Fingerprint Attendance System for Educational Institutes

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Abstract

Fingerprint attendance system aims to automate the attendance taking procedure of an educational institute using biometric technology (fingerprint). The automated attendance taking procedure is extremely efficient compared to the traditional name call out procedures. It saves the time consumed by the traditional method. However, the available commercial attendance systems are expensive and complex to design and develop. This study proposes a system which is flexible, inexpensive, easy to use and capable to integrate with future development of an educational institute. In brief, the proposed system is most efficient and widely uses solution that keeps the discipline of the students at highest level and allows the guardians of the students to monitor and follow up on the attendance of their students via Internet.

Keywords: Fingerprint reader, Attendance system, Educational institute, Graphical User Interface (GUI), Microcontroller and Data Base (DB).

1. Introduction

Conventional attendance system followed in an educational system, where the teacher calls out the name of each student and marks the attendance, causes time wastage during lecture time. This becomes more severe especially when the number of students in a class is very large. Managing the attendance data of such a large group is also very difficult. Another disadvantage of the conventional systems is the chance for the student to mark fake attendance. The need for easy recognition of students in various activities has become very important in educational institutes. This is to check truancy and lateness to classes by students, respectively. Among the most important of these activities are Lecture and Laboratory attendance and Semester Examinations.

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It has become an academic rule that a student must attend 75% of lectures in a course for a semester in order to be eligible to be evaluated in that course. To check the attendance percentage for each student and course by using the manual attendance sheets is very tiresome and nearly impracticable. Hence, this study proposes a system that can capture the biometric fingerprint of students and use it to check attendance to lectures and other activities. Also, biometrics ensures physical presence unlike password and card security systems which are transferable. The fingerprint device attendance taking method is an efficient method that needs no supervision of a principle. Also, this automated system allows the guardians of the students to monitor and follow up on the attendance of their students anytime and anywhere in real time via web-interface system. Also, it allows the guardians of the students to have reports of their students' attendance via e-mail. As shown in figure 1, this study proposes a modular system that consists of three separate parts in order to make it more flexible and suitable to use at any institute based on the need. The three parts of the system have the same concept of fingerprint devices, which are fingerprint reader, control unit and store unit, so it can be used in corporate environments easily by some modifications in software.

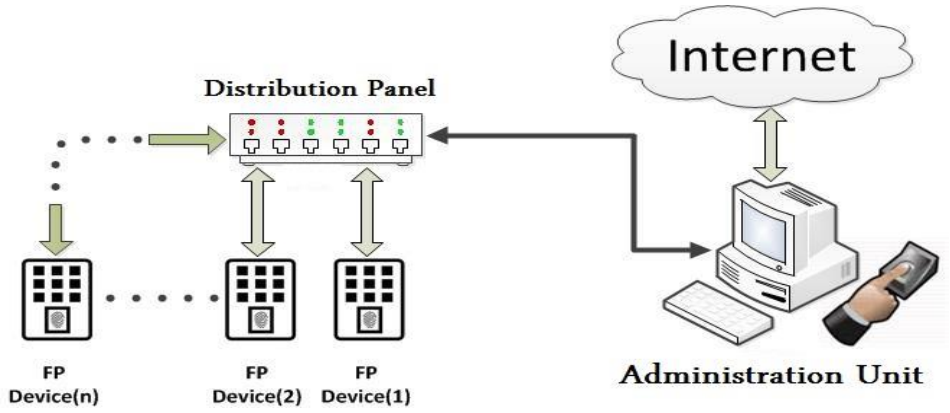

Figure (1): System's Structure

2. Related Works

There are many of previous researchers have worked on students' attendance system using various biometric technologies such as fingerprint, face and eyes recognition. However, all these studies are limited to attendance issue and neglect other benefits such as the monitoring of students' attendance by their guardians via website. The work in [1] uses a portable fingerprint to take attendance in a class. A teacher shall

take the portable fingerprint device with him and pass it in the class to all students. At the end of a class he shall move all data from the portable fingerprint device to a computer, so this way still wasting the time. Research [2] focuses on design and analysis of student biometric attendance system and staff. Moreover, its system monitors the attendance via online Internet interfaces. It's a good work but it doesn't mention how to allow students' guardians to monitor their students on the website or via email message. In [3] the work takes the same principles of fingerprint attendance system and is implemented for Christian service University College. However, its system is interested deeply in registering fingerprint template. In [4] the work uses fingerprint to take attendance in a class. Also, the recommendation they made is highly commendable in terms of packaging for easy use and mobility. However, there is nothing about the reporting of students' attendance, which can evaluate the rate of discipline for each student, or the monitoring of students' attendance by their guardians. In [5] the work proposed online students 'attendance monitoring system using RFID (Radio Frequency Identification technology). However, it uses the ID card affixed with RFID tag. Hence, when a student or staff forgets his ID card they will not be recognized by the system.

3. System design and components

Our proposed system consists of three main parts in order to make the system more flexible and suitable to use at any institute based on the need. The parts of the proposed system are fingerprint reader, control unit and PC or server, that is connecting with Internet, as shown in figure 2.

