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IOT Based Biometric Attendance Management System

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Abstract--Biometric attendance system increases the efficiency of the process of taking student attendance. In our project, we are using Internet of Things (IOT) based system that records the attendance using fingerprint based biometric scanner and stores them in a database. This reduces the human effort in manually taking attendance and storing them. The records are securely stored and can be retrieved whenever required. A student can check his attendance, class teacher can check their attendance and their respective class' attendance and the Head of the Department can check their attendance, staff attendance and all classes' attendance in their department. One cannot modify those things after stored. A website is to be designed for students, teachers and HOD to log into their accounts and check the attendance.

Keywords: Biometric attendance system, IOT, website, database.

I. INTRODUCTION

Attendance recording and monitoring is one of the important tasks for effective functioning of any organization, whether it may be a business organization or an educational institution. The conventional method is paper and pen method. Attendance is taken orally or one should sign in a logbook. This method consumes more time by wasting both students' and teachers' time. One has to maintain those records safely and have to upload them into the website safely. Human errors can occur while taking attendance orally. If marked wrong, they cannot be corrected. This project provides a method to reduce time, energy and errors. This project has a Biometric Attendance System which is easy to use, reliable, compact, portable and consumes less power.

There are other systems like Barcode Attendance System, RFID Attendance System. Barcode Attendance System gives unique barcodes for every user. User can mark their attendance by scanning his barcode at the scanner. This system is compact, portable and cheap. But if barcode is damaged, it is not possible to scan it. Scanning process takes more time. RFID Attendance System assigns unique card numbers by scanning chip in the RFID Tag which can be used as a College ID card. We can print details of student on RFID
Tag. This system is compact, portable and efficient process. But one has to bring RFID card every day to mark their attendance. One can send their card to their mates to mark their attendance too without their presence. This system is bit more expensive than Barcode.

Biometric Attendance System uses biometrics of individual which are different for each individual. Biometrics includes finger, face, iris, vein etc. This project uses fingerprints to identify every user and mark their attendance. This project is compact, portable, easy to use, faster scanning, secure and consumes less power. The attendance system is connected to the internet to automate the process of attendance marking. The Attendance System sends the IDs to the database and one can see the data by logging into their accounts. One can enroll, verify by using only one system.

II. RELATED STUDY

Authors in [1] developed an attendance system by using NodeMCU and fingerprint module only. This system displayed messages of all operations in serial monitor of NodeMCU. Attendance details were stored in an Excel Sheet.

Authors in [2] explained about different attendance systems in market. Basic knowledge about the importance, advantages and disadvantages of available attendance systems was gained.

Authors in [3] developed an attendance system using ATmega2560 microcontroller, stored the attendance details in MicroSD card and also uploaded the details in an Excel sheet. Graphical User Interface (GUI) to control the operations of the attendance system was developed using Visual Studio.

Authors in [4] developed the project using Arduino Uno, ESP8266 and fingerprint module. Nokia Display was used to provide information at the system itself. This paper provided basic knowledge about a webserver and database. Attendance details were uploaded into a MySQL database.

Authors in [5] used XBEE technology instead of using Wi-Fi. A XBEE transmitter unit and XBEE receiver unit were used for successful data transmission. Graphical User Interface (GUI) was used to view attendance.

To know the overview about the Fingerprint Matching Algorithms, authors in [6] provided knowledge about the minutiae based algorithm which is used in our optical fingerprint scanner-R307.

Textbook in [7] was used to build PHP scripts required for developing a website.

III. SYSTEM OVERVIEW

A. HARDWARE IMPLEMENTATION

a. ARDUINO UNO:

Arduino UNO is used here to control the operations involved in taking attendance. The four operations that are to be performed are to enroll, verify, delete and reset. Arduino is chosen here as it is easy to use, code, handle and has many modules which add on features to Arduino board.

b. NODEMCU V1.0:

NodeMCU is used here to upload attendance details to a database. NodeMCU is a Wi-Fi enabled board, which supports this project to automate the attendance system. All the enrolled IDs are stored in a table. This table is checked while registering in website. While verifying, the attendance details are updated into another table. In delete and reset, all the tables in the database get altered. NodeMCU acts as a bridge between client and server.

c. FINGERPRINT MODULE – R307:

R307 is an optical fingerprint scanner which is an upgraded version of R305. R307 has its own database which can store 1000 templates. Security level for R307 is from 1-5. This module has less false error rate, fast searching process, high speed processor, uses minutiae based algorithm to work with scanned fingerprints.

d. 16X2 LCD DISPLAY:

LCD Display is used here to provide messages to the user to have a better interaction with the device. LCD Display has greenlight in background with characters displayed on them in black. Characters are displayed in 7X5 matrix.

