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IoT Based Auto-alert and follow-up of covid-19 cases in an Educational campus

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Abstract: Since the corona outbreak, it has become very difficult to identify those who are affected by the virus or not. It can impact a lot of students if proper preventions not taken. To solve this issue, temperature devices are often used to measure body temperature. These devices have non-contact IR temperature sensors which can measure the body temperature without any physical contact and will update the security department. If the temperature of the person exceeds the threshold temperature and entry will be restricted in the campus by a barricade prototype followed up by facial recognition. Using temperature sensor (MLX90614) temperature of the person is recorded. If the temperature doesn't exceed the threshold temperature the person can enter the campus. If the temperature of the person exceeds the threshold temperature an alert will be triggered and the sensor will capture the image of the person and match with the database of campus and the information is sent to security department and information regarding temperature violation. The information will be consisting of picture taken during checking of temperature, name, USN, department. We propose a low-cost internet of things (IoT)-enabled COVID-19 standard operating procedure (SOP) compliance system that counts the number of people entering and leaving vicinity, ensures physical distancing, monitors body temperature and warns attendees and managers of violations. The system comprises of multiple sensor nodes communicating with a centralized server. The data stored on the server can be used for compliance auditing, real-time monitoring, and planning purposes. The system does not record the personal information of students nor provide contact tracing information.

I. INTRODUCTION

The COVID-19, an acronym for "Coronavirus Disease-2019", is a respiratory illness caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), a contagious virus belonging to a family of single-stranded, positive-sense RNA viruses known as coronaviridae. Much like the influenza virus, SARS-CoV-2 attacks the respiratory system and causes ailments such as cough, fever, fatigue, and breathlessness. While the exact source of the virus is unknown, scientists have mapped the genome sequence of the associate editor coordinating the review of this manuscript and approving it for publication was Victor Hugo Albuquerque. SARS-CoV-2 and determined it to be a member of the β -CoV genera of the coronavirus family, which typically derives its gene sources from bats and rodents [1]. The COVID-19 was first reported to affect human life in Wuhan City, in the Hubei province of China in December 2019. Since then, the COVID-19 has spread like wildfire throughout the rest of the world, marking its presence in 213 countries and independent territories.

In the current wake of the COVID-19 pandemic, preventing and limiting the community spread of the virus is a mammoth task, with governments and administrations across the world applying different strategies to restrict population movement and social interaction. A result has been serious socio-economic impacts.

Internet of things (IoT), as an enabler of data sharing through connectivity, is very attractive in healthcare applications. An advantage of this technology is that it enables remote health monitoring. IoT also enables human-to-human, machine-to-human, and machine-to-machine communication without any external intervention. It can therefore be a very useful tool in implementing and monitoring human social interaction during COVID-19.

In today's world, the Internet of Things is revolutionizing our life by developing a number of systems which can be monitored and controlled remotely. In this project, we will leverage the power of IoT and we will build a Temperature Monitoring device with Email alerts using Raspberry Pi, MLX90614 and Pi-Camera. The current scenario with covid-19 has thermal screening anonymously used. This urges a need for a prototype which automates the thermal screening and also tracks progress of infected persons. This prototype IoT based auto-alert and follow-up of covid-19 cases in an educational campus solves different issues faced in thermal screening and adds many more features.

II. RELATED WORK

IoT can provide substantial value across the entire life sciences value chain, from research and development digitalization to enhancing the patient experience. This remote technology based on IoT platform is especially

