Implementation of IoT Based Attendance System on a Dedicated Web-Server

Nadar Prince, Abhishek Sengupta, Ms.Keerthi Unni

Abstract— In this paper the concept of Internet of Things (IoT) is applied to the basic attendance system in a class room. A portable device is designed, where in every student can feed his/her attendance during each lecture. The student verification is done using R-305 Finger Print module. The student data is fed already in the finger print module. Once successful recognition of finger print pattern is done, the student's attendance is ready to be pushed to the web-server. This data is sent through the serial interface to the Arduino. Arduino provides a data sequence, which is a combination of the student ID, teacher ID and device ID i:e a unique no. of the hardware, so that the attendance cannot be forged. This combination is then sent to the web-server using Wi-Fi Module esp8266-01. This combination is to be sent to the web-server, where it will be decoded. In order for this value to reach the web-server, esp8266 provides wireless connection to the access point, which is in the range, and whose credentials are available. Esp8266 gets access to the internet from the access point(AP), whose Service Set Identifier (SSID) and password is fed in the esp8266 module already. Once the combination reaches the web-server, a PHP script does the subsequent work, to interpret the data, and the MySQL database is updated. Data from the database is retrieved and sent to the website for easy viewing by the student. The whole system is implemented on a dedicated web-server. As a result, the real-time behavior can be analyzed, which helps us to understand the latency and efficiency of the entire system.

Index Terms— arduino, attendace system, dedicated web-server, esp8266, Internet of Things, MySQL database, PHP.

1 Introduction

CLASSROOM attendance system basically involves students submitting their attendance either orally or in the form of signature on paper. In such systems, redundancy of work happens. The soft-copy of attendance is required, which is again fed into Excel or other similar software packages for detailed monitoring and calculations. This is an extremely time consuming process, and very much prone to human error. Detecting and troubleshooting a simple error in the attendance becomes a tedious process. Also maintenance of the bulk of paper work, is difficult. Apart from this, forging a signature in an attendance sheet may also happen. The work increases much more if the class strength is more [1]. Hence, a lot of work force has to be put into attendance verification and analysis. A fingerprint module which can store a large data of the class can reduce the manual work involved. This project uses the concept of Internet of Things to set up a smart attendance tracking system.

2 Concept of Internet of Things

2.1 Generalized structure of IoT

IoT is the integration of the different electronic sensors, peripherals, etc. providing data or information of any sort into a physical network (Internet or local network) [2]. These different sensors, could be transducers, providing digital output or analog output (which is then given to a ADC).

The data is used to monitor a particular variable of a system. IoT is based on the concept of accessing data through internet. To be precise, multiple data from multiple sensors are made available in the internet so that monitoring of any system parameter can be done by anyone at any time very easily.

The data collected from all the different devices, are stored in a centralized database. When this data is centralized, then using the different data mining techniques, a relation between the data can be found. The advantage of having the data on the internet is, the data analysis becomes easy, and any modification can be reflected in multiple places at the same time. Since this data is available in digital domain, it can be easily used to drive other sub-systems thus helping in creating interconnected systems.

2.2 Wi-Fi Module esp8266

In any IoT based system, the hardware consists of a combination of sensors, microcontroller, display, and the most important, hardware providing access to the internet. This hardware should be capable of uploading the data from the sensors or microcontroller to the internet. Example of one such hardware is esp8266-01.

Fig. 1 shows WiFi Transceiver module esp8266 – 01 [3]

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These modules have extremely small form factor, and are the most commonly used WiFi module. They can be easily interfaced with any microcontroller and operate strictly on 3.3V.

3 CLIENT SIDE INTERFACING

3.1 Interfacing Arduino with R-305

The module takes an 8-bit pixel image as input in 256 grey scale. The image is stored in an Image Buffer, during the process of enrollment. This is stored in the 512 bytes ROM of the module. Out of the the 8-bit image taken only the upper 4-bit value is stored, thus discarding the remaining 4-bits. Since just by using the 4-bit grey level, the pattern can be recognized easily, thus saving a 128 grey level image. During the process of detection, an image is taken again, and compared with the images which have been stored in the database. The image taken while detection is stored in a 512 bytes RAM. The data from this RAM buffer is cleared when a detection is complete and memeory is made available for a new image. Fig 2 Illustrates the interfacing of Arduino with R-305.