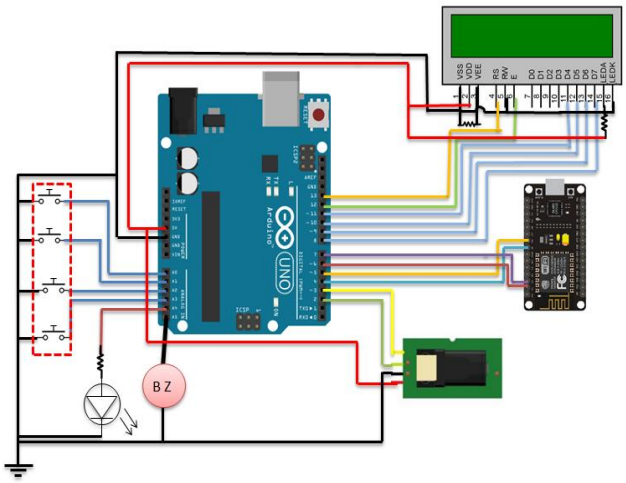

Figure.1 Circuit Diagram of project

e. Other Components used are resistors, buzzer, LED, push buttons.

B. SOFTWARE IMPLEMENTATION:

a. XAMPP:

XAMPP is a software tool to provide local server and a database. PHP scripts, which are used to create website, should need a server to work. To store attendance details, database is required. Apache HTTP Server is used to run PHP scripts and phpMyAdmin is the database.

b. PHP and MySQL:

PHP scripts are used to build the webpage. MySQL commands are used along with PHP so to store the data directly in the database. PHP is also used to retrieve the data in the database so as to check the attendance.

c. ARDUINO IDE:

Arduino IDE is used to program the Arduino UNO and NodeMCU. Arduino UNO is programmed to perform attendance managing processes and send data to NodeMCU. Node MCU is programmed to send the data to respective webserver to store the data into database.

IV. WORK FLOW

A.BLOCK DIAGRAM:

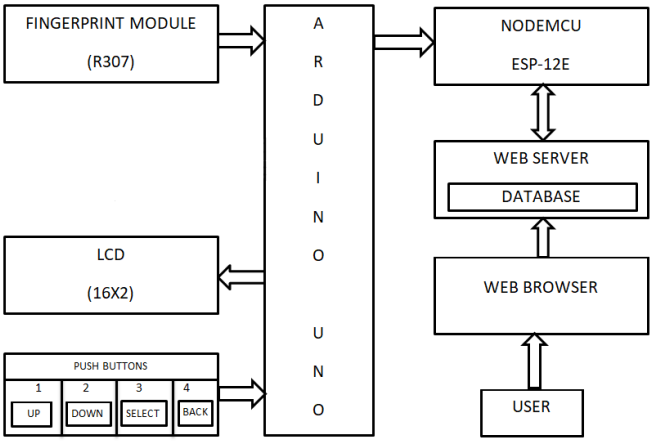

Figure.2 Block Diagram of proposed model

Fingerprint module R307, 16X2 LCD Display, Push Buttons and NodeMCU are interfaced with Arduino. Push Buttons are used to toggle in the menu. The operations performed are enrollment, verification, deletion and reset. These options are displayed on LCD. Serial Communication is established between NodeMCU and Arduino. NodeMCU is connected to webserver by connecting to a local network. NodeMCU receives data from Arduino and sends it to the webserver. A file in the webserver receives this data and stores it in the database. A website is created for user where registration and login are present. By registering, user gets an account in which their attendance is present. By logging into the account, user can check attendance. User can open the website using a web browser.