True in Coronavirus-19 disease, directly impacting public health measures on service medical in social sectors. This research article proposes the contactless body temperature monitoring of the in-patient department (IPD) using the internet of medical promotion. IoT has started to find broader applications in the field of medical material management visualization. The proposed IoT-CBTM used for the in-patient department assists in avoiding public health problems by aiding in medical treatment. The device can track the body temperature of IPD automatically using a wireless infrared sensor embedded IoT-Microcontroller module. This solution increases medical treatment quality while the seriously COVID-19 disease situation regarding the ward's routine activities measures the vital signs, such as heart rate, blood pressure, and body temperature. Based on these data, the medical officer can remotely observe the patient's monitoring process. This paper focuses on a remote body temperature monitoring system, which proposes to keep up with emergencies during COVID time. The proposed item works on microwave frequency which is a form of electromagnetic radiation, and it operates frequencies ranging from 300 MHz to 300 GHz. The infrared thermometer sensor is adapted to measure body temperature on the forehead. Measuring a person's temperature can be done in several ways, and in this work, the infrared thermometer sensor MLX90614 DCI infrared sensor was adopted to measure a person's surface temperature with non-contact on the forehead. Long distance measurement of a person's body temperature may be used to reduce cross-contamination risk and minimize the risk of spreading Coronavirus disease. While typically -70°C - 380°C , but in consideration of body temperature period is about 37.0°C , which is the average temperature, some studies have shown that normal temperature can be within a wide range, from 36.1°C to 37.2°C . Therefore, this proposed prototype proposes understanding the benefits, limitations, and proper use of these contactless body temperatures. The improper use of them may lead to inaccurate temperature measurements. Thus, the accuracy issue was solved to get more reliability of the prototype according to the discussion section.

The related studies of "Contactless body temperature monitoring of IPD via the "IoT network" were reviewed. This Section presents the overall system that designed and developed an embedded system using an infrared temperature sensor that works with an IoT-Wi-Fi controller on the NodeMCU ESP32 board. The detected data will be transferred to users via the internet network, and it will be stored on a cloud internet system. The proposed system is presented in

The system was designed to embed the software programming according to the user's requirements. The monitoring module for IPD using IoT network uses innovative embedded medical sensor and smart monitor applied in conjunction with the IoT technology. The information can be viewed at any time, and it alerts when something goes wrong. The information data will be stored on the cloud network, which is a storage system on the internet). The highlight of this innovation is storing data in real-time, and it can be browsed through the online internet system with the notification system. Therefore, this prototype improves hospital management and patient care because it can reduce infection risk from working in a risky area.

III. PROPOSED SYSTEM

- 1) This prototype uses a camera integrated MLX90614-IR temperature sensor with IoT technology using Raspberry pi 3b+ for monitoring of screening process to get the real-time temperature data.
- 2) Image of person who fails thermal screening process is captured by the camera and using image processing technique (haar cascade algorithm) name/USN of the person is retrieved by matching with the dataset which includes sample pictures of the person.
- 3) Name/USN of person on the camera screen/video stream is obtained by training the model with sample pictures.
- 4) After this process facial recognition labels the person on the screen with given name/USN. Mailgun domain is used to send email is used to check the status of the persons who failed screening and security personnel uses this application to keep track of those persons.
- 5) Access is restricted by coordinating with Sg90 stepper motor is a prototype/miniature of barricade.
- 6) A Google form link is then displayed and is instructed to be filled for further more information which can be helpful for security personnel.
- 7) Google form can be converted to excel sheet and in turn to PDF file along with the timestamp of each responses
- 8) Follow-up activity of 14-days is planned for persons detected with covid-19 positive by restricting their access into the campus using sensor MLX90614.

- 9) If the student wants to enter the campus he must produce covid-19 report or doctor recommendation before 14 days and it should be sent to admin/security personnel email (displayed in Google form).
- 10) Customized barricade Opening/Closing which can be only accessed by admin/security personnel can be used for those who have high temperature but have produced covid-19 report or doctor recommendation.

