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BIOMETRIC ATTENDANCE SYSTEM FOR HOSTEL STUDENTS

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Abstract — The system includes an R307 fingerprint sensor and an Arduino microcontroller interface. The fingerprint sensor detects the fingerprint, takes a picture, and stores the information in the hostel database. The database will be used to hold the in-time and out-time information. The LCD screen, fixed with other components, will display the validated information. This technique helps maintain the hostel students' attendance efficiently and effectively.

Keywords - R307 fingerprint sensor, Arduino Microcontroller interface, LCD Screen, database

I. INTRODUCTION

Tracking the presence of the students in the hostel, obtaining the student's permission letters, and requiring the students to hand-sign the attendance sheet poses numerous drawbacks. If the hard copy is missing, it poses serious issues for the administration and the students. Nowadays, it's incredibly challenging to keep an eye on the security of the hostel and the student's presence and absence. Therefore, this study presents a fingerprint system and Arduino Uno microcontroller solution to these issues.

To scan the students' fingerprints, the system uses the fingerprint sensor. The Android database is used to gather and store the fingerprint data and obtain the student's name, registration number, and arrival and departure times. The system helps to maintain the records by using the biometric attendance system. This is carried out by the following components and materials.[5] The system uses an R307 fingerprint sensor and an ESP32 board or Arduino Uno to add a biometric fingerprint attendance system to confirm a student's attendance. The fingerprint sensor analyses the user's fingerprint. Using a service called webhooks triggered by the IFTTT platform (The Online Database Software), the Node MCU (The Internet Source) assists in uploading the attendance and relevant data to Google Spreadsheet. The 16"x2" LCD is connected to show the information obtained from the fingerprint sensor, which aids in determining which finger is not present at the moment. This information is then forwarded to the ESP32 and Arduino UNO WIFI module and connected to the webhooks activated by the IFTTT platform, which stores all the information in a Google Sheet.

The three key components of the proposed system are enrolling, searching, and displaying attendance. The fingerprint sensor and ESP32 or Arduino Uno WIFI module are connected to the computer to begin using this simple device. An essential part is played by enrolment. It entails

photographing the user's fingerprint. When searching, a group of fingerprints that have been kept are turned through and put to the test against the input fingerprint. The output pane displays the user's name, ID number, date, and scanning time. The information in this system is shown using a Google spreadsheet.

This Paper is Organized into a Review of the Literature, Components and Software, Block Diagrams, Libraries, Fingerprint Authentication Algorithm, Enrolling and Fingerprint, Results, and Future Works.

II. REVIEW OF THE LITERATURE

In this session let us discuss the functions and methods of the fingerprint biometric sensor and some of the research done in the specific field of IOT, Fingerprint Sensors, and Biometric Facilities. [3] Zainab H. Ali, Hesham Srafat Ali, and Mohamoud M. Badawy, who have worked on IOT (Internet of Things), say that IOT is a new technology that's like a fancy wireless network. It's a bunch of smart devices that can talk to each other all around the world. This helps us to realize why we need IOT: to make our Gadgets and devices better. [6] Shahzad Memon, Mojtaba Sepasian, and Wamadeva Balachandran researched fingerprint sensors. They found that when it comes to biometrics (using your unique traits for identification), fingerprints are the best. They're universal (everyone has them), unique (no two are the same), and they stay the same throughout your life. People like using fingerprints because it's easy and doesn't bother them. So, fingerprints are one of the most accepted and reliable ways to identify someone. [7] Sunil Sharakannavar, Prashanth CR, and Raja KB researched biometric authentication systems. They say that biometrics means using things unique to a person, like their body or behaviors, to verify who they are. These unique things don't change as a person gets older. [9]

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Wencheng Yang, Song Wang, and Craig Valli researched using biometrics to make the Internet of Things (IoT) more secure. The IoT includes many smart devices that connect with people, and keeping these devices safe is important. They suggest that using biometrics, like fingerprints or facial recognition, could be a good way to make IoT devices easier to use and more secure. This can help solve some of the security problems that come with new IoT gadgets. [10] Mohd. Abdul Muqet, Fabia Akbar, and Syed Habeebullah Hussaini conducted a study on creating a smart security system using fingerprints and Raspberry Pi 3 for IoT. Their idea is to design a system that allows only authorized people to enter a place by scanning their fingerprints. If someone unauthorized tries to enter, the system will send a signal to stop them. They use a Raspberry Pi 3 computer to make this happen. [11] Sankha Sudha Ghosh, Swapnadip Moni, and Monojeet Das researched an attendance system that uses biometrics (like fingerprints) and connects to the internet. They found that biometric systems have become quite advanced and can be used in portable systems. Also, with the help of cloud-based technology, data can be stored safely and accessed when needed. [15] Tripti Jain, Urvashi Tomar, Umang Arora, and Swati Jain researched an attendance system that uses fingerprints. They found that fingerprints are very reliable for identifying people. Their project includes a device that scans a student's fingerprint to figure out who they are. If the scanned fingerprint matches the fingerprint data stored in a cloud database, it means the student is present and their attendance is marked. The latest research on Fingerprint authentication is in "A Secure Online Fingerprint Authentication System for Industrial IoT Devices over 5G Networks by Aseel Bedari, Song Wang, and Wencheng Yang. They say [17] "In this paper, we propose a secure online fingerprint authentication system for IoT devices over 5G networks to address the issues faced by traditional biometric authentication, including slow performance, limited database capacity, and data transmission problems".

