DEVELOPMENT OF REAL-TIME, CONTACTLESS, TIME AND HEALTH DATA ACQUISITION (TiHDAS) USING INTERNET OF THINGS

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ABSTRACT. *COVID-19 is a fatal disease and a global public health concern, and the fever has been reported to be a common clinical finding of COVID-19. University of Science and Technology of Southern Philippines (USTP) plans to implement an IoT thermal scanner device for employees to prevent individuals with abnormal body temperature from entering the school. With this in mind, the study aims to develop in-house software that interfaces with the IoT device and transmits data to existing information systems. The MinMoe of HikVision (IoT device) is now configured to send data, time logs of employees, health parameters, and alarms from this device to the Time & Health Data Acquisition System (TiHDAS). There are 855 registered accounts of USTP employees are created in the system; it filters and transmit employee's time logs to HRIS as input for the employees' daily time record for payroll processing and also helps to filter and send body temperature to HIMS for monitoring and assessment, in order to maintain the safety of the employees and students to avoid transmission of the virus within the university premises.*

Keywords: Data Acquisition, Internet of Things, Digitalization

1. INTRODUCTION

A traditional healthcare system stores personal information from patients in a hand-written format, the nurse in charge took time to retrieve patients' charts or records when needed [1]. In the case of the attendance system, some are still using log-books, which makes it a tedious task for many companies to retrieve data [2]. Many institutions started deploying techniques for recording attendance, like Radio Frequency Identification (RFID), iris recognition, fingerprint recognition, and so on. However, these systems are queue-based, which might consume more time and are intrusive [3].

Face recognition has set an important biometric feature, which can be easily acquirable and is non-intrusive [4]. And since COVID-19 came, a non-contact device is more appropriate to prevent the transmission of the virus [5]. As a science and technology university, the school also needs an upgrade in adopting with new technological attendance system.

Roshan Tharanga's research aims to build a face recognition system to track employee attendance. Smart Attendance with Real-Time Face Recognition (SMART-FR) allows you to identify multiple employees at once rather than one by one [6]. Algorithms are required to improve the Recognition's accuracy, efficiency, and reliability. These problems are addressed using Principle Component Analysis (PCA) and the Hwaar cascade. PCA is one of the most successful picture identification and compression systems ever devised.

Nandhini et al.'s technology-based strategy use facial detection and recognition algorithms; when an employee report to work, the system will immediately their face [7]. The technology will automatically mark attendance after the face has been spotted and recognized. One of the most prominent algorithms for this purpose is ("Viola-Jones"), and this technique is utilized in this system, which detects students' faces using ("cascade classifier"). We can comprehend the system's efficiency and compare it to other conventional attendance methods and increase class monitoring efficiency.

University of Science and Technology of Southern Philippines (USTP) aims to develop an attendance software to be installed in an existing IoT device. A software that can transmit data, and interface with the existing information systems of USTP; Human Resource Integrated System (HRIS) and Healthcare Information Management System (HIMS). MinMoe Temperature Screening Terminal is used as an intelligent device for the project, it has the capability of reading employees' body temperature and monitors it daily to ensure safety and hinder the virus from spreading throughout the campus [8].

2. METHODOLOGY

2.1 Conceptual Framework

Figure 1 shows the framework of the TiHDAS, it is developed to data log employees' daily time logs and temperature when reporting to the USTP. The employees are the main users of this project, their time logs are sent to HRIS that can be accessed by the human resource personnel and the body temperatures are going to the HIMS for personal records that are needed by the USTP medical staff. USTP Support is the IT professionals who take care of the whole system. The online Server and Disaster Recovery module is responsible for the storage of data.

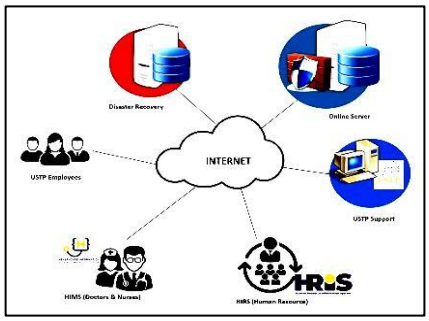

Fig. 1. Conceptual Framework of TiHDAS

2.2 Process Flow

Figure 2 shows the process flow of TiHDAS using MinMoe Temperature Screening Device, Model: DS-K1TA70MI-T HikVision of China. The existing Software Development Kit (SDK) of the MinMoe IoT device was revised using in-house software to communicate with HRIS and HIMS for it to send data through these systems securely. When the device captures the employees' image upon logging in, the time and temperature parameters read by the device are filtered by the developed in-house software and sends it to the designated receiver; time logs to HRIS and body temperature to HIMS.