B. CLIENT SIDE WORK FLOW:

a. WORK FLOW AT ARDUINO:

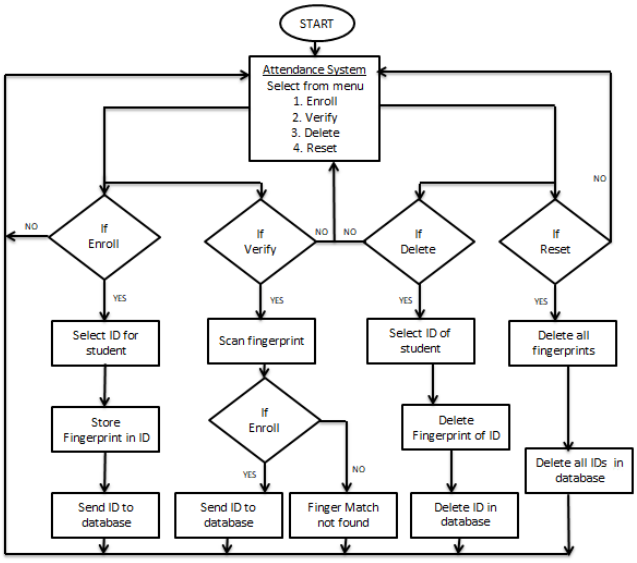

Figure.3 Flowchart at Arduino

The program starts by showing a menu – Enroll, Verify, Delete, Reset. Select one of the options by clicking the Select button. In Enroll step, select ID and to increase or decrease the ID number, click Up and Down buttons. After selecting, place a finger on fingerprint module and store that fingerprint template in the module for that respective ID. This ID is sent to the database. In Verify step, the device enters into a loop where it waits for a finger on the fingerprint module. Fingerprint module verifies the captured fingerprint image, converts into template and compares with the stored templates. If finger template is present, the system sends the ID to database to mark attendance. If not, the system waits for a valid finger, or we can press Back button to get back to menu. In Delete step, select ID number which is to be deleted. After selecting, fingerprint module deletes the fingerprint template and also in database. In Reset step, all fingerprint templates in the module and attendance records in the database are cleared. The program will be in loop.

b. WORKFLOWATNODEMCU:

NodeMCU connects to a Wi-Fi. (If not connected, waits to get connected). NodeMCU searches for Data from Arduino UNO. If the data is received at D5, D6 pins of NodeMCU, it sends the received data to finger.php file in webserver. Connection is established between the NodeMCU and the webserver for data transferring. After data is sent to the webserver, the connection is closed. If the data is received at D1, D2 pins of NodeMCU, it sends the received data to delfinger.php file in webserver. Connection is established between the NodeMCU and the webserver. The connection is closed after transferring the data.

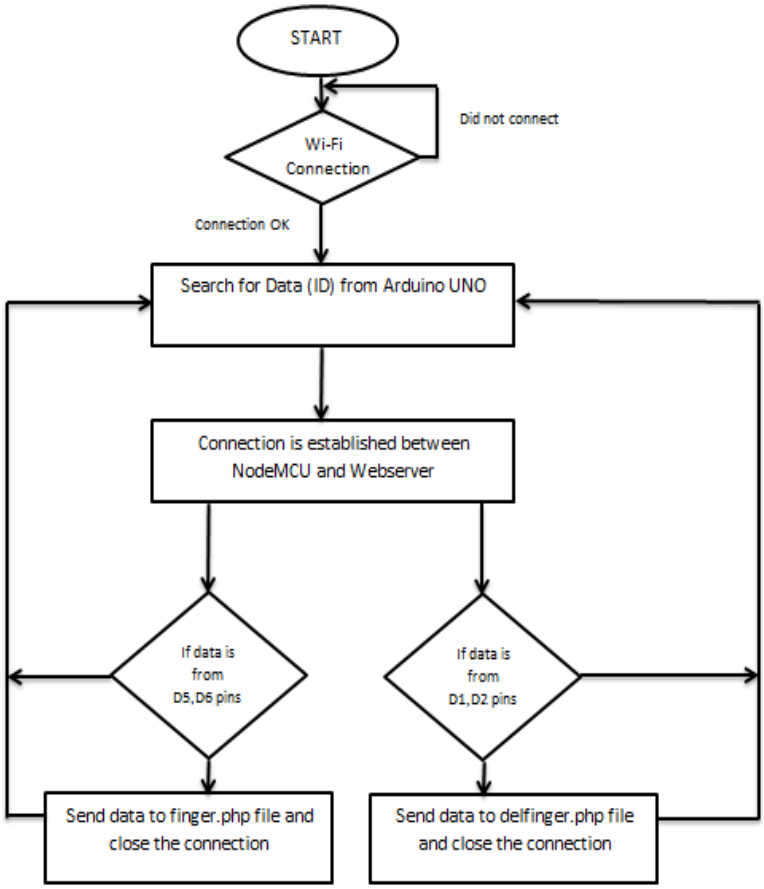

Figure.4 Flowchart at NodeMCU

C. SERVER SIDE WORK FLOW:

a. ENROLL, VERIFY PROCESS:

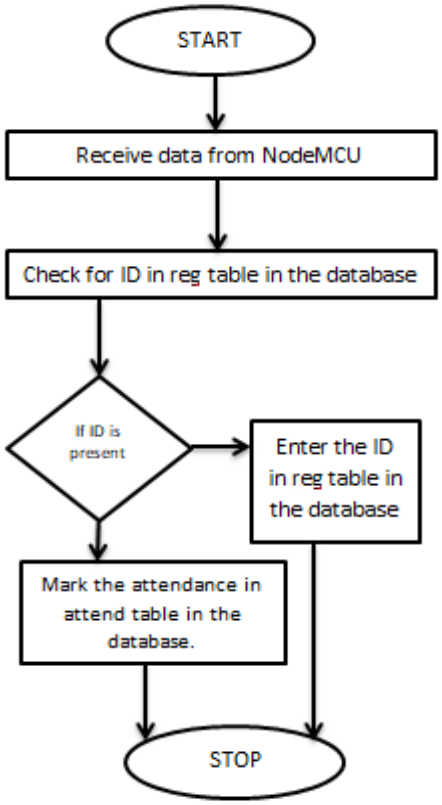

Figure.5 Flowchart of finger.php while enrolling and verifying

NodeMCU receives the data from the Arduino. NodeMCU then sends the data to a PHP script present in the code. Here data is at D5, D6 pins of NodeMCU. So, finger.php file is executed. finger.php connects to the database. In finger.php, the file first checks whether an ID is received or not. If not, the file returns a payload stating the error, if defined. If ID is present, the file checks the reg table in database for ID. If ID is in database, the file marks the attendance in attend table. If not, the file enters data (ID) as new ID in reg table for new student enrollment.

b. DELETE, RESET PROCESS:

D1, D2 pins of NodeMCU receive the data from Arduino. So delfinger.php file is executed. delfinger.php connects to the database. If an ID is received, the file checks for that ID in reg table and deletes that ID in reg table and attendance records in attend table. If not, the file states an error in the payload which we defined. To reset the system, ID is to zero (0). So if ID=0, then the reg and attend tables will be cleared.

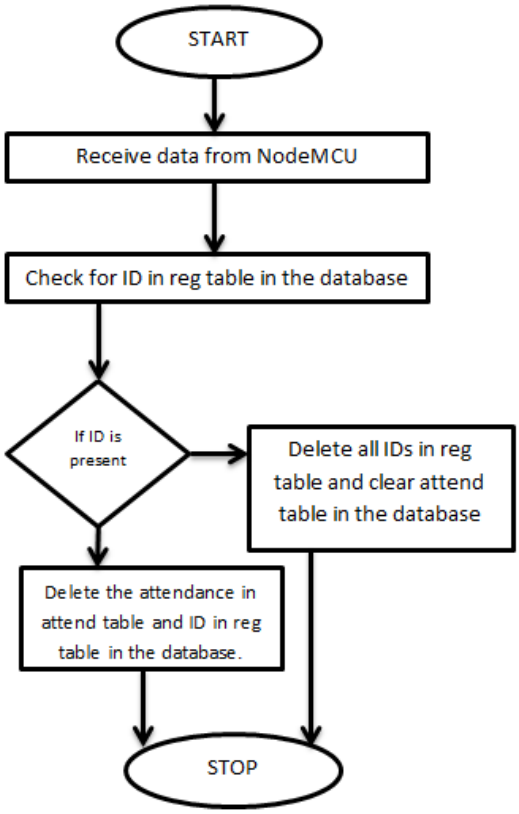

Figure.6 Flowchart of delfinger.php while deleting and reset

V. EXPERIMENTAL RESULTS

a. RESULTS AT HARDWARE:

All the operations that are going in the model are displayed on the LCD Display. A welcome message is displayed followed by verifying the fingerprint module. Next, a menu of operations are displayed. By selecting one of the options, a process can be invoked.

