Experimental Design and Implementation of Fingerprint Based Exam Hall Authentication System with Temperature Sensing and Analysis using Internet of Things

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***Abstract* – The world is going through a global crisis due to the contemporary COVID 19 pandemic situations. In these taxing times, students have been severely affected. So our government has not compromised their future and has decided to conduct all competitive examinations. Thus, it becomes crucial for the students to register for the exams. However, the traditional exam hall authentication system does not assure that the students would not be exposed to the infection. So it is important to come up with a solution for this scenario. This paper presents a model in which the student's registration and authentication happen using the fingerprint sensor and Atmega328 microcontroller in addition to recording the student's body temperature by the LM35 temperature sensor. The data is transferred to a cloud server where it can be monitored and analyzed. The cloud server shall store the time of recording and the temperature of the student. If the temperature is higher than standard body temperature, an email alert is sent to the concerned authorities. The authorities can consequently take appropriate action and this would help in curbing the spread of the virus among the students present in the exam hall.**

Keywords- Thingspeak, Atmega328, Fingerprint sensor, Temperature sensor, Authentication

I. INTRODUCTION

Conducting examinations during any pandemic is an arduous task. The safety and security of student's health will be considerably hampered if proper and effective steps are not taken by the respective personals and the government. India is a highly populated country that must implement proper technological solutions in the examination centers. This will effectively isolate ailing persons if found so that they don't transmit the infection thus preventing examination centers from becoming the super spreader of the disease. Examinations are essential and integral part of the Indian Education System. Each year thousands of students sit for different entrance exams like JEE, GATE, CAT, UPSC, etc. As we all know, when a student appears for an exam, he/she has to give his/her fingerprint on a fingerprint scanner as well as on manual record using ink from the stamp pad [1-2]. In the current pandemic situation if the same process is followed, then the students are at higher risk of exposure to the virus [3]. An infected student may leave traces of that virus on the fingerprint sensor as well as on the stamp pad. In the examination, authentication has always posed a serious challenge [4]. Verification of the authentic candidate is an onerous task consuming a lot of time. An accurate automatic personal identification is becoming more and more important nowadays for the operation of our increasingly electronically interconnected information society [5-8]. Manual verification of the identity of an individual, through some ID cards like PAN, ADHAAR, etc. are not considered safe enough to assure authenticity or differentiate between an authorized person and an imposter who falsely acquires the privileges of the authorized person [9]. Biometric may be a technology that uniquely identifies an individual who supported his physiological or behavioral characteristics [10]. Fingerprint and iris are only two parts that are unique to each human being [11]. Fingerprint recognition is straightforward and can be implemented easily than iris recognition [12]. Also, it can easily differentiate between an authorized person and an imposter [13]. The chief purpose of our project is to uniquely identify the students permitted to sit for the exam alongside maintaining the safety of the exam center from COVID 19 by monitoring the body temperature of the students [14].

II. PROPOSED METHODOLOGY

One of the most common symptoms of COVID 19 includes fever. In the model proposed, there will be detection of the student's body temperature in real-time using temperature sensor continuously and automatically without any human intervention. It results in getting more accurate data instantly without any human error. Once the data is obtained, it is sent to a cloud computing server or data analytics server like Thingspeak for visualization in addition to keeping records. In Thingspeak, the temperature data of each student is scrutinized to check if any students have a fever or not. If found, the server will immediately send an email notification or SMS to the concerned authorities of that examination center and the concerned people can take necessary steps for that infected student. A student will only be allowed to put his/her fingerprint contingent on concerned authorities not

978-1-7281-9654-1/20/$31.00 ©2020 IEEE
DOI 10.1109/ICPS51508.2020.00012

receiving a warning message from the server indicating he/she doesn't have a fever.