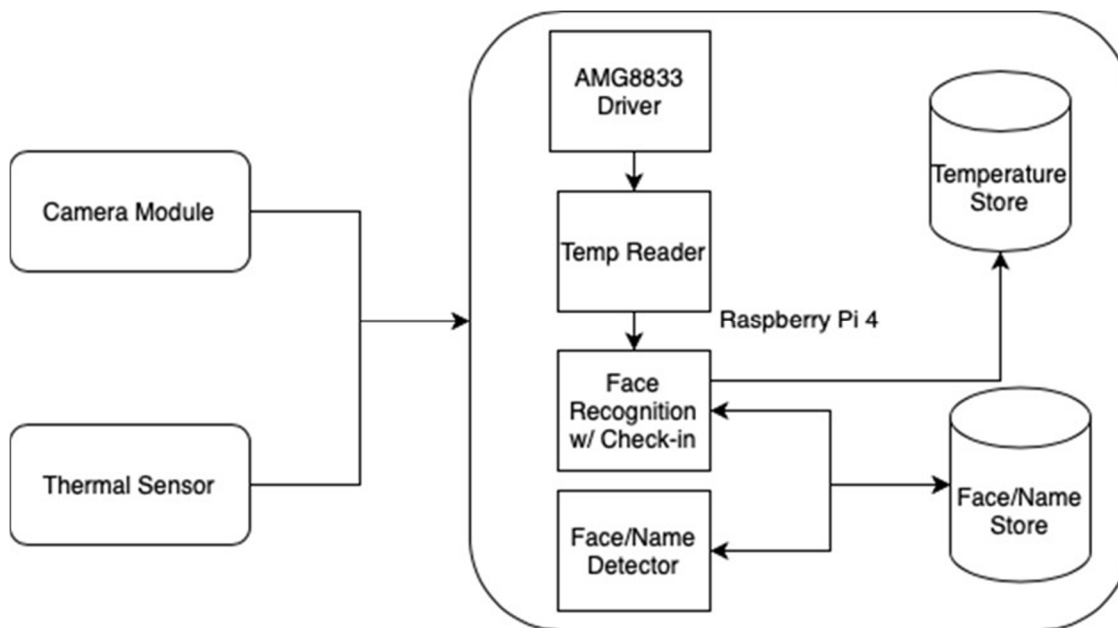


Figure: Architecture of the Proposed System

IV. IMPLEMENTATION

The models provide four basic types of functionality, that is, create, read, update, and delete the resources. This is often referred to as CRUD by computer scientists. A model should have the ability to perform all these four functions in order to be complete. If an action cannot be described by one of these four operations, then it should be contained in a model of its own.

We use python to build the functionality of the system. We need to install several packages which are:

- 1) First, we need to insert raspbian os in sd card
- 2) After this is achieved we need to insert the SD card into raspberry pi and provide power supply.
- 3) Now, we need to connect to raspberry pi desktop, but to achieve this we need to connect to raspberry pi using Wi-Fi or Ethernet cable.
- 4) We are using Wi-Fi to connect to raspberry pi, for this we have to enable SSH and insert a file containing SSID and password of WIFI.
- 5) After this step, we can connect to raspberry pi desktop with the help of VNC viewer by entering raspberry pi's IP address.
- 6) We will then enable camera and i2c option in interface option of raspberry pi configuration.

