet Framework
- OpenCV
- Raspbian OS

Technology stack

- Image processing
- Computer Vision
- CNN
- System Designing

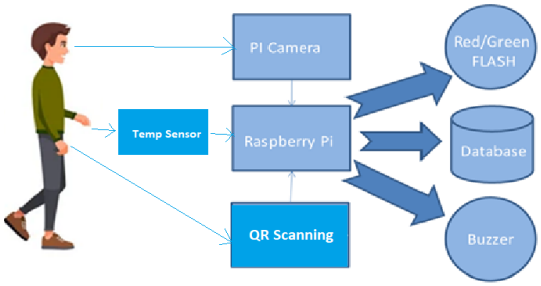

Fig.8 Working Diagram

V. RESULTS

This system is fully working and the pictures below show how the system works.

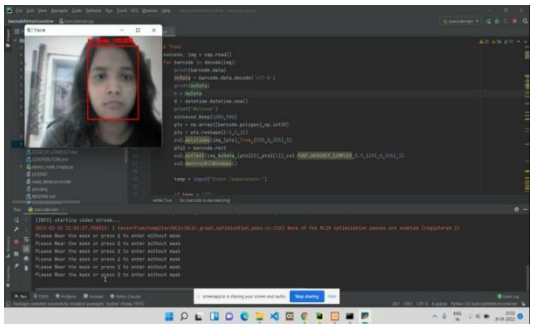

Fig.9 Result with no mask

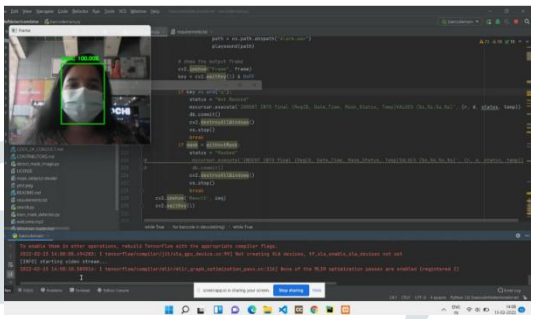

Fig.10 Result with mask

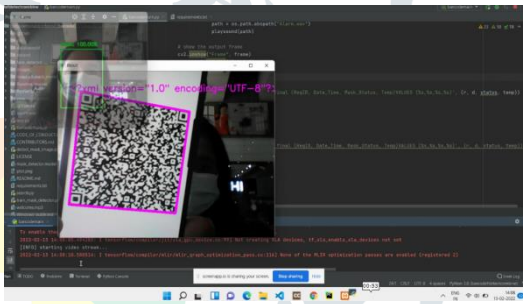

Fig. 11 QR scanning result

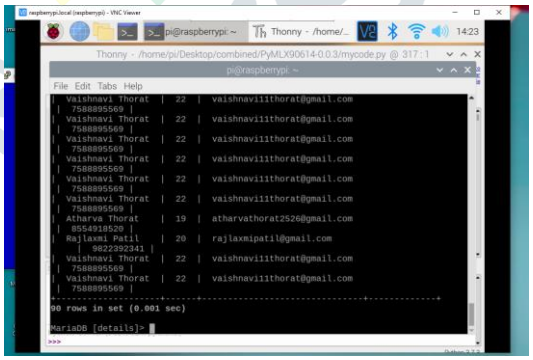

Fig.12 Database Result

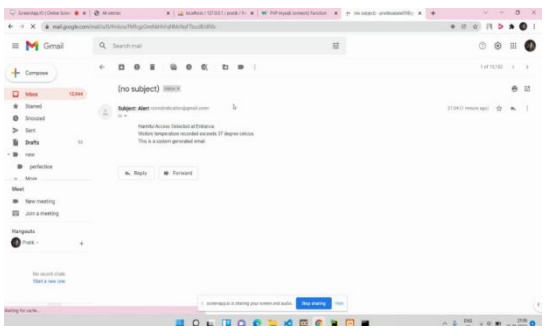

Fig.13 Email result

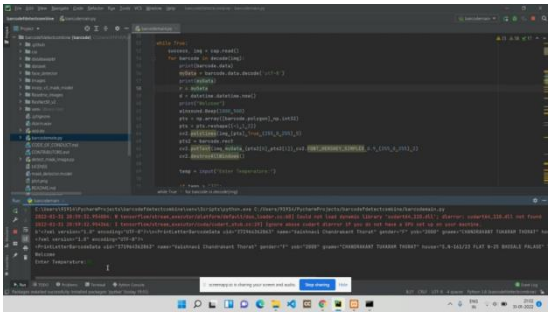

Fig.14 Temperature Detection result

Detection result

For detection we have given 10 to 60 input images to the detection algorithm and we get different detection rate when we change the input data. The result of detection is given in Table 1.

Table 1
Detection Result

Input Images	Detected images	Detection Rate
10	10	91%
20	19	95.63%
30	28	98%
60	49	100%

VI. FUTURE SCOPE

- This device will be located on every entrance of rooms and cabins so that every individual would have breathtaking meets with their clients.
- This project not only ensure that the person is fit but also records the data of entering person, face of high temperature victims and save images in the database.
- So we have a bit more advantages in this system rather than the thermal guns outside the mall.
- This system can be connected to automatic doors so that covid victims cannot enter and indoor people can work fearlessly.
- No human interference is required. The system is fully automated.

VII. CONCLUSION

Hence we can conclude that. By using this system we can detect temperature of many people in less time and it helps to store the data of the person with higher temperature and also check if a person is wearing a mask.

By using IOT in medical science helps to reduce the work of the frontline worker. It also allows the user to collect the data into a database by scanning the QR code from public or private ID cards and extracting the data from the scanned QR.

This system will not only reduce the work of front line worker but by installing this system at the door step of classroom, offices, etc. will definitely help to read and manipulate the data.

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