Smart Door Camera with Facial Recognition Feature for Thermal Screening

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Abstract

The "Smart Door Camera with Facial Recognition Feature for Thermal Screening" is an intelligent access control system designed to enhance security and public health safety, especially in high-traffic areas like offices, schools, hospitals, and residential buildings. This project integrates facial recognition technology with thermal temperature screening to allow only authorized individuals with normal body temperatures to enter the premises. The system utilizes an ESP32-CAM module to capture real-time video and images for facial recognition, ensuring contactless identification of individuals. A temperature sensor (MPU or infrared sensor) is used to measure the body temperature from a distance. If the face matches the stored data and the temperature is within a safe range (e.g., below 37.5°C), access is granted. In case of abnormal temperature or unrecognized faces, the system restricts access and can trigger alerts using an LCD display, LED indicators, or notification system.

Additional components such as a step-up booster, Lithium battery, Arduino Nano, cooling fan, and heat sink ensure smooth operation and system stability. This solution offers a low-cost, efficient, and scalable way to automate health monitoring and access control.

Introduction

(COVID-19) is an infectious disease caused by a newly discovered corona virus. This disease can show mild to moderate symptoms and like tiredness, aches and pains, sore throat, fever, difficulty in breathing or shortness of breath, loss of speech or movement, chest pain or pressure etc. This disease gets transmitted from person to person through droplets generated when an infected individual coughs, sneezes, or exhales. These droplets are too heavy and hence they don't hang in the air, so they settle on floors and surface. When other person encounters these infected surfaces and thereafter if he touches his mouth, nose or eyes there are high chances to get exposed to this virus. Due to these situation, many protection and safety measures were taken by governments to reduce the disease spread, such as obligatory indoor mask wearing, social distancing, quarantine, self-isolation, limiting citizens' movement within country boarders and abroad, often together with prohibition and cancellation of huge public event sand gathering. In these times of COVID-19, it is essential to go through thermal screening for checking one's body temperature before entering any premises. However, it is a tiring process as it involves measuring body temperature of all people, one at a time. At the same time, those who carry out thermal screening are required to stand for more than 8 hours a day and check every person. This takes a lot of time and effort. So, to come up with a solution that can do this job effortlessly, we have built a Facial Recognition Thermal Screening System. The device works by recognizing the face of each person and doing thermal screening to detect the body temperature. If a person is found to have a very high temperature, then the system will not allow entry and instead will automatically notify that person to take a COVID-19 test. If the body temperature falls between the required normal temperature range and is found to be okay, then entry is allowed after proper sanitization

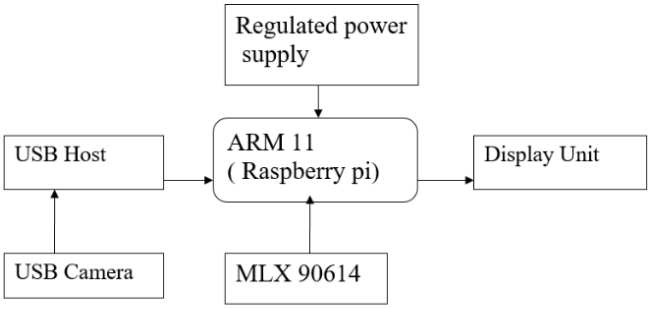


Fig . Block diagram of Smart thermal scanning using facial recognition using IR sensor..

Objective Of the System

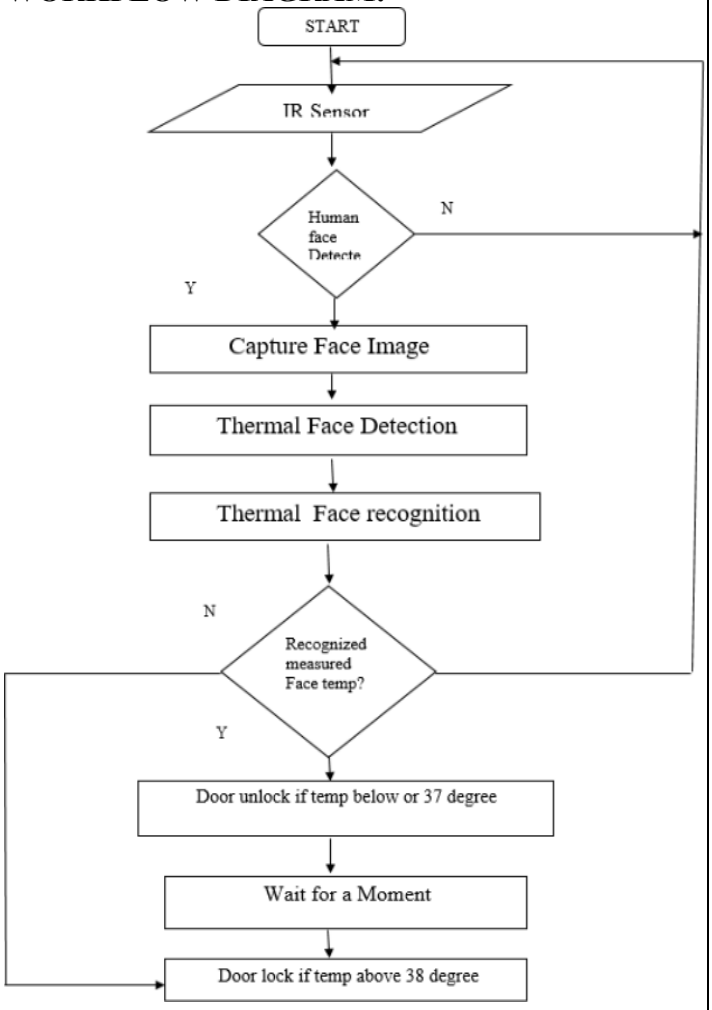
The device works by recognizing the face of each person and doing thermal screening to detect the body temperature. Individual is found to have a very high temperature, then theses model will not allow entry and instead will automatically notify that person to take a COVID-19 test. If the body temperature falls between the required normal temperature range and is found to be okay, then entry is allowed after proper sanitization. To control and monitor easily without human effort.