Type sudo raspi-config and then go to interfacing options

```

Raspberry Pi Software Configuration Tool (raspi-config)
1 Change User Password Change password for the current user
2 Network Options Configure network settings
3 Boot Options Configure options for start-up
4 Localisation Options Set up language and regional settings to match your location
5 Interfacing Options Configure connections to peripherals
6 Overclock Configure overclocking for your Pi
7 Advanced Options Configure advanced settings
8 Update Update this tool to the latest version
9 About raspi-config Information about this configuration tool

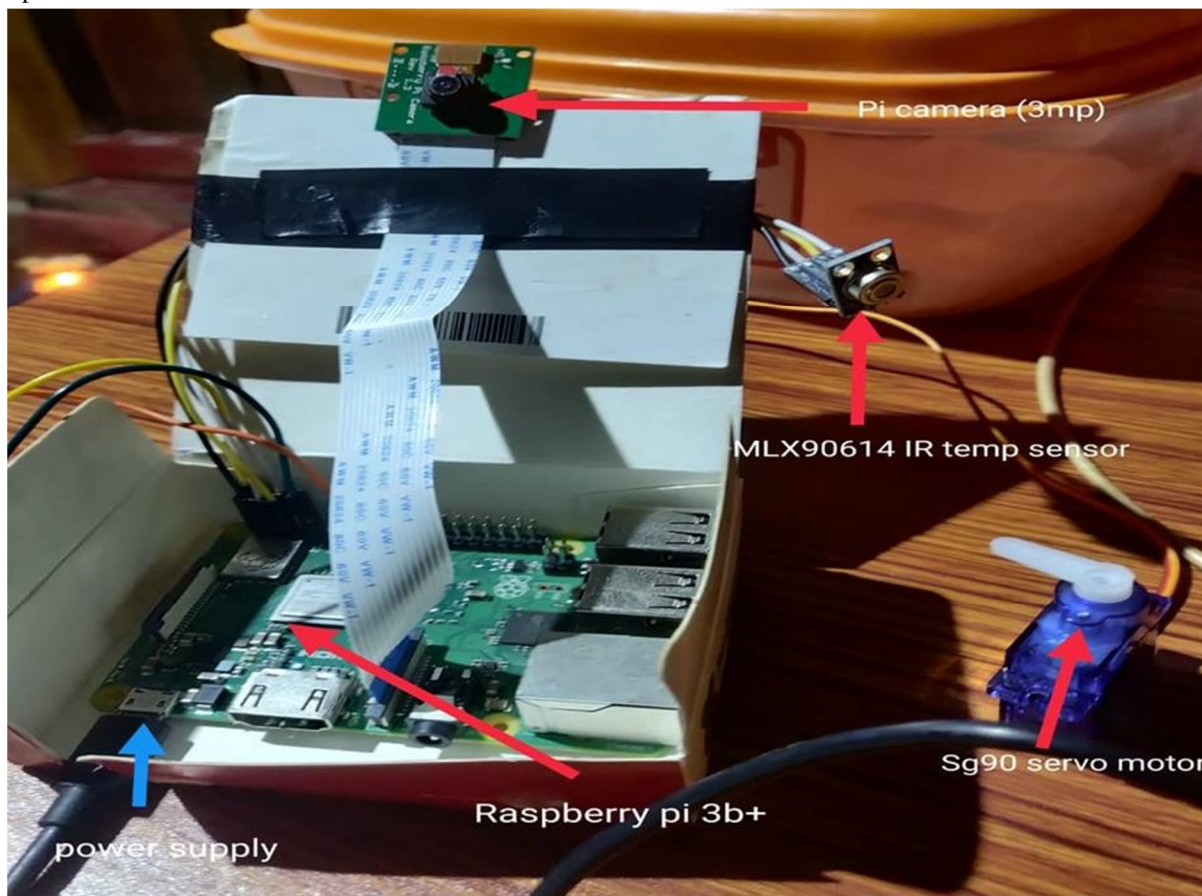
<Select> <Finish>

```

7) Next, we head towards terminal to install packages.8.Following are the packages that are installed:

- a) *Open cv*: Used for facial detection and recognition
- b) *PyMLX90614*: used for functioning of MLX90614
- c) *GPIO*: Used for gpio programming
- d) *Smbus*: Used for i2c communication
- e) Face recognition and imutils

8) Then comes circuit connection, MLX90614 is connected to GPIO pins: 1, 2, 5 and SG90 servo motor to GPIO pins: 15, 2, any ground pin.



9) After this step, coding is achieved to get the desired results.

10) Mailgun domain is set for email alert.

11) Finally, temperature scans in loop until violation, if any violation of temperature occurs motor rotates and facial recognition begins along with email alert and form filling process.

