VOLUME V
ISBN No.: 978-81-953602-8-4
Computational Science

Estd. 1957

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www.ngmc.org

International Conference on Emerging Trends in Science and Technology (ETIST 2021)
Jointly Organized by Department of Biological Science, Physical Science and Computational Science
Nallamuthu Gounder Mahalingam College, Affiliated to Bharathiar University, Tamilnadu, India.
Published by NGMC - November 2021

IoT Based Detecting Body Temperature and Alerting System Using Thermal Imaging Sensor

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ABSTRACT: The Internet of Things (IoT) brings together physical devices with the virtual world. Smart devices and machines are connected to each other along with internet for sharing information. The information about environment is being captured with the support of sensors, then analyzed and actuated and makes it available in a network. Since the corona outbreak, it has become very difficult to identify those who are affected by the virus or not. 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. There are many temperature guns available in the market, but none of them gives any alert to higher authorities to take appropriate actions when the temperature exceeds a particular limit. This paper focus on proposing a solution that can help to detect the body temperature without in contact with human and keep people away from the infected person. The solution is the use of Thermal imaging Camera that has a heat sensor which helps to detect any difference in temperature. The camera can be integrated with access control systems in most crowded places like Hospitals, Factories, Universities, etc. which has employees walks daily. If camera gives the high temperature value then warning can be raised in the form of Alarms. So immediately the employee or person can intimate and may ask to go for further examination for the virus. Even doctors may get this infection while treating people. So it will be secure to integrate such a solution to avoid direct contact and may save lives to certain extent.

Keywords: IoT, IR Sensor, Thermal Imaging Sensor, Covid-19.

I. INTRODUCTION

We all know that this is a tough time of COVID-19 with which the whole world is fighting. It is a virus that can spread through close contact and droplet and may also spread through air. The main symptoms include fever, cough, and tiredness. The Internet of Things is transfiguring our life by improving numeral systems by controlling and monitoring the data tenuously. IoT can be used along with Thermal imaging sensor to detect body temperature of a human. After sensing the high temperature by prior setting of threshold temperature value, it can be sent to the Raspberry Pi Kit [1]. Then raise of warning can be done by attaching the alarm to the kit, if sensor examines high temperature. Infrared camera systems formulate imaging of body temperature. As a non-contact and non-invasive diagnostic procedure is a patient-friendly and does not only provide punctual temperature measurement but gives a detailed data of person's body temperature distribution [2].

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II. LITERATURE REVIEW

Various research works insisted that the use of Thermal cameras in airports restricted the travelers having high body temperatures. This is precaution measures so that other travelers will protect from endangered situation of virus infection. The main objectives here are [3],

- To establish the connection among the central body temperature and those given by the thermal cameras. There will be fluctuation in results due to surroundings. In order to avoid false positives, skin temperature can be chosen for the accurate prediction.
- There is also a drawback that during the early or the afterward stages of fever it is difficult to identify the infected person because they won't have high body temperature which not be picked by the camera.
- The improper setting up of the camera also causes erroneous results due to poor focal point, long-distance from an object, and poor quality of the camera. So, the person must be close to, and the resolution of the camera should be highly adequate[4].
- Fixing of camera in the entrance of crowded places for fever screening, once person with high body temperature is found, warning will be raised in the form of alarm. So the person may be stopped from entering the campus and ask to go for further examination. The recognition of fever using thermal cameras is contact-less and time-efficient, which is different from gun thermometers [5].

This paper is focused on the system to recognize the infected person at the early stage which is one of the premeditated objectives given by the World Health Organization (WHO) to fight against COVID 19.

A framework was featured in the research work of Maghdid, H. S., et al., to detect COVID-19 based on a mobile by setting up sensors. The workflow is that the symptoms are realized which includes fever, fatigue, and dry cough. Then the structure discriminates the normal fever with the COVID fever using built-in sensor. Algorithms are also implemented to check the human-health. The different sensors are used to take various data input like the temperature, the tiredness that can be detected by the cameras. The framework seems to Mobile phones which are used today daily [6].

The fever screening is also conducted by using infra-red thermography which is used to detect the infra-red energy which is emitted from object which is then converted to temperature. The various parts of the face are scanned, reading from 0.5m to1.5m are taken, and then compared to the body temperature are taken through usual methods such as mercury thermometer. After this, the resultant statistics is fed into the correlation and regression analysis. As a result, it was observed that IRT reading gave the most precise result from the side of the face and was consistently determining the body temperature. This system can be implemented at the Airports and border crossings to check the travelers for high body temperature [7].

III. WORKING OF THERMAL IMAGING SENSOR

To get significant and precise body temperature was always a subject to unease for massive screening of fever. For this reason, a steadfast source from the human body, temperature can be acquired, and the fact that the skin temperature does not depend mainly upon the central body temperature but it is also affected by external factors which comprise the atmosphere. So by using the camera, there should be no false-negative rate because with the intensification of the false-positive rate the logic of forged security may nurture. The effectiveness and accurateness of thermal cameras are estimated while massive screening for fever is done. When used correctly, thermal imaging systems normally shows accurate measure on skin temperature without being physically slam to the person being estimated. Thermal imaging systems will not show accurate values when temperature is

screened for multiple persons at a time. The impending use of thermal imaging cameras was originally designed for surveillance, Military Operations, inspecting buildings and also for skin temperature screening [8].