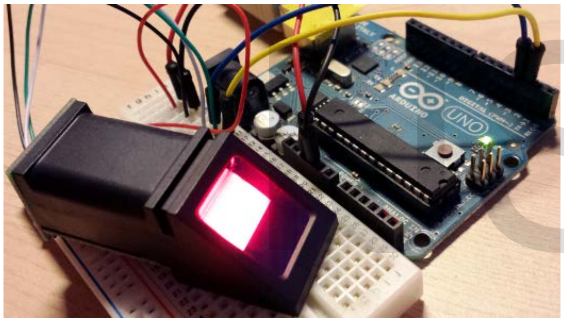


Fig 2. Interfacing of Arduino with R-305 [4]

Serial communication is accomplished with baud rate ranging from 9600 – 115200bps. The R305 module operates at 3.3V to 6V with current consumption of 100mA (Peak current value 150mA). R-305 can be interfaced with Arduino Mega using the hardware serial port. Arduino Mega has 4 hardware serial ports. Serial Port 0 is avoided, since during programming Arduino Hardware Serial 0 is used [5].

3.2 Interfacing Arduino with esp8266

esp8266-01 module is interfaced with Arduino Mega using the hardware serial port 2. There are many firmwares available for esp8266. The firmware decides which programming language will be understood by the esp8266 module. Communication with esp8266 will be done using AT Commands (Attention Commands). Using AT commands, instruction can be given to the esp8266 Module as to which SSID it is to be connected. The type of connection is selected as either TCP or UDP. Fig 3 shows the interfacing of Arduino with esp8266.

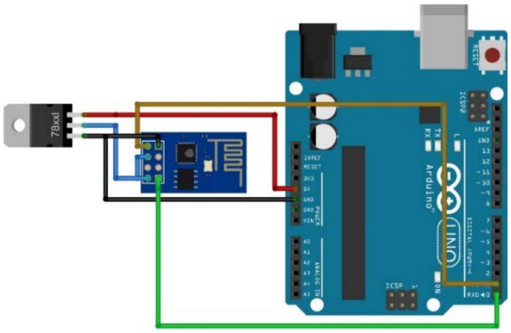
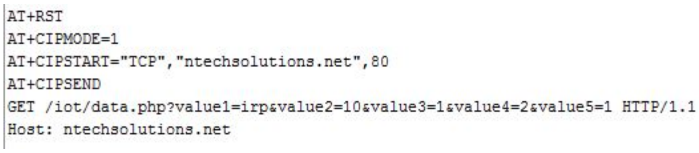


Fig 3. Interfacing of Arduino with esp8266 [6]

AT commands are used to communicate with esp8266. These AT commands essentially form the GET request, which passes the value from the client to the server. Fig shows the final AT commands used to send the GET request(only).



```
AT+RST
AT+CIPMODE=1
AT+CIPSTART="TCP","ntechsolutions.net",80
AT+CIPSEND
GET /iot/data.php?value1=irp&value2=10&value3=1&value4=2&value5=1 HTTP/1.1
Host: ntechsolutions.net
```

Fig 4. Shows a snippet of the AT commands used.

Using any terminal software these commands can be given to esp8266 while testing, but in the actual operation, the commands are sent using Arduino.

3.3 Interfacing Arduino with Nokia 5110 display

A real time monitoring is implemented using Nokia 5110 display. Arduino is interfaced with Nokia 5110 over SPI, therefore it needs three wire interface i:e MOSI, MISO and SCK. Also the backlight of the display can be adjusted using a trimmer pot connected to the backlight pin.

The advantage of using Nokia 5110 Display over the other display devices such as 16 X 2 LCD Display is that; special characters can also be displayed.

As opposed to 16 X 2 Display which can display only 32 characters, these can display up to 84 x 84 alpha-numeric characters and symbols. Fig 5 Illustrates the interfacing of Arduino with Nokia 5110.

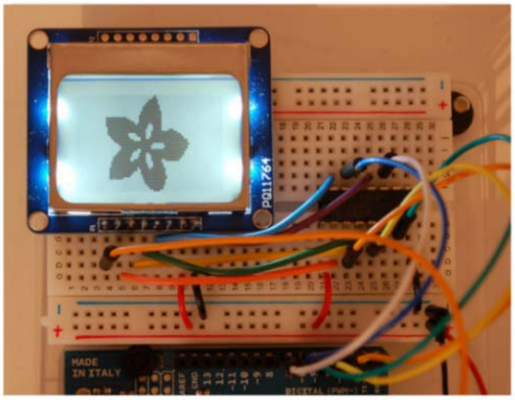


Fig 5. Interfacing of Arduino with Nokia 5110 [7]

The current consumption of Nokia 5110 is only 80mA, which makes it favorable for long term use, as there will be no heating or loading issues.