III. Proposed System

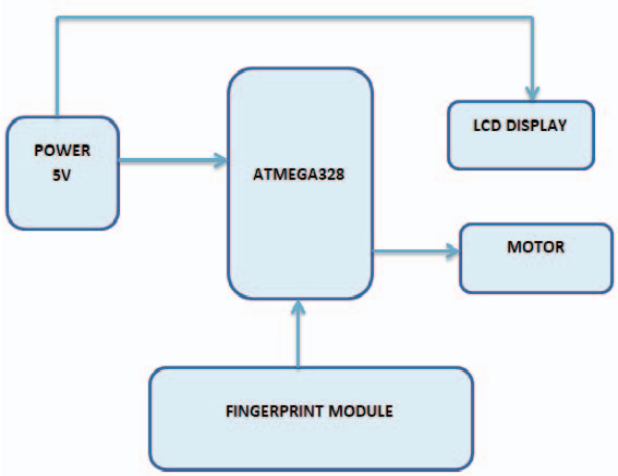

Fig1: Block diagram of fingerprint based exam hall authentication

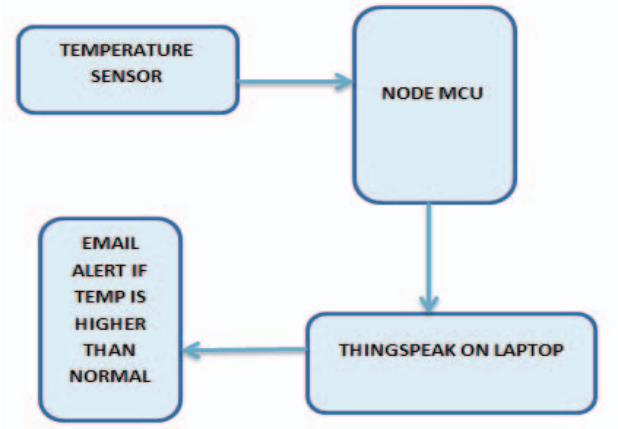

Fig2: Block diagram of temperature sensing of the student

In Fig1, a 5V power supply has been given to the Atmega328 as well as the LCD. The Fingerprint Module is connected to Atmega328 which accepts the candidate's fingerprint for registration as well as authentication. The door, represented by the DC Motor is connected to Atmega328 to allow the candidate to enter the exam hall after authentication.

In Fig2, the LM35 temperature sensor is connected to the Node MCU which gets its power supply from the laptop. The temperature of the candidate is displayed on the ThingSpeak platform through which email alert is sent in case the temperature is high

IV. Experimental Setup

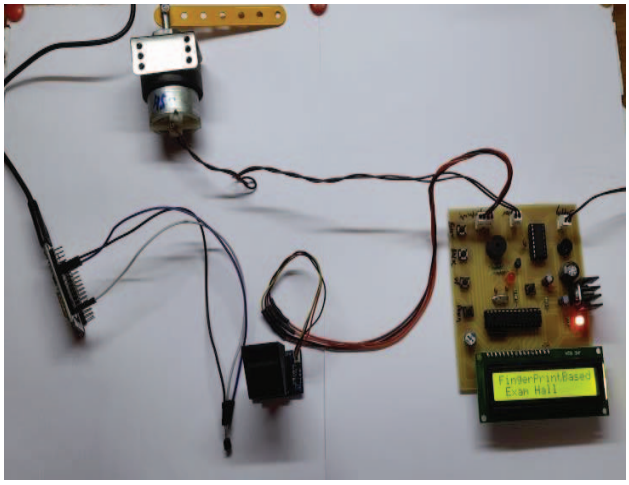

Fig3. Experimental setup of proposed model

In Fig3, fingerprint sensor scans the finger of the candidate for both registration and authentication. The candidate is kept updated about his registration throughout, as the LCD screen displays the message fed into it through Atmega328. The temperature of the candidate is recorded by the LM35 temperature sensor and sent to the ThingSpeak platform through the Node MCU. As soon as the temperature recorded is higher than normal body temperature, an email alert is sent through the Webhooks service of IFTTT. Also, the motor and buzzer are attached to the microcontroller.

V. Hardware Specifications

- R305 Fingerprint Sensor Module with TTL UART interface directly with 3v3 or 5V microcontroller through MAX232/USB-Serial adapter.
- Atmega328 is an 8-bit low power CMOS microcontroller with 28pins. It works between the range of 1.8V-5.5V combined with 16MHz crystal oscillator and 22pF capacitors. It has 32kbytes of flash memory, 2KB of RAM, and 1KB of EEPROM.
- Motor Driver (L293D) is used to drive the motor in the forward direction.
- Buzzer beeps when the DC motor rotates and the user is authenticated.
- 16x2 LCD screen displays the message of registration and authentication of the candidate.
- 4 push buttons(ENTER, BACK, UP, DOWN) in which the ENTER push button activates the fingerprint sensor for registration and authentication, the BACK push button is to go to the main menu displayed on LCD, and DOWN and UP buttons for scrolling up and down in the menu.

- The LM35 temperature sensor senses the temperature of the candidate.