IV. EFFECT OF COVID-19 ON STUDENTS AND EMPLOYEES

There are certain places where students and employees gather daily. In such situation there is a possibility for persons to get affected. For example, like hospitals, staff gathering daily for servicing the public, there are chances that these people them-selves may get affected. In such cases it should be detected properly in places like colleges and working institution or organizations. This solution may provide prior detection by using thermal imaging cameras. Thermal imaging cameras are not as much of usage during this pandemic situation. Usage of cameras may prevent high defection in society. If a person is detected with a temperature high-er then the person can be stopped from entering inside campus. The detected can further go for medical observation. Some cases this is best preventive measure to avoid spreading of virus at earlier stage [9].

V. METHODOLOGY TO DETECTING AND ALERTING AN AFFECTED PERSON

The first step is to detect virus at earlier stage is to find the person with high fever which is the common symptom of coronovirus. The temperature of a person can be detected using thermal imaging camera. Once high temperature is detected, raising of alarm may be as a warning which may prevent the person from to enter the campus and can go for further observation [9].

A. Methodology

This system has an access control system where thermal camera integrated along with the sensor. Many places like Universities, Industries, and Factories etc… have access control systems for various security purposes. During this covid situation to avoid spreading of virus best solution is to use thermal camera which sense the temperature of human body. These cameras may not be misguided even when any other hot objects are taken along with us. Fever is considered as the main symptom for the COVID – 19. Hence we can keep hold of affected person from entering the college or office [10].

In order to identify the temperature of a person, he/ she have to stand straight in front of thermal camera. The camera first observes the person's temperature. If the person with high temperature is detected, alarm will be raised as warning. So the person will not be allowed to enter the campus or login process. IR temperature sensor can be used to measure temperature but it has some disadvantages. High infrared waves from the sensor may damage eyes. It doas not work through walls and doors. So one person should hold the sensor for measuring the temperature which is a high risky process because that person may get infected by the virus and also have to stand for long time until all persons are checked. It requires line of sight between transmitter and receiver for communication. Such drawbacks can be overridden by using thermal imaging camera [10].

The scenario is also explained with the help of the flowchart given, shown in figure 4.

- The person stands in front of the thermal camera to read the temperature
- If the temperature is less than 99°F, no warning alarm raises and the person is allowed to enter the campus
- If the temperature is more than 99°F, warning alarm raises and person is not allowed to enter the college or work place or campus

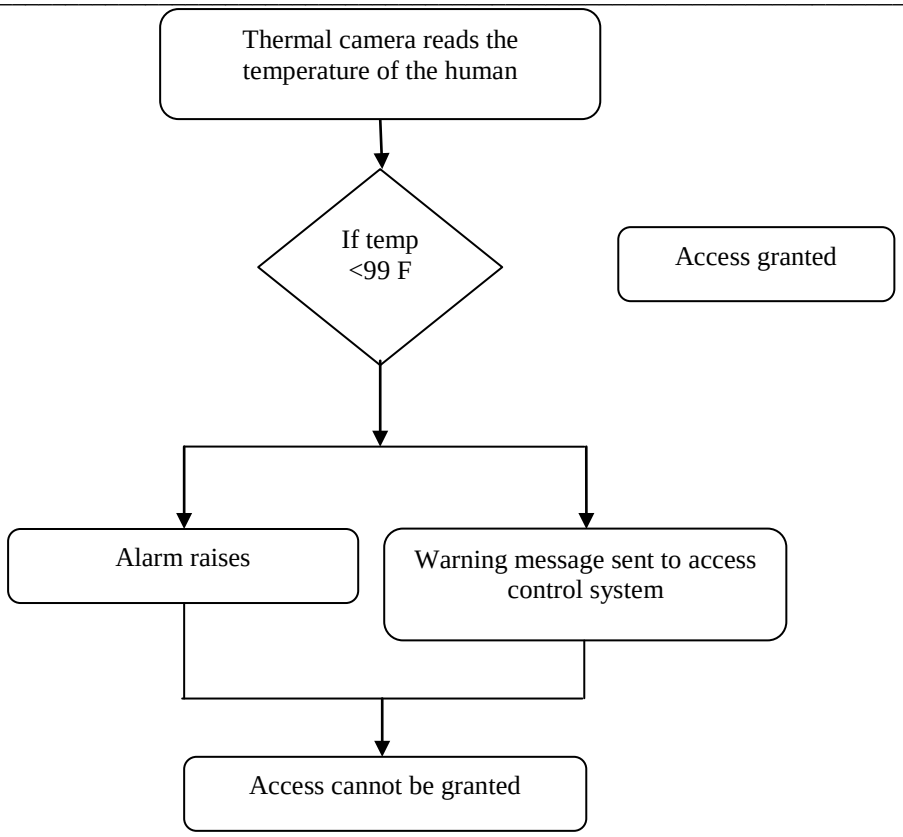

Figure 1: Flowchart

B. Advantages of the Proposed Model

Thermal Cameras are mostly used in Airports to scan the people traveling from and to the foreign cities to check their body temperature. At this pandemic situation, it is significant to aware of being keeping the infected people away from other people because the disease may spread day by day.

In airport is not an automated task, human is involved, they should check the camera frequently. The advantage of this representation is that the human involvement of persistently staring at the camera is removed as we have integrated it with the alarm and access control system. The system raises an alarm for the people having high body temperature will not have right of entry inside the campus or work place which reduces the risk of an infected person entering and infected many others.

VI. CONCLUSION

Since Coronavirus disease is an infectious and Communicable disease, it may affect person of all age. Here focusing is mainly on students and employee in working places. In this paper, a solution is proposed to detect the higher temperature of the students and employees. Our solution is based on the thermal camera which is integrated with an access control system of the organization. The person with a high temperature will not be allowed to enter the organization. The person may be infected with COVID-19 and this person can be further examined. There are some restrictions like the camera accuracy and situations which are not in control like an infected person not showing the higher temperature or uninfected person showing increased temperature. But with little limitations, this solution can help in public protection.

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