4 Client side and server side

4.1 Client side workflow

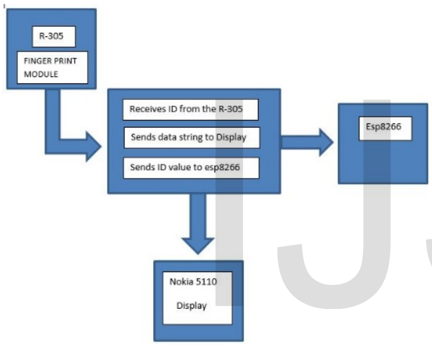

R-305
FINGER PRINT MODULE
Receives ID from the R-305
Sends data string to Display
Sends ID value to esp8266
Esp8266
Nokia 5110 Display

Fig 6. Block diagram of the system

Fig 6 shows the block diagam of the proposed system. Initially, each module is checked for proper working and acknowledgement is provided. Once the acknowledgement is obtained “READY” message is displayed on the display module. The device first asks for the teacher’s validation. A button interface is provided for the teacher to select the no. of hours he/she is conducting the lecture for.

Next, each student validates his/her attendance by providing the thumb impression. Therefore, three different ID: teacher_ID, hours_ID and student_ID are made available. These three values are then passed on to the esp8266 module, which forwards it to the web-server.

4.2 Server-side

Server-side refers to the web space, which is associated with a particular domain name. For this project the domain name ‘ntechsolutions.net’ is used, and it is associated with 100MB of data. This is referred to as web-server. This web space has different HTML, PHP, JScripts, etc which will be handling the data sent from the esp8266. In order to send data to the web-server, HTTP 1.1 application protocol is used. The TTP protocol is designed to enable communication between client and server. It works as a request-response between client and server. HTTP is a client-server application-level protocol. It typically runs over a TCP/IP connection [8].

The client-side data is provided by the esp8266, which consist of the teacher_ID, hours_ID and student_ID. Once this data reaches the web-server, that values are received by a PHP script. This is provided using a GET request, which will pass the value to the variables present in the PHP script. PHP script will have three variables, teacher_ID, hours_ID and student_ID.

Web-server consist of MySQL database, consisting of two coloumn per subject. One is the actual attendance which corresponds to the teacher’s credentials and the other is the other corresponds to the student. Every time, a new value is passed to the GET request, the MySQL database is updated. Once the database is updated, the student shall be able to view his/her attendance. For this an interactive website is designed. The student needs to provide only his roll no which is compared with the student_ID. Once a relevant match is found, then his/her attendance of all the subjects are displayed.

5 Results

Proper functioning of the client side is ensured, when the different electronic components i:e Arduino, esp8266, Finger Print module R-305 and display 5110 works properly. Initial testing was done on breadboard using connecting wires. When powered using a 5V supply i:e using a power bank. The sytem worked properl. Fig 7 shows the implementation of the smart attendance system on breadboard.

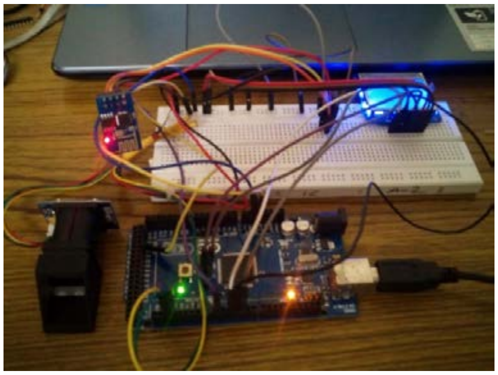


Fig 7. Implementation on breadboard

The final hardware set up of the project is shown in Fig 7. The PCB was designed using Eagle CAD software.

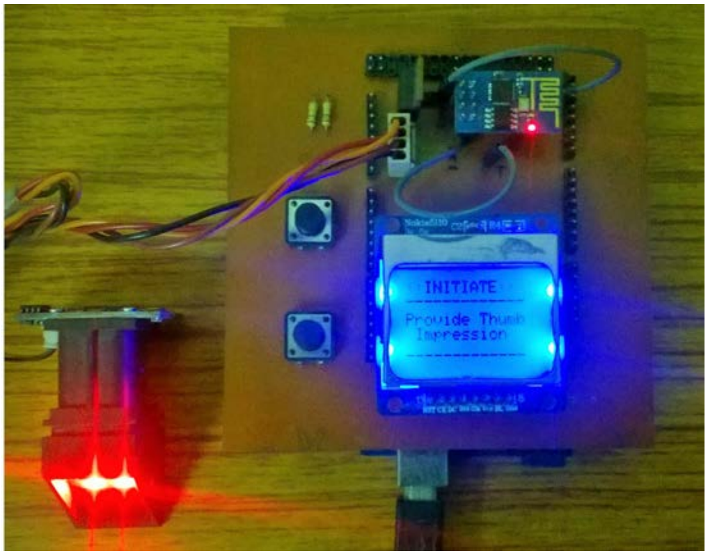
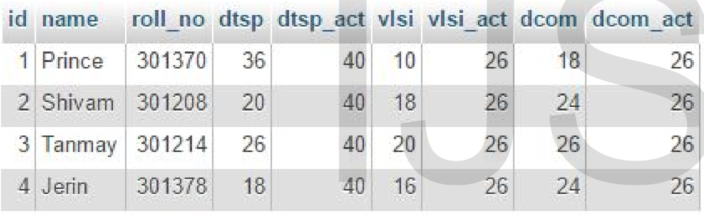