VI. Software Specifications

- Using ThingSpeak, an IoT based platform, the temperature of the candidate is recorded.
- Email Applet made using Webhooks services provided by IFTTT Thingspeak.
- ThingHTTP and REACT apps for setting conditions of email alert.

VII. Results And Discussion

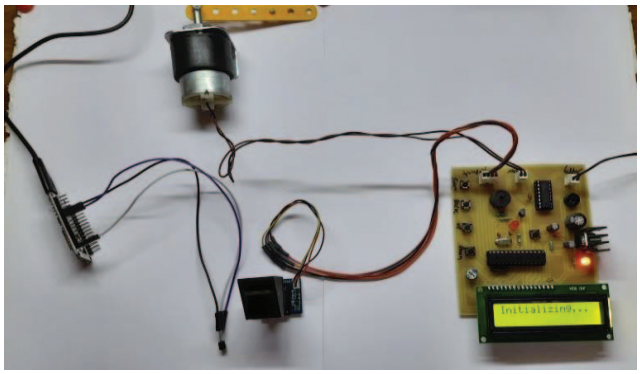

Fig4. Finding the fingerprint sensor

Fig 4 shows that as soon as the 5V power is fed, the microcontroller tries to find the fingerprint sensor and as soon as it finds it, it initializes it with the system and message displayed is 'Initializing'.

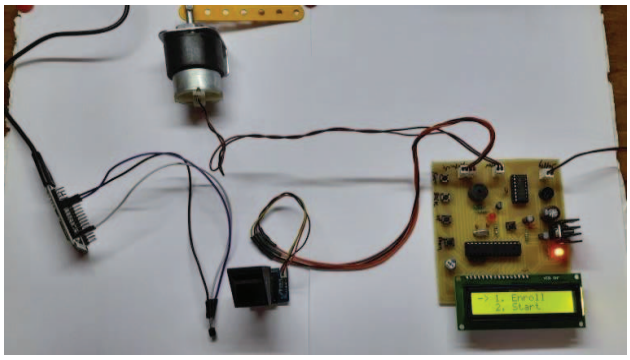

Fig5. The main menu of the system

In Fig5, the LCD then displays the main menu where ENROLL is for the registration and START is for the authentication of the candidate. The ENTER button is pressed to select the options.

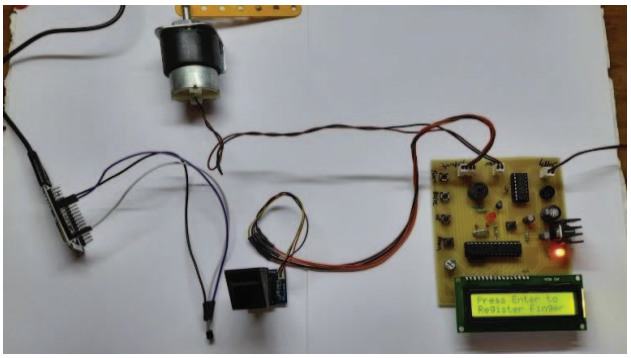

Fig6. Enrolling for registration

In Fig6, the candidate would be registered with ID1 after pressing the ENTER button and scanning his fingerprint. Total 100 candidates can be registered.

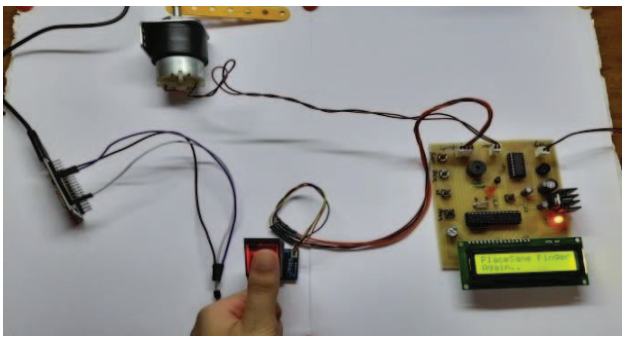

Fig7. Placing the same finger again

In Fig7, the same finger is placed again for further security and confirmation before registration as sometimes the fingerprints can be blurry and then the LCD displays 'Fingerprints do not match' otherwise it displays 'Prints matched'.

