International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 12 | Dec 2020 www.irjet.net p-ISSN: 2395-0072

Entrance Management using IoT

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Abstract - *The health and hygiene aspects has been gaining a quite more attention since COVID-19 has become a global pandemic. It is quite natural that even when the situation comes under control, people become more aware to treat health and hygiene as a security aspect. It would be necessary for people to have a domestic level prevention policy under which a visitor will be allowed in only if he doesn't show any epidemic symptoms. In the vision of such cases, we have proposed a home safety entrance management system that uses face recognition to identify the visitor along with the interfaced sensors that measure the health statistics of the visitor. The system will pass on the identity and health stats of visitor to the owner by and decide whether to allow the visitor in or not. The proposed system uses IR temperature sensor to measure the body temperature, camera module interfaced with the Raspberry Pi controller for face recognition, cloud communication using IoT between the system and the owner and a motor which controls the opening or closing actions of the door*

***Key Words*: health and hygiene, face recognition, IoT, cloud communication, entrance management**

1. INTRODUCTION

The proposed system can be introduced as a combination of three systems. Each of them is designed to perform a specific tasks, namely- face recognition, measurement of body temperature, cloud communication using IoT and operating the door.

1.1 Face Recognition

One of the main feature of an entrance management is system is to identify the visitor. In professional systems, a hardcore secured platform can be designed using technologies like RFID coded cards but in a vision of the domestic level applications, face recognition will be enough The system must identify the visitor on the door correctly provided that necessary dataset is already fed to the system.

1.2 Measurement of Body Temperature

When people start considering health and hygiene as a security aspect, the home security systems should also be upgraded to a design that allows only the people who are well defined as a harmless i.e. the one who is completely free of epidemic symptoms. This can be verified by using the sensors who detect the health stats of the visitor by measuring various health parameters of the visitor's body.

Here in our proposed system, we have chosen body temperature as a parameter. The system is expected to measure the body temperature of visitor and decide his health status based on the preset limiting value.

1.3 Cloud Communication using IoT

Being a semi-automated, the system needs his owner as its master. The master should be able to monitor (and control if needed) the functions of the system. Thus, the system and the user are planned to be bridged through cloud communication using IoT. As soon as the system reaches its decision, the owner should be informed with the dataset that contains identity and health status of the visitor. The owner should be able to command the system to help the system take decisions, if necessary, through the same cloud communication link.

1.4 Operating the Door

Based on the results of face recognition and temperature measurement modules, and, if needed, the commands from the owner, it is supposed to be possible for the system to control the opening and closing of the entrance door.

To represent the proposed idea into a fundamental system model, AWS cloud service provider can be used for better implementation of system as a cloud source [1]. We decided to use Raspberry Pi and Camera Module for face capturing [2]. Also we concluded that running code on cloud is efficient than running it on board for speed results [3]. There are different algorithms for facial detection and recognition that can be used for the system [4]. The IoT and Wi-Fi based door access can be designed and provided the decision factors based on results of our system as well as the owner's command [5].

2. PROPOSED SYSTEM:

The system will consist of a microcontroller (Raspberry Pi), an IR temperature sensor, a camera module, a cloud network, a motor driver module and a motor. The system schematic is shown in fig-2.0.

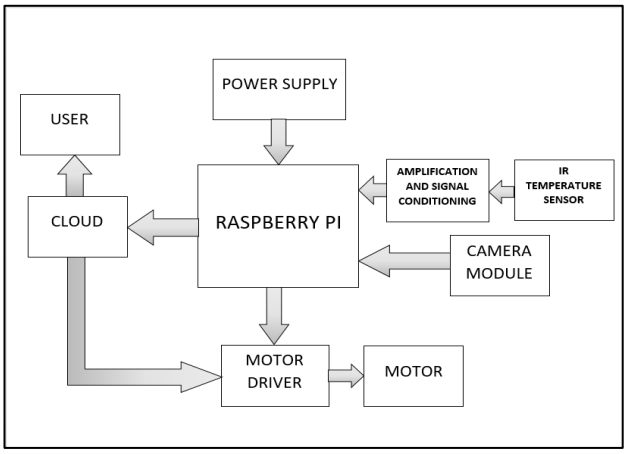

Fig-2.0: System schematic diagram.

2.1 Camera Module

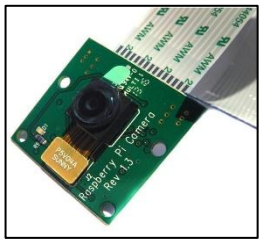

Fig -2.1: Camera Module

Fig-2.1 shows the camera module OmniVision OV5647. The OmniVision OV5647 is a camera module which provides direct interface with Raspberry Pi via the CSI2 bus using ribbon cable. It features a 5MP CMOS type sensor with fixed focus providing 2592x1944 maximum resolution.

2.2 IR Temperature Sensor

Fig -2.2: IR Temperature Sensor

Fig-2.2 shows the IR temperature sensor MLX90614. It is a digital contactless sensor, capable of measuring temperature of a certain object in a range from -70° C to 382.2°C. The IR radiations are used to measure the temperature of the object and communicates to the microcontroller using the I2C protocol. The IR rays emitted by an object is focused onto one or more photodetectors, which convert them into proportional electrical signals. The IR temperature sensor module MLX90614 is used in various industrial as well as household applications. It can also be used to measure and monitor the temperature of moving bodies due to its high accuracy and precision.