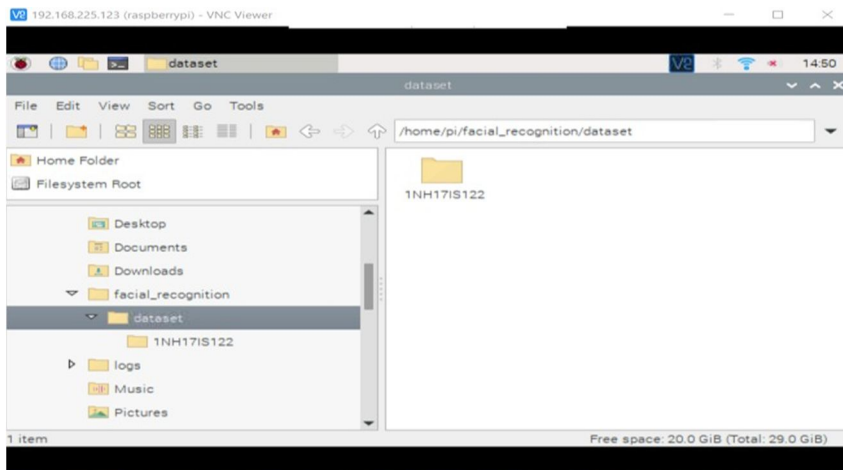
V. RESULT AND FUTURE ENCHANCEMENT

A. Result

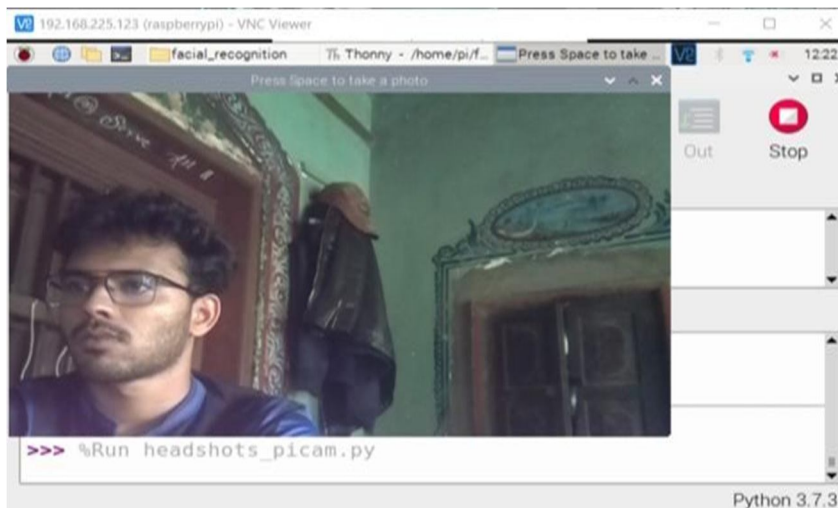
Automated Thermal sensing and follow-up using sensors and IoT device provides a more efficient and reliable solution to monitor the campus and ensure the potential risk of getting infected from others is reduced.

- 1) It provides an automated, better, secure and smarter solution for thermal screening process. Restricting access and tracking data of persons who failed screening process, reporting to security is made easy.
- 2) Efficient Image processing techniques are used to retrieve the data.
- 3) Incorporating new software solution to manage follow-up activity more effectively

