Research Article

Developing Affordable IoT-based Body Temperature Screening

Rakan Emad Tabiah[1], M. Iwan Solihin[1,*], Affiani Machmudah[2]
[1]Faculty of Engineering, UCSI University, Kuala Lumpur, Malaysia
[2]Faculty of Advanced Technology and Multidiscipline, Universitas Airlangga, Indonesia
*Corresponding author: mahmudis@ucsiuniversity.edu.my

thermal Imaging; body temperature screening, IoT

Thermal infrared thermometers are nowadays being used everywhere to test the body temperature in areas with large numbers of people. This is because allegedly one very important symptom of COVID-19 is high body temperature. But this practice is tedious and time-consuming. An alternative to thermal body screening is using thermal camera-based measurement. However, the price is normally high. This research initializes the attempt to develop an affordable device capable of automatically detecting and monitoring the elevated body temperatures from the thermal image with fewer human interactions. The device uses a low-cost thermal sensor that can be incorporated into an IoT-based Mass Fever Screening (MFS) system. The system may be used for tracking the screening process to record the real-time data and take the necessary action when an infected person is suspected by triggering action such as a panic alarm or sending a notification or an email.

In today's society of global mass transportation travel, contagious disease outbreaks will cross over national and international borders within hours. “The SARS”, “Bird Flu”, and “Swine Flu”, “H1N1”, “Ebola virus” and now “corona virus COVID-19)”, have infected thousands of people and businesses in all aspects of life with major change. Corona virus is a kind of virus that also spreads disease to animals [1] and individuals [1,2]. In January 2020, The World Health Organization (WHO) announced the new virus called by 2019-nCoV [3]. In most COVID-19 patients, the common symptoms such as fever, dry cough, and tiredness are easily known [4-6].

It has been widely implemented for the detection of suspected virus

WS2812B NeoPixel LED Stick - 8 LED.
Official RPi 15W (5V/3A) Power Supply USB type C.
16 or 32GB Micro SD Card with NOOBS for RPI pre-installed.
Raspberry Pi 4 Micro-HDMI to Standard HDMI cable.
Female to Female Jumper Wires.
3D-printed plastic case.

Figure 1. Flowchart of the proposed system

Initially, the Raspberry Pi was operated by connecting an external monitor, a keyboard, and a mouse for exploring the environment in which all the software development is going to take place. The code is written using Thonny IDE software, a Python Integrated Development Environment. The main procedure behind the project was to first, connect the pi camera and install all the essential packages and libraries. The next step was to connect the thermal camera sensor to the correct GIPO pins on the raspberry pi and install the "Adafruit" library for utilizing the sensor. With all the components set and ready, the following milestone was to produce the heat image. "Adafruit library" contained an example script for reading the sensor and mapping the temperatures to colours, However, the moving images it created could not be implemented. Therefore, the code was rewritten to a format supporting image processing, mainly for fusing two frames together. When a final image could be obtained, it was required to be sent to a web server. To do so a script from GitHub written by Antonio ALVES [12] was modified to suit this project's purpose.

The first step in the process was to gather data from the thermal camera. Adafruit library was utilised, which allows for easy reading of the sensor using the command "readPixels()", which generates an array containing temperatures in degree Celsius measured from the sensor's separate elements. Concerning the pi camera, the function command "picamera.capture()" generates an image with a

Figure 5. Firebase real-time data sample

If the temperature of the object exceeds the threshold temperature,

An internet of things-based smart homes and healthcare monitoring and management system, Journal of Physics: Con- ference Series 1450, 012079.

[10]. S. L. Fong, D. Wui Yung Chin, R. A. Abbas, A. Jamal, and F. Y. H. Ahmed, “Smart City Bus Application with QR Code: A Review,” 2019 IEEE Int. Conf. Autom. Control Intell. Syst. I2CACIS 2019 - Proc., no. June, pp. 34–39, 2019.

[11]. S. L. Fong, D. Wui Yung Chin, R. F. Y. H. Ahmed and A. Jamal, “Smart City Bus Applica- tion with Quick Response (QR) Code Payment,” in ICSCA '19 Proceedings of the 2019 8th International Conference on Software and Computer Applications, Pages 248-252, Penang, Malaysia — February 19 - 21, 2019.

[12]. GitHub: PiCameraStream. https://gist.github.com/nioto/9343730?fbclid=IwAR0fKY6URG33SJDcCfZw3gMaugP0cffTw4IsBwW3GIihC32uAkxgm0OcQrI Retrieved 03-04-2021.

[13]. Cambridge in colour: Image Interpolation https://www.cambridgeincolour.com/tutori- als/image-interpolation.htm. Retrieved 04-04-2021.

[14]. Serveo: How it works manual and alternatives self-host https://serveo.net/. Retrieved 04- 04-2021.