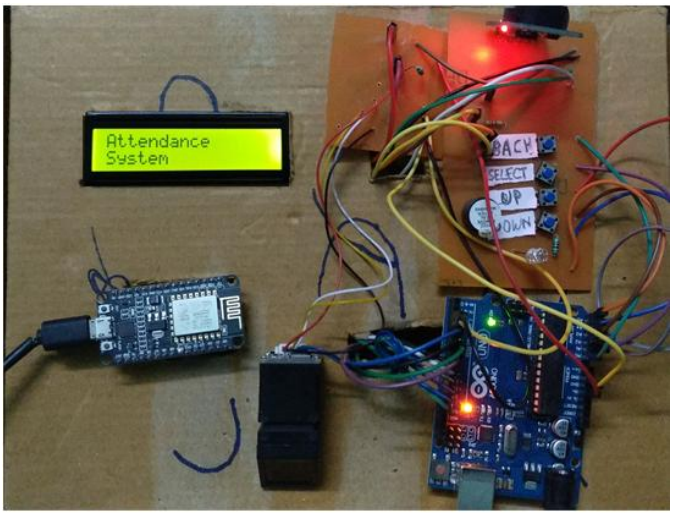

Figure.7 Proposed Model

b. RESULTS AT SOFTWARE:

The registration page is used to get an account in the website so that attendance for that user can be marked and viewed. Login page is used to login to the account and view the attendance. Attendance page gives details based on the role of the user. If the user is a student, only his attendance is displayed. If the user is a teacher, teacher's attendance and

their class' attendance can be viewed. If the user is HOD, HOD's attendance, staff attendance and all classes' attendance can be viewed. Only logged in users can check the attendance.

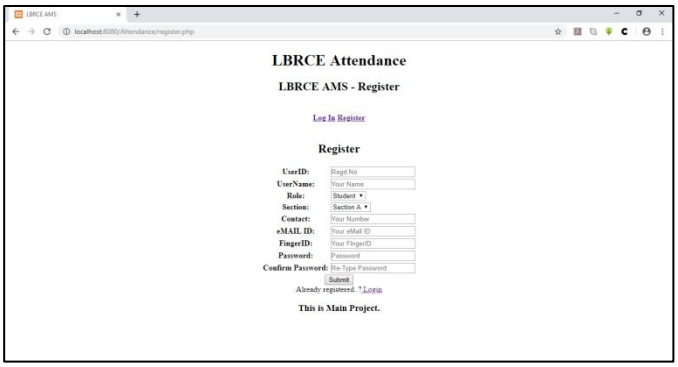

Figure.8 Registration Page

If a user misses to fill some fields, the page notifies us about the error. If a user is already registered with an ID, the page will notify the error. While registering, Finger ID is chosen by the user and for that ID only, the user has to enroll their finger. Passwords should match while registering.

Login page contains User ID and password. User ID and Password should be correct in order to login to the account. User ID should be present in the database. If not, the page notifies to register and redirects to registration page. By logging into the accounts, features like viewing the profile, editing the profile and attendance details can be viewed.

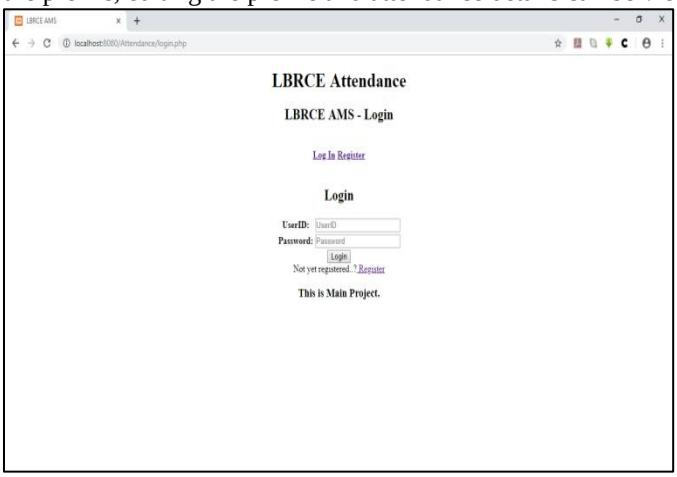

Figure.9 Login Page

The home page is different for logged in users and all users. For logged in users, attendance can be viewed. For new users, the page asks to register first to mark their attendance.