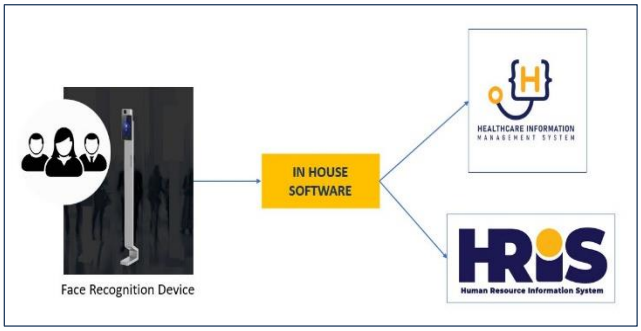

Fig. 2. Process Flow of TiHDAS

The developed in-house software that performs the system flow of the process is shown in Figure 3. Since MinMoe temperature screening is already existed and manufactured by HikVision, the data gathered from this device are collected by the developed third-party software and then sent to HRIS and HIMS. Enable to execute the desired design for the third-party software.

It will first initialize the desired information if it suits its requirements and log in to the device [9]. The secondarily developed third-party platform can automatically connect and send the alarm/event uploading command to the device when the alarm is triggered, or the event occurs. The device then uploads the alarm/event information to the platform for receiving.

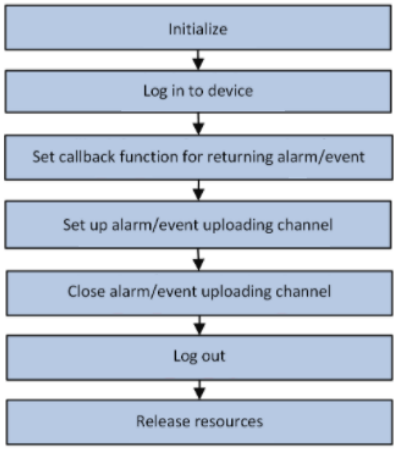

Fig. 3. System Flow of the Algorithm of the Developed Third-Party Software

2.3 MinMoe touch-free temperature screening terminal of HikVision

Among all the temperature scanner devices available in the market, the developers selected MinMoe Face Recognition for Time logs and Temperature Screening Terminal of HikVision. MinMoe is an intelligent thermal scanner that can send the data like time logs of employees, health parameters, and alarms from this device to the Time & Health Data Acquisition System (TiHDAS).

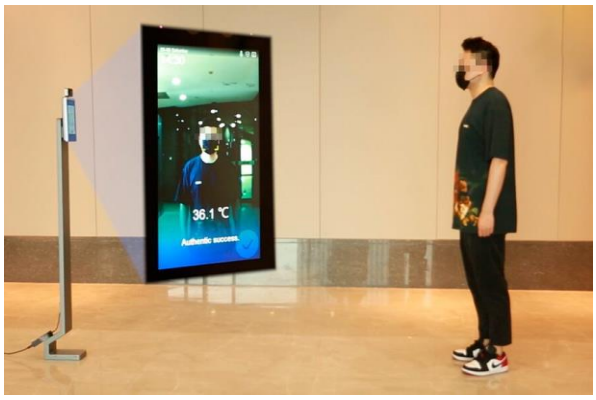

Fig. 4. MinMoe Temperature Screening Terminal (Hikvision, 2020)

The MinMoe touch-free temperature screening terminal of HikVision (IoT device) is used to give people an easier way to enter a building, record attendance and simultaneously check temperature and mask-wearing without having to touch a terminal or gate, using face recognition and thermographic technologies. The touch-free nature of the terminal makes access more accessible and safer, suitable for long-term temperature screening with access control for any building with a high footfall of people. It can also be configured to allow people to 'self-check their temperature [10-12].

The MinMoe is a thermographic technology device that measures forehead temperature after face recognition with a 0.1 ˚C accuracy [13-14]. It has the capability of detecting if someone is wearing a mask or not (Figure 5).

Fig. 5. MinMoe Touch-free Temperature Screening Features (Hikvision, 2020)

2.3 Registration Process of MinMoe Through iVMS Software

The registration process provides the system with' necessary information: Person ID, Name, Gender, and Photo (Figure 6).

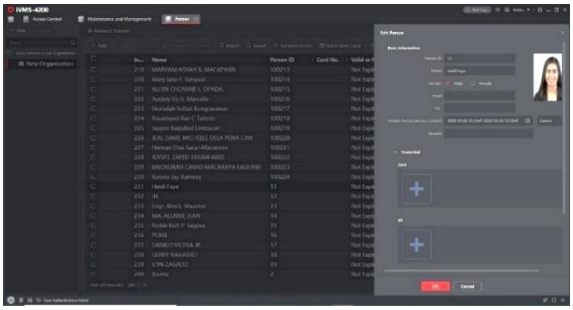

Fig. 6. iVMS Software Registration Process from HikVision

3. RESULTS AND DISCUSSION

Figure 7 shows the actual testing of TiHDAS. It displays the authenticated ID with corresponding temperature and time logs. The time log-ins are sent directly to HRIS for the employees' records and a straightforward process of payrolls on every 15th and 30th day of the month. On the other hand, it sends the employee's temperature to the HIMS, an Office that monitors the USTP students, employees, and staff healthcare, especially amid the COVID-19.