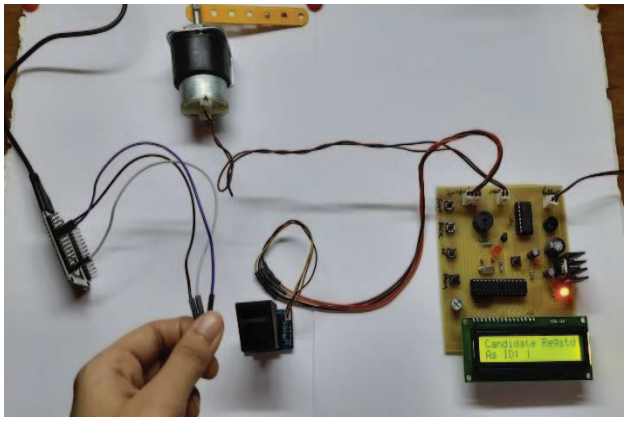

Fig8. Candidate is registered successfully

In Fig8, the message is displayed as 'Candidate registered as ID1' and now the temperature of the candidate is being recorded through the temperature sensor.

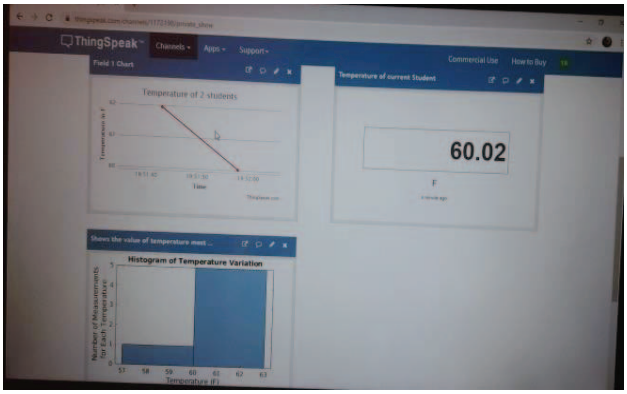

Fig9. Data is uploaded to Thingspeak

Fig 9 shows that 3 channels have been created in Thingspeak for comparing temperature of previous and current student, temperature recorded of the current student and a histogram plot depicting the variation in all the temperatures observed.

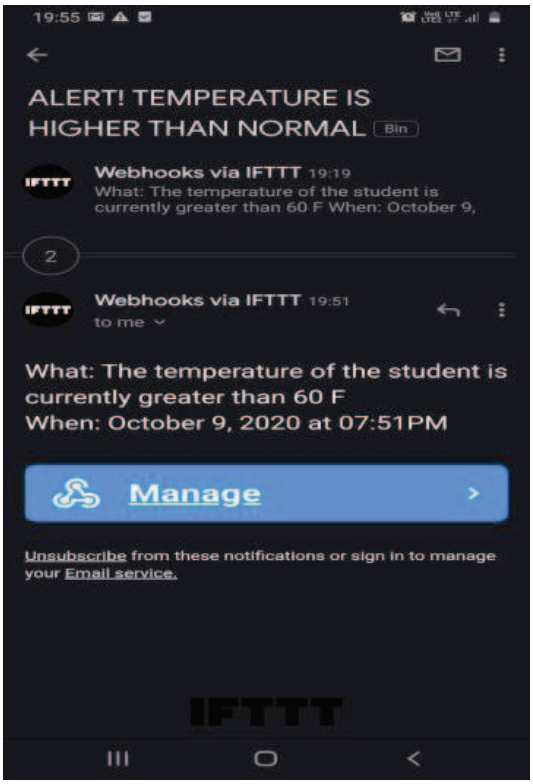

Fig10. Alert is sent to mail id

Fig 10 shows alert being sent to mail id of concerned authorities warning that the temperature is greater than the normal temperature and when it occurred.

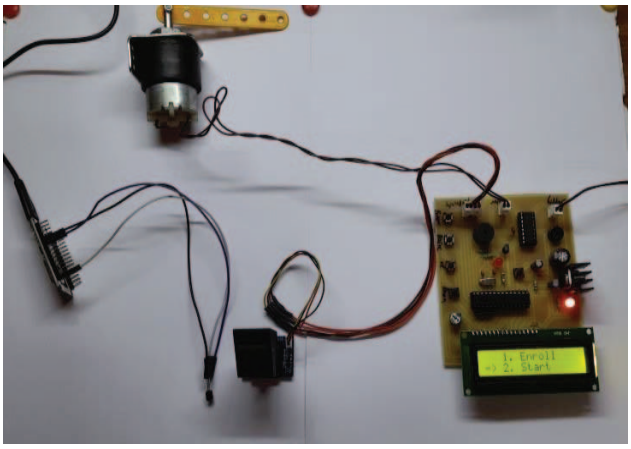

Fig11. For the authentication of candidate

Fig11 shows that the authentication of the fingerprint happens by going back to the main menu using the BACK button and choosing the START option.