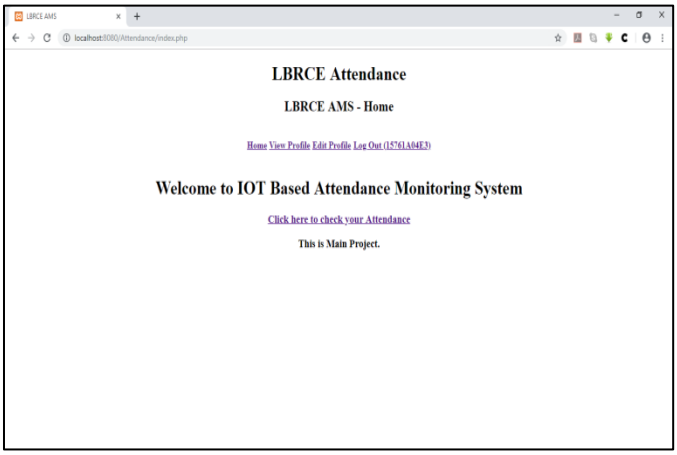

Figure.10 Home Page

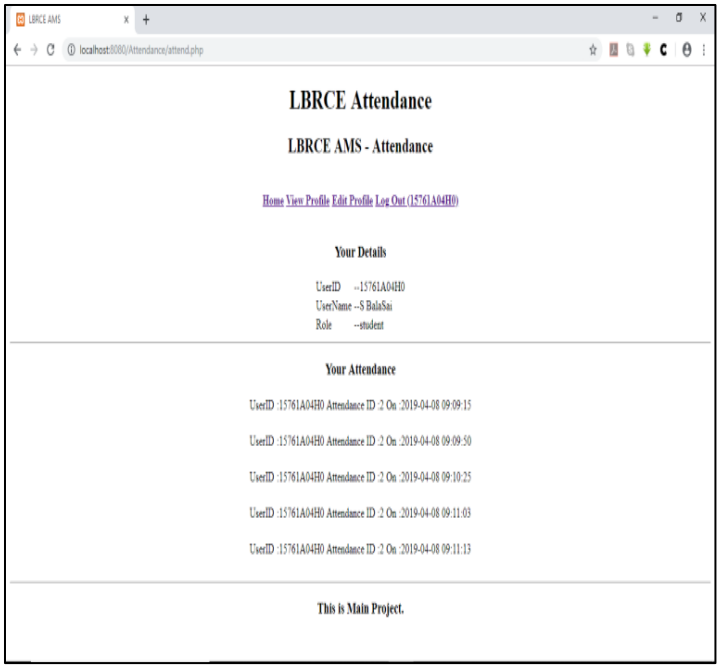

Figure.11 Attendance details for Student

The User ID, Finger ID and the date and time when the attendance is marked is viewed here. For Teachers and HOD, their attendance along with their class attendance can be viewed.

Attendance details for students, teachers and HOD are different. Students and teachers have to select their class while registering so that while viewing attendance details there will be no confusion.