Fig 8. Mounting on PCB

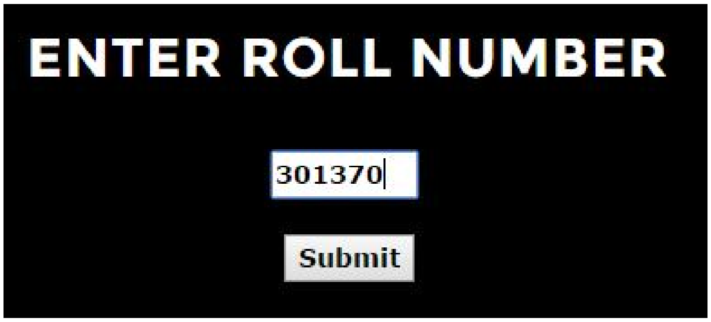
Proper functioning of the server side is obtained when the PHP script, which receives the data sent from the client, interprets the data in the correct manner and then updates the relevant data base. A snapshot of the MySQL database residing in the webspace is shown in Fig 9.



id	name	roll_no	dtsp	dtsp_act	vlsi	vlsi_act	dcom	dcom_act
1	Prince	301370	36	40	10	26	18	26
2	Shivam	301208	20	40	18	26	24	26
3	Tanmay	301214	26	40	20	26	26	26
4	Jerin	301378	18	40	16	26	24	26

Fig 9. MySQL Database used at the server-side

The interactive website retrieves the data from the database and displays the data on the website. The student whose roll number were fed in the database already, their attendance was displayed. Fig 10 shows the user-interface, where the student will provide their roll no. to check for his/her attendance.

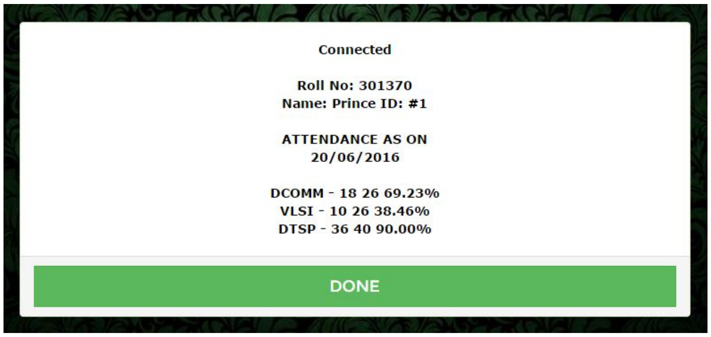


ENTER ROLL NUMBER

301370

Fig. 10 Text-Box Submit interface for user input

Once the roll no. is matched the corresponding information is fetched from the MySQL database hosted in the web-server. Fig. 11 shows the response obtained for roll no. 301370. The output obtained has a direct relation to the data in the MySQL database as seen from Fig 11. and Fig 9.



Connected

Roll No: 301370
Name: Prince ID: #1

ATTENDANCE AS ON
20/06/2016

DCOMM - 18 26 69.23%
VLSI - 10 26 38.46%
DTSP - 36 40 90.00%

Fig. 11 Attendance of the roll no. provided as input

Dummy data were sent continuously for 6 hours at an interval of 20 seconds. No errors were observed in the data being transmitted. Also, there were no heating problems even when the device was kept on for nearly 6 hours.

5 Conclusion

Both the server-side and client-side system worked, without any delay or error in the data transmission. The main limitation in this system currently is that, in case the internet connection breaks, the attendance process has to be started by the teacher again. Currently the PHP script works in a simple dump data method. Using PHP session method, the credentials of the teacher will be held in the server-side once a session has started. As a result of this, if there is internet failure or power failure, on successful connection again, the student can continue entering the attendance, without the teacher to initialize the system again.

Acknowledgment

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