2.3 Raspberry Pi 3B plus

Fig -2.3: Raspberry Pi 3B plus

The Raspberry Pi 3B+ model is shown in Fig -2.3. It consists of a 64 bit quad processor which functions at 1.4GHz, faster Ethernet, PoE via separate PoE HAT, Bluetooth 4.2/BLE and dual-band wireless LAN (2.4 GHz and 5GHz) with modular compliance certification. This makes the board capable to be designed into end products, improving both cost and time to market.

3. METHODOLOGIES USED:

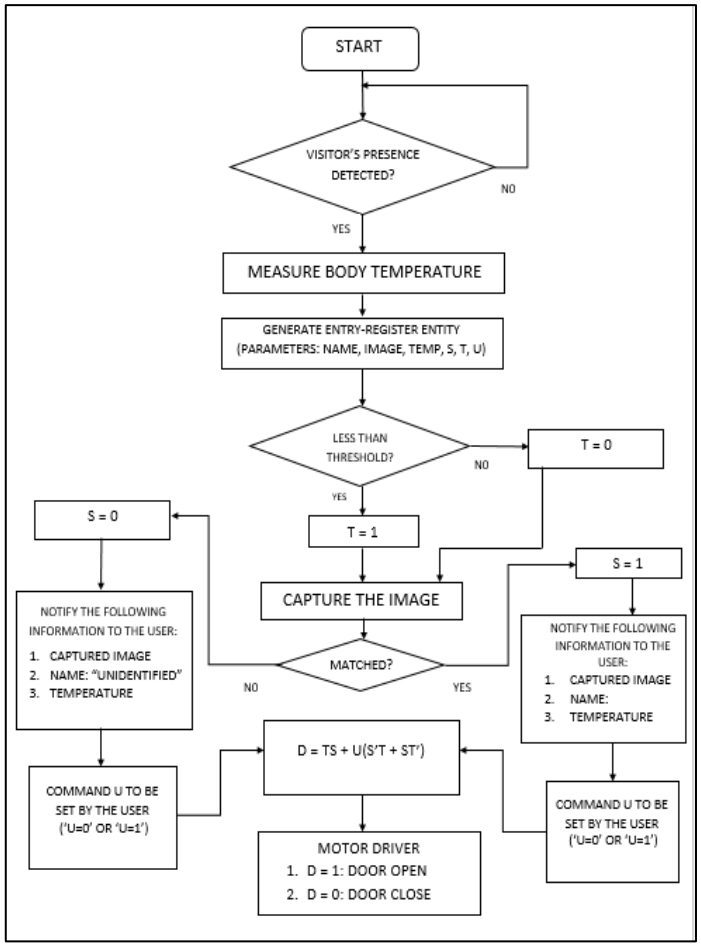

Fig-3.1: Flow Chart

The flowchart of working of the system is as shown in Fig - 3.1.Once the system is activated, the body temperature of the visitor will be measured using IR temperature sensor and it will be compared to the threshold limit. After that the Camera module will scan the visitor's face and pass it to Raspberry pi. The visitor's face will be compared to the image database to recognize his identity. If the match is found, then the name of the visitor with his/her body temperature will be sent to the owner's mobile number through cloud.

After checking the body temperature and identity of visitor, the owner will decide whether to grant the entry to the visitor. If the owner wishes to grant the entry, he/she will open the door by means of DC motor by sending the appropriate command to raspberry pi through cloud.

4. SPECIFICATIONS:

4.1 Camera Module OmniVision OV5647

This module is suitable to capture the visitor's image with pixel quality good enough for face recognition. It is a 5MP camera with 2592 x 1944 still pic resolution. The camera module can also be used if the system is designed for real time mode with video support of 1080 pixels at frame-rate of 30fps, or 720 pixels at the frame rate of 60fps.The module OmniVision OV5647 provides 15-pin MIPI serial interfacing and hence it can be plugged in directly to Raspberry Pi.

4.2 IR Temperature Sensor MLX90614

Supply voltage: 3.3V to 5V, Temperature range (surface/surrounding): 40°C to 85 °C, Temperature range (object): -70°C to 380.2 °C, Accuracy: upto 0.02°C, Precision: ±0.5°C for 0 to 50°C, Field of view (FOV): 35°.

4.3 Raspberry Pi 3B plus

The board consists of BCM2837B0 chip by Broadcom, A 64-bit system-on-chip Cortex-A53 processor (ARMv8) working at 1.4GHz, SDRAM of 1GB (LPDDR), IEEE 802.11.b/g/n/ac wireless dual band LAN (2.4GHz and 5GHz), Bluetooth 4.2/BLE and Gigabit Ethernet over USB 2.0 with maximum throughput of 300 Mbps. It also features CSI camera port to connect the camera module, port for Micro-SD in order to load the operating system and store the regarding data and PoE i.e. Power-Over-Ethernet provided that PoE HAT is made available externally.

4.4 DC Motor

Standard 130 Type DC motor; Supply: 4.5V - 9V; No load current: upto 70mA; RPM at no-load: 9000 rpm; current rating: 250mA for 10g*cm.

5. CONCLUSION:

The system is able to efficiently and accurately measure the visitor's body temperature and maintain proper records. The system can detect and recognize the visitor's face with great extent of accuracy. The system is be able to form a communication link between system and the owner to notify the owner about visitor's identity and health status immediately through IoT and cloud platform. It is possible to operate the door controlled by either the commands from owner or by the system based on visitor's identity and health status. The system provides easy database updating facility i.e. to add, delete or modify entries; to the owner or the authorized members.

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