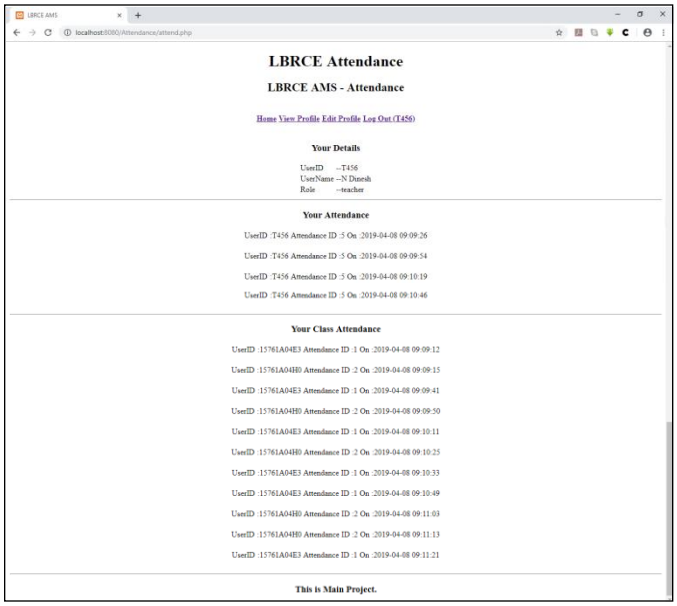

Figure.12 Attendance Details for Teacher

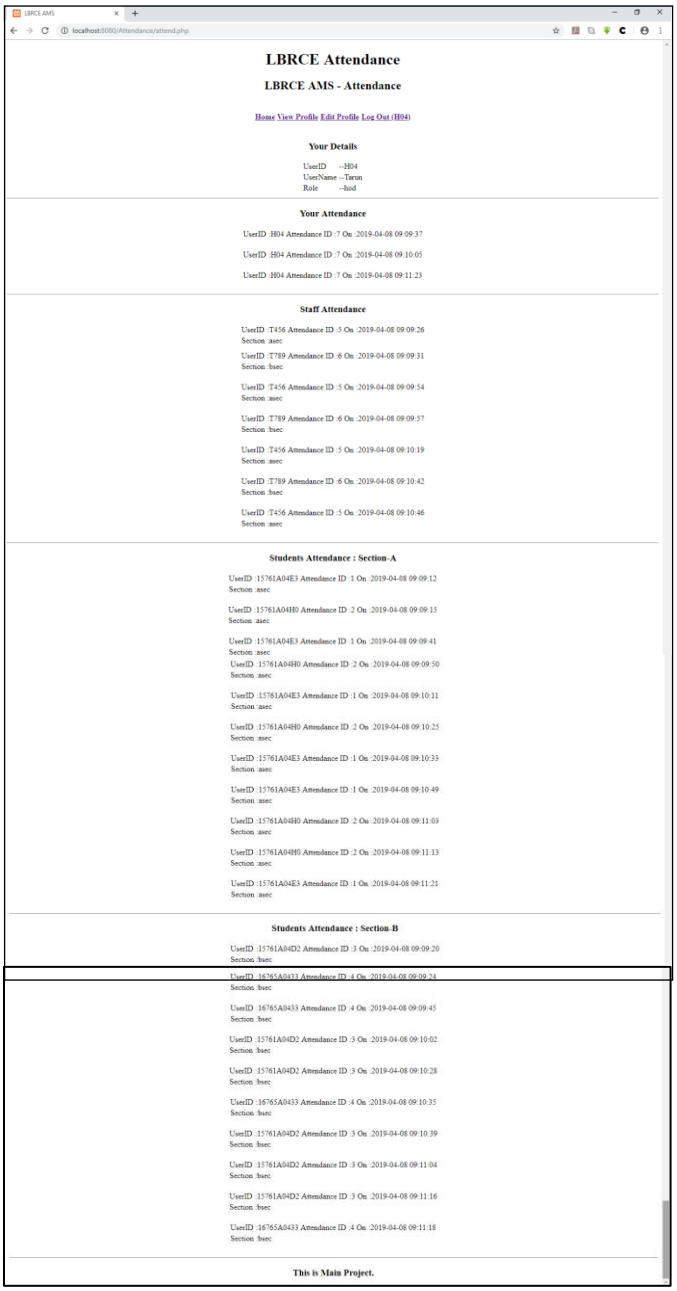

Figure.13 Attendance Details for HOD

VI. FUTURE SCOPE

The hardware size can be reduced. A good display can be used instead of basic 16x2 LCD Display. One can try to interface all the required modules with the NodeMCU to reduce the size. A better interactive website can be designed. We tested our website with local server. This can be uploaded to the main server so one can access it from anywhere. The databases have to be connected with the college server. Website can be designed attractively. Even more pages can be created to add extra features for it.

VII. CONCLUSION

An IOT based Biometric Attendance System which is compact, portable, fast, consumes less power is created. The hardware works very efficiently. There are no issues with the hardware. The connection between hardware and software is established. The attendance details are stored into a database. A website is created through which one can check the details in the database. A user friendly, easy to use device which reduces the human effort and consumes less time for the operations is developed.

VIII. REFERENCES

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