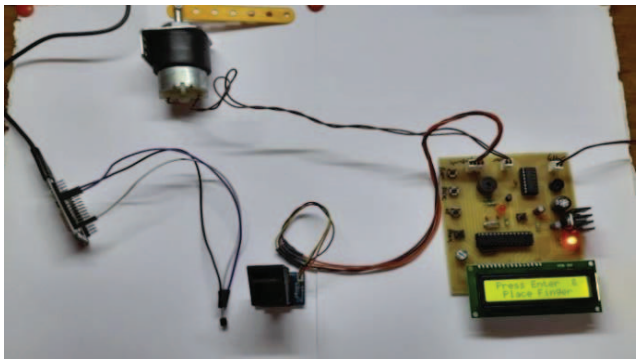

Fig12. Placing the fingerprint

In Fig12, the registered candidate having ID1 places his finger for authentication.

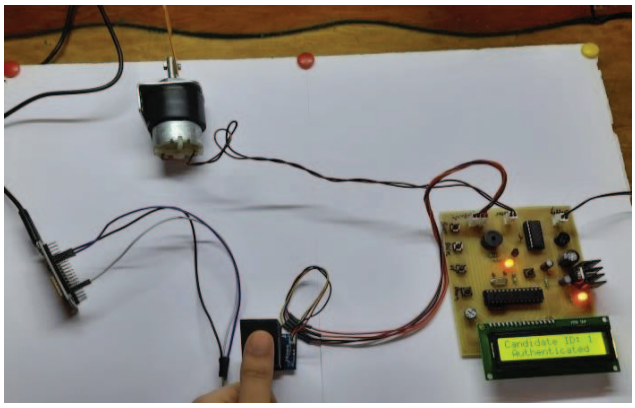

Fig13. The door opens

In Fig 13, the registered candidate is authenticated and allowed to enter the exam hall. The motor represented as

the door rotates, buzzer beeps and message displayed is 'CandidateID1Authenticated'.

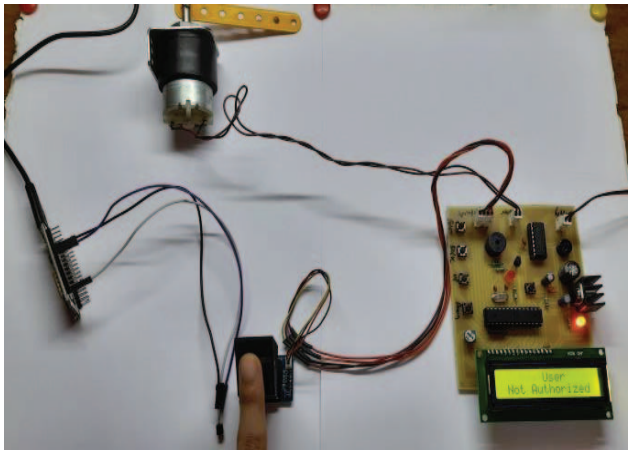

Fig14. Door remains closed

In case the candidate is not registered as shown in fig 14, the motor does not rotate and the message is displayed 'User not authorized'.

VIII. COMPARATIVE STUDY

S.No.	*Title*	*Result*	*Comparison*
1.	Implementation of Cloud Services [3]	Thingspeak and IFTTT web service is used for better result.	Instant and automatic sending of email using IFTTT web service when an anomaly occurs.
2.	Fingerprint Authentication and Temperature measurement [8].	Simultaneous finger print authentication and temperature sensing.	Temperature sensor is added to simultaneousl y measure the temperature.
3.	Authentication Method [12].	Fingerprint recognition system is used for authentication.	Fingerprint recognition is much faster and more reliable than face recognition.

IX. CONCLUSION

A low-cost, reliable, and efficient product has been experimentally designed and tested. The placement of each module and sensor has been done carefully to yield the best results. Implementing this system in the real network and platform can be done for future work. Further advancements can be made in the model like coupling the fingerprint module and temperature sensor together so that the temperature is recorded and registration of the student is done simultaneously, without having to press on the temperature sensor separately. This system solves three problems of the exam conducting authorities- registration of student, authentication, and temperature sensing with an alert, at a modest cost. Using certain modules, libraries and growing technology, the product has been successfully implemented.

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