Figure 7. Actual testing of MinMoe device with a USTP Employee's Temperature and Time-Logs sent to HRIS and HIMS

The developed software receives data from MinMoe, and executes processes to filter and SEND required data to the existing HRIS and HIMS. A program code is shown in figure 8 for the execution of such a command. MinMoe, through its face recognition technology, can identify a particular individual, logs time it checks in and out, register body temperature, and determine if the individual is wearing a mask or not in real-time. TiHDAS filter and

Fig. 8. Program Code for Sending Data Information to HRIS and HIMS

transmit employees' time logs to HRIS as input for the employee's Daily Time Record (DTR), required for payroll processing. It also helps filter and transmit body temperature and wearing mask status to HIMS for monitoring and assessment to maintain the safety of the employees and students and avoid transmission of the virus within the university premises. There are 855 employees of USTP are registered to TiHDAS, and it is still growing (Figure 9).

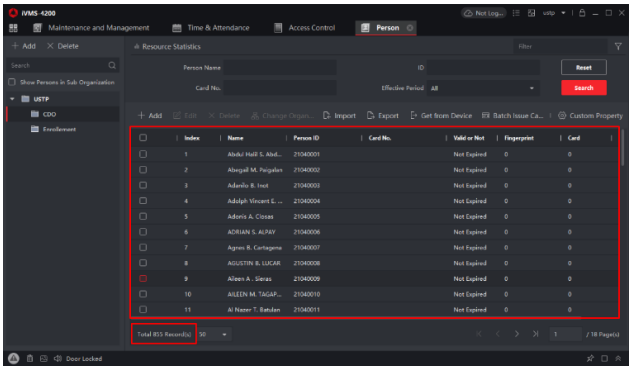

Fig. 9. Total Number of USTP Employees Registered in TiHDAS

Figure 10 shows the user-interphase of the Real-time, Contactless, and Health Data Acquisition System Using the Internet of Things. The individual's Time Logs and Temperature are posted and sent through HRIS and HIMS systems. With the help of this developed system, Daily Time Records (DTR) for employees are made easy and time-efficient due to the real-time process compared to the conventional way of doing it.

USTP-HIMS was came-up corresponding with the New Normal; monitoring of employees is necessary to protect and prevent the university from further infection of the COVID-19. Tracking individuals' temperature is one of the efficient ways to avoid the school virus-free (Figure 11).

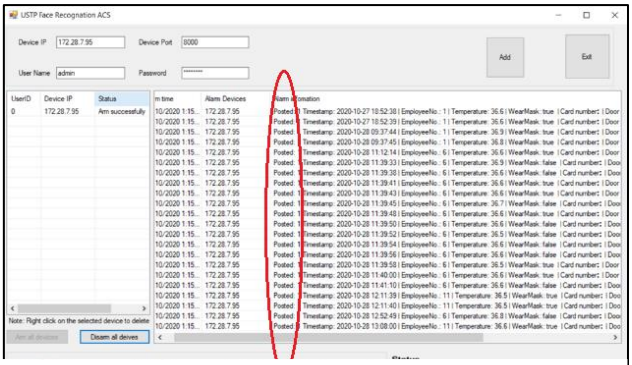

Fig. 10. User-Interface of the Developed Real-Time, Contactless and Health Data Acquisition Using Internet of Things

4. CONCLUSION

The daily time logs of USTP having many employees reporting to school is a bulk of work when complying with monthly payroll. The evolution of TiHDAS deals with a significant role in terms of giving solutions to this problem. Real-time logs of employees are sent to the HRIS Portal, which employees can view using their accounts logged in

the website hris.ustp.edu.ph. Time-in and time-out of individual employees are now tabulated and downloadable in a PDF format.

Due to the global pandemic present, monitoring body temperature is necessary when coming into any establishment, especially in your work environment. The ability of TiHDAS in getting a person's body temperature using thermographic technology associated with the MinMoe Face Recognition device helps monitor the daily temperature of the USTP employees. Temperature logs are sent to HIMS Portal that can be accessed through the hims.ustp.edu.ph; once an employee has an abnormal temperature, they are advised to work-from-home to prevent further transmission or spread of any virus or disease inside the university's premises.

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