Proposed System

This system come up with Precautionary measures for limiting the spread of virus we have made this Device. This venture intends to identify faces from pictures in Raspberry Pi. In face discovery, the calculation ought to be powerful and quick. In this model, the calculation utilized is proposed by Viola and Jones which has a very high identification rate, low false positive and negative rates and short computational time. Utilizing the proposed calculation, a face indicator is based on a Raspberry Pi Model B.

After detection, we recognize the faces from the recognition algorithm. IN the recognition part we recognize the different faces which are captured from web cam. Once face is detected our secondary system will measure temperature using mlx90614 thermal scanner. This system will avoid the entry of person having high temperature hence to reduce spread of covid-19 virus. Block diagram of the system is given below.

WORKFLOW DIAGRAM:



Literature review

Since past few years most of the industries are working in the fields of machine learning, artificial intelligence, big data analytics, IoT based project

the major moto of all these is to make things easy and smart. These became need for digitalizing with lot security tools by these our daily life locks become smart and introduced the locks movable with stepper motor and need to digital number pad to get input from user, and it need to add infrared or any Bluetooth module to operate all these devices. A major difference in face recognition door lock is that no need to use stepper motor and the application detects the face with stored images

In the application program in our application. We have eliminated unwanted components of stepper motor and drivers which are in existing models. we have added newer and unparalleled features of facial detection as an access point to open or close the door. Where it is the combination of relay module and solenoid lock for opening the door and it is unique and user friendly. Here have been used USB attachable with HD Webcam to do efficient and dependable facial detection and it can be stored by using cloud computing for future need.

This facial recognition door model allowing people to get more interested in because of its features and advantages and due to its functionality. There are some of drawbacks in that based on that the industries working in this field and improving the security models day by day.

Currently, there are lots of fraud things and thefts are going on, became significant issues for all. Even if we have locks to the door, others can enter inside by getting key but if we have password lock also, they can get and access it by this modern technology. By these the facial recognition doors become more secure in these field, here we can use biometric for face recognition, so others cannot enter inside. In this new era face recognition plays important role for security and privacy purpose. These face recognitions identify the people, who the person is, if the face is matched with stored database, then it will automatically open the door otherwise it will be sent an alert message to the owner.

Face Description with Local Binary Patterns: Application to Face Recognition", Timo Ahonen, Abdenour Hadid, and MattiPietikainen, 2016.The texture extraction technique is considered from this paper modification is made to extract and detect the face based on Haar classifiers and Adab Oosting technique.

Fast Face Detection Using AdaBoost, Julien Menet", 16th July 2017.The detection of faces in input images is proceeded using a scanning window

at different scales which permits to detect faces of every size without re-sampling the original image.

"Face Recognition as an Authentication Technique in Electronic Voting", Noha E. El-Sayad, Rabab Farouk Abdel-Kader, Mahmoud Ibraheem Marie, 2019.The calculated distances are compared with Gabor database and the real time image. The result shows whether the captured image is authenticated or not.

"Local Gabor Binary Pattern Histogram Sequence

(LGBPHS): A Novel Non-Statistical Model for Face Representation and Recognition", Wenchao Zhang, Shiguang Shan, Wen Gao, Xilinx Chen, Hongming,2015. This project proposes face recognition based on Local Gabor Binary Pattern Histogram Sequence (LGBPHS).

In this approach, a face image is modelled as a "histogram sequence" by concatenating the histograms of all the local regions of all local Gabor magnitude binary pattern maps.

RESULT:

The Smart Door Camera with Facial Recognition and Thermal Screening system was successfully developed and tested. The integrated system was able to:

Accurately detect and recognize faces of authorized individuals using the ESP32-CAM module.

Measure body temperature contactlessly and reliably using the temperature sensor (MPU/infrared).

Grant access only to individuals who matched stored facial data and had body temperature within the normal range (≤ 37.5°C).

Display real-time results and access status on the LCD screen.

Use LED indicators (green for access granted, red for denied) and optional cooling mechanisms for thermal safety of the components.

Operate on battery power with a step-up booster, ensuring portability and uninterrupted performance.

The system performed well in controlled environments, demonstrating real-time processing, low power consumption, and accurate access control. This proves its potential for use in real-world scenarios such as schools, offices, and public buildings.

CONCLUSION

In summary, the project "Smart Door Camera with Facial Recognition Feature for Thermal Screening" offers an innovative solution by integrating facial recognition technology with temperature sensing to enhance security and health safety. Through the combined use of Raspberry pi, a Python-installed PC, and a temperature sensor, the system establishes a robust authentication process, permitting access only to recognized individuals with normal body temperatures within predefined thresholds. This integration not only strengthens security measures but also proactively monitors individuals' health status, making it an asset in various environments, including healthcare facilities, offices, and public spaces. Overall, the project represents a significant advancement in access control technology, embodying a comprehensive approach to addressing both security and health concerns.

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