III. COMPONENTS AND SOFTWARE

The components and the software used to implement the proposed work are discussed in this section, such as the Arduino module, Fingerprint sensor, Arduino Software (IDE), and IFTTT platform.

A. Arduino module

[1] A 5-volt source powered the Arduino. Data from the fingerprint sensor is transmitted to the Arduino, which is linked to webhooks started by the IFTTT platform and stores all the data in a Google Sheet.

B. R307 Fingerprint sensor

[4] The fingerprint module comes in a variety of forms. They include thermal, RF, piezoelectric, optical, capacitive, piezoresistive, ultrasonic, and piezoresistive.

In this technology, a fingerprint is detected optically. This sensor reads the fingerprint pattern. A template is created from the scanned image and stored in memory. Two procedures are involved in the fingerprint sensor: I) fingerprint enrolment and II) fingerprint matching. Each module uses an R307 scanner to recognize the address of the user. The captured fingerprint data is transferred to the data package when the module interfaces with the system. Only those data packages that match the scanner's details will receive a response from the scanner. When R307 interacts with the system, the detail will be shown to the User and the Admin.

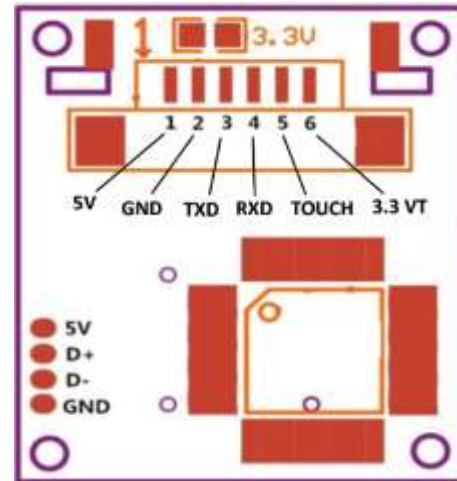


Fig - 1 Fingerprint Sensor

Fig -1 The Fingerprint Sensor has the components of 5V, GND, TXD, and RXD to connect with Arduino, Touch sensing, and 3.3V for the additional voltage. So, These options can connect with the respected points in the Arduino Module.

C. Arduino Software (IDE) (Size 10 & Bold &)

[1] A cross-platform program (for Windows, macOS, and Linux), the Arduino Integrated Development Environment (IDE) is created using C and C++ functions. Programs can be written and uploaded to Arduino-compatible boards using this tool. GitHub serves as the hosting service for the Arduino software's active development. See the code construction instructions. The IDE has access to the latest release source code archive. Using this GPG (Gun Privacy Guard) key ("It uses a system of "public" and "private" keys for the encryption and signing of messages or data"), you can confirm the authenticity of the PGP (Pretty Good Privacy) -signed archive.

D. IFTTT platform

[8] IFTTT takes its name from the programming conditional statement "if, this, then, that". You can create applets that respond to other activities using the website service IFTTT. You can create web requests with the IFTTT webhook service that will start an action. The incoming action sends an HTTP request to the web server, and the outgoing action sends an email. The automation is implemented via applets, which operate somewhat similarly to macros and link different apps to carry out automatic processes. We can activate or disable an applet using the IFTTT website or mobile apps. IFTTT's user-friendly, straightforward interface enables us to create our applets or alter pre-existing ones.

IV. BLOCK DIAGRAM OF BIOMETRIC FINGERPRINT SENSOR

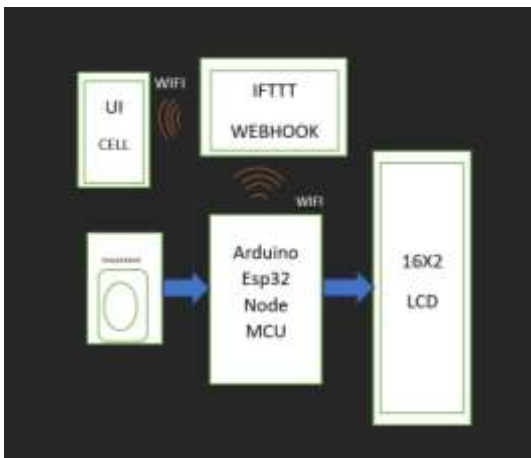


Fig - 2 Block Diagram of Biometric Device

Fig - 2 Block Diagram contains the working principle of the Biometric system. It has Arduino, IFTTT Webhook, Fingerprint Sensor, LED Screen, and User Interface. The WIFI connection travels between the Arduino and the IFTTT Database and it can be viewed on the Mobile Interface. The students can see the updates through the LED Screen.