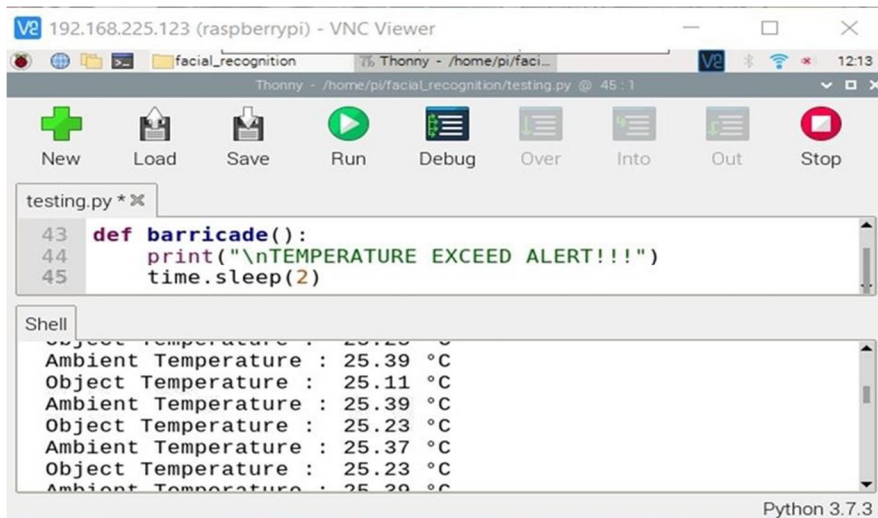
Adding sample images to the dataset



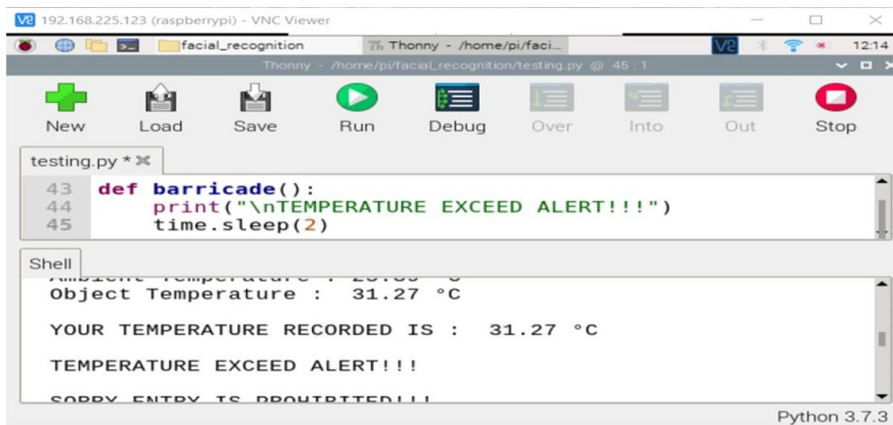
Capturing sample images for dataset



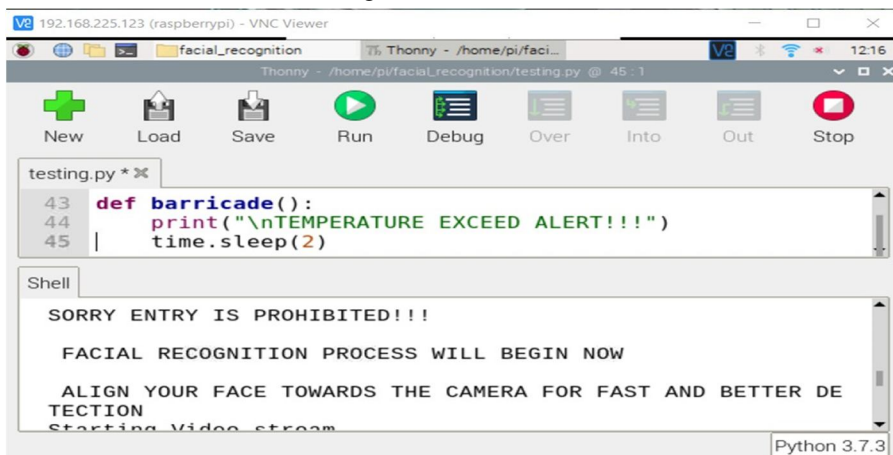
Temperature Scanning including Ambient and Object Temperatures:



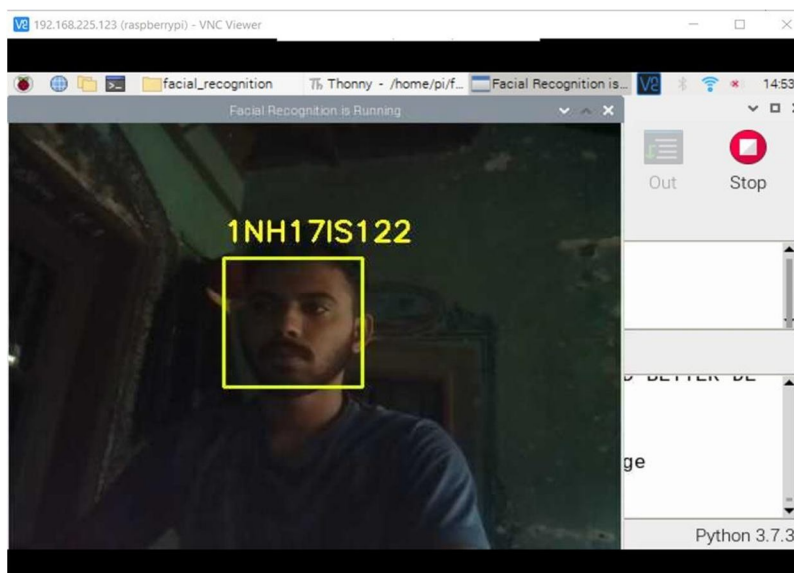
High temperature being recorded



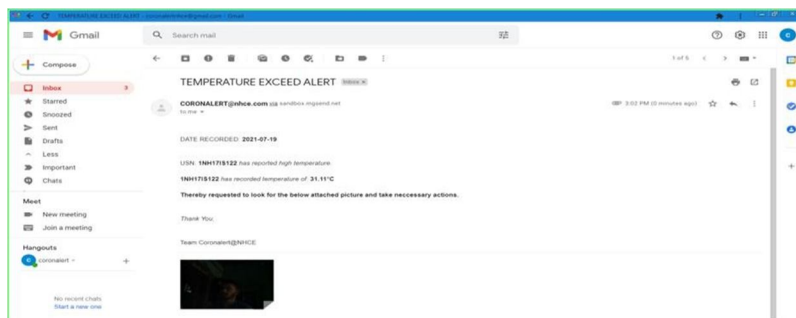
Barricade closing and initialization of face detection



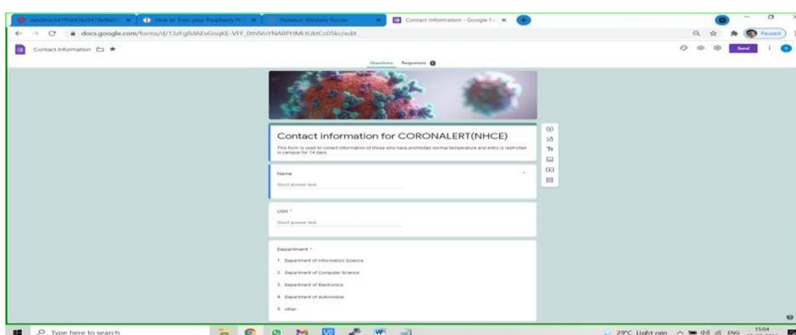
Facial recognition and detection



Email alert and notification



Google form



B. Future Enhancement

This application has much potential for future enhancement. As the new technologies are easily available as open source, we can add many new features to it. Few of the enhancements we can work on are as follows:

- 1) Connection with Android application.
- 2) Unknown person alert mechanism.
- 3) Improve the GUI to make it modern or futuristic.
- 4) Utilize cloud functionality to store data on cloud. Instead of link QR code can displayed for easier form filling.
- 5) Make it available on different platforms like IOS, Oak, etc.
- 6) Provide administrators with functions such as the analysis of student arrival rates, the flow of personnel, and the self-management of personal temperature.

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