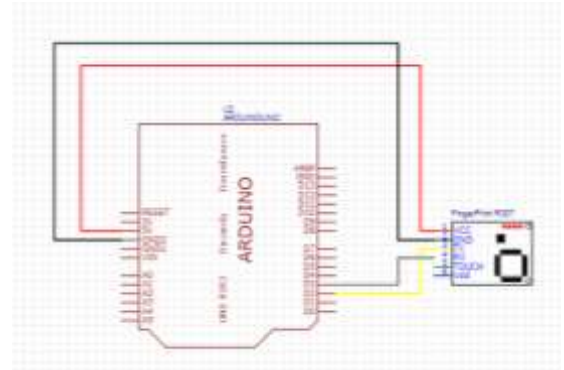
V. FINGERPRINT AUTHENTICATION ALGORITHM

1. Start.
2. Set the fingerprint ID equal to 0.
3. Begin the procedure with the setup ().
4. Begin the procedure for the loop () statement.
5. Set this fingerprint ID equal to getFingerprintIDez () Methods.
6. Set p is equal to a finger. image2Tz () Method.
7. Set p is equal to finger.fingerFastSearch () Methods.
8. Begin the procedure to display the Main Screen () Method.
9. Begin the procedure to display User Greeting (String Name).

10. Again, Set the fingerprint ID equal to 0.

11. Stop

VI. CIRCUIT DIAGRAM



[4] The Arduino and the R307 fingerprint sensor are shown in the circuit diagram coupled in corresponding ways. The VCC, GND, RX, and TX connections are the four main ones. The 5V in the Arduino module is connected to the VCC in the R307 fingerprint sensor. Each superette module's GND (Ground) is wired to the other. RX and TX in the R307 fingerprint sensor are connected to D2 and D3 in the Arduino module. D3 is connected to RX, whereas D2 is connected to TX. This can also be shown on the LED module.

XI. ENROLLING AND FINGERPRINT

[2] First, Arduino Uno is linked to the R307 fingerprint sensor module. The serial monitor is used to enroll the Registration ID number. The fingerprint is scanned using a sensor; if this stage is successful, the result is displayed as 'Found fingerprint sensor.' The message 'Did not find fingerprint sensor' appears if we make the incorrect connection. The fingerprint is then transformed into templates and saved in EEPROM (Electrically Erasable Programmable Read-Only Memory). Another fingerprint is then obtained and recorded as a new ID number.

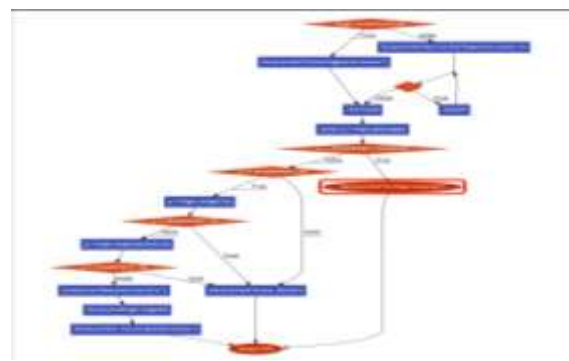


Fig - 4 Process Flow Diagram of Biometric Device

The format in detail of the program the system used in the fingerprint sensor module is shown in Figure 4, the process flow diagram. The password is automatically verified when the respected person inputs their input using their finger. It displays 'Found fingerprint sensor' if it is true and 'Did not find fingerprint sensor' if it is false. The loop statement is executed, and the fingerprint image is obtained if the condition is true. It sends the user an approval message, checks the respectable person's information, stores it in the database, and tells the user details. When the test is false, the input is delayed, and the user is subsequently given an Access refused message.

X. RESULTS

The system can link the Arduino and R307 fingerprint sensor to the app using the code. This facilitates the application's enrolment of the hostel student (Name, Registration No., In and Out Time, and data storage in Google Sheets).

Screenshot:



Fig - 5 IFTTT Database Web Link

	A	B	C	D	E	F
1	REG.NO	NAME	DEPT	HOSTEL	IN TIME	OUT TIME
2	1006	SACHIN	MCA	MURPHY	10:45	12:30
3	2016	HARI	MBA	MURPHY	01:23	03:45
4	6034	ARUN	MSC CS	MURPHY	08:34	12:20
5	8023	SAI	MSW HR	MURPHY	10:30	02:40
6	1001	STEPHEN	MCA	MURPHY	09:00	11:00
7						

Figure – 6 Record Observed from Biometric Device

XI. FUTURE WORKS

These days, systems are gradually advancing toward AI. Therefore, IoT-based applications are more beneficial for advancing AI technology. In the future, the system won't need any third-party software or programs to store the data. The system can independently develop an Android application and store the required data there.

To improve performance for the security of some organizations such as hospitals, schools, colleges, hostels, and others, the system can gradually transition to facial restructuring while simultaneously reducing the size of the fingerprint picture and freeing up storage space. These are the IoT projects' next tasks.

CONCLUSION

The fact that this system displays names, ID numbers, dates, and times on an Excel page makes it user-friendly and dependable. Microsoft Excel is used to store the attendance on the Excel sheet and it can also be viewed. If not, this attendance system can be used to monitor who visited the hostel on time, early, or late. Therefore, this system's development is very helpful in saving hostel students valuable time while writing their permission letters to take leave to visit their home and return.

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