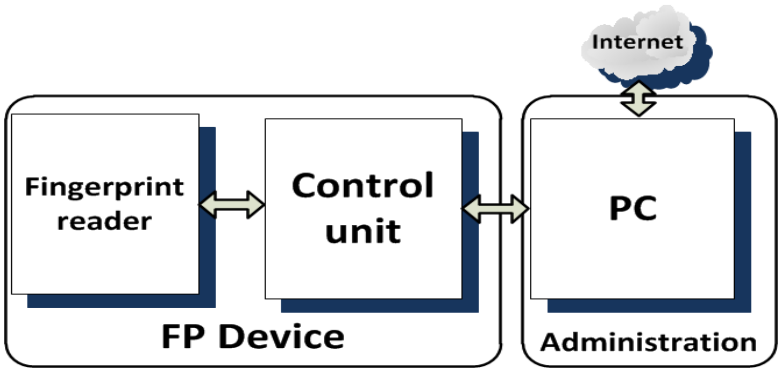

Figure (2): Block diagram of the proposed system

3.1 Fingerprint reader

It is a device that works to record and match human fingers. It's integrated with control unit to create a device called fingerprint device. The fingerprint device should be located in a class and connected to a management PC or server by serial technique RS 232 or RS 485.

3.2 Control Unit

It is a device that controls fingerprint reader and communicates with the server to download or upload data. The controlling unit consists of a microcontroller, buttons and LCD. The LCD displays the status and details of each student during the enrolment and during the attendance taking processes. It also displays date and time. The control unit has an interface for enrollment operations of the finger print reader.

3.3 PC

PC or server that is used to manages fingerprint attendance system and its applications. All applications are called a GUI. A GUI applications in the server help to manage fingerprint devices and attendance of students by transferring students list to the fingerprint device, storing all data for whole system in a database, showing statistics of attendance on website and sending reports by Email. The data can be accessed by only authorized person.

Generally, this system is made up of the data capture system (enrollment system). Students will be requested initially to record their fingerprint during the registration process. They will have only to place their fingers on the fingerprint reader. Then, the system will automatically submit the name of the students along with date and time to the controlling unit. The system has a user-friendly interface for fingerprint enrollment and verification. The database provides the data elements expected in the data capture phase. However, the most important are fingerprint and student identification number. After initial registration, the data which has provided can be used as a lecture attendance list. The system can generate a report concerning the percentage attendance of students to each course at the end of the semester. Also, it helps to verify of a student who actually takes the exam. The graphical user interface in the PC or Server allows the system administrator to monitor and produce statically reports of the students' attendance status.

4. System Implementation

4.1 The Hardware

The major hardware part of the system is the fingerprint reader module R305. It is used to capture finger images, convert it to finger templates and save the templates for future matching. Another important part is the microcontroller ATMEGA328P.Itis

aRISC microcontroller from ATMEL and it has 32MB of flash memory, 2KB of RAM and 1KB of EEPROM. The microcontroller works as a link between fingerprint reader and other system components including management server and database. As shown in figure 3, the main board contains RTC chip DS1307 to handle the date and time. Also, it contains a large EEPROM chip which is used to save the attend records. The chips MAX232 and SN75176 are used for communication with the management server. Last part is the 4 lines LCD which is used to display the academic numbers and status of the device, as shown in figure 4.

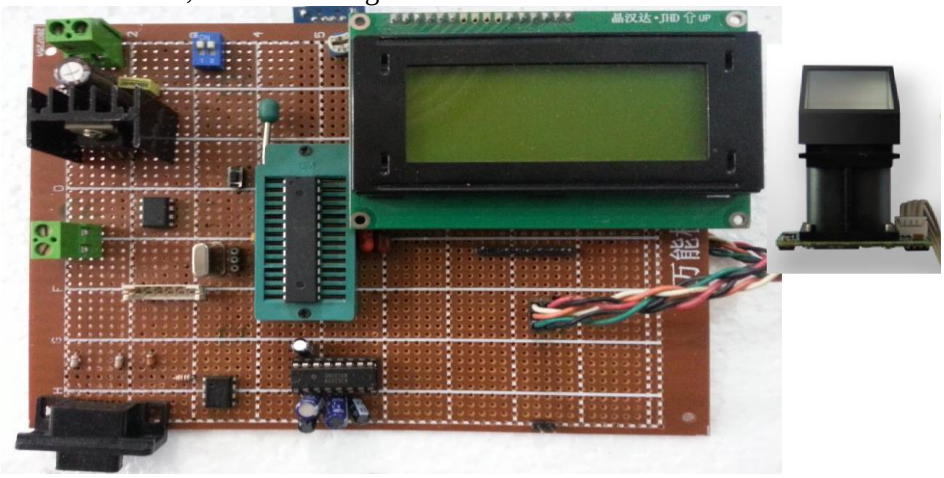

Figure [4] describes the LCD that is used with microcontroller circuit to show date, time and some information that describe the current process and result.

Figure (4): LCD Display

4.2 The Software

The design methodology of the software part includes all applications that the fingerprint attendance system needs such as microcontroller code, software design, database design and web portal design. All applications that manage whole system depend on information of students and timetables of courses.

4.2.1 Flow Charts

There are three basic flow charts that explain how this system is working and describe its basic functionalities such as new fingerprint enrollment, logging events for students which are used to make sure their attendance and checking commands that issue from administration (server), as shown in figures 5, 6 and 7. Figure 5, that is called a student enrollment chart, is used in server application to register fingerprint template of student. This is applied in classrooms when the students record their attendance. As shown in figure 5, the student starts enrolling his fingerprint then the system generates a first template and requests enrolling again to generate a second template. Then, it compares the two templates to ensure enrolling in the right way and stores fingerprint template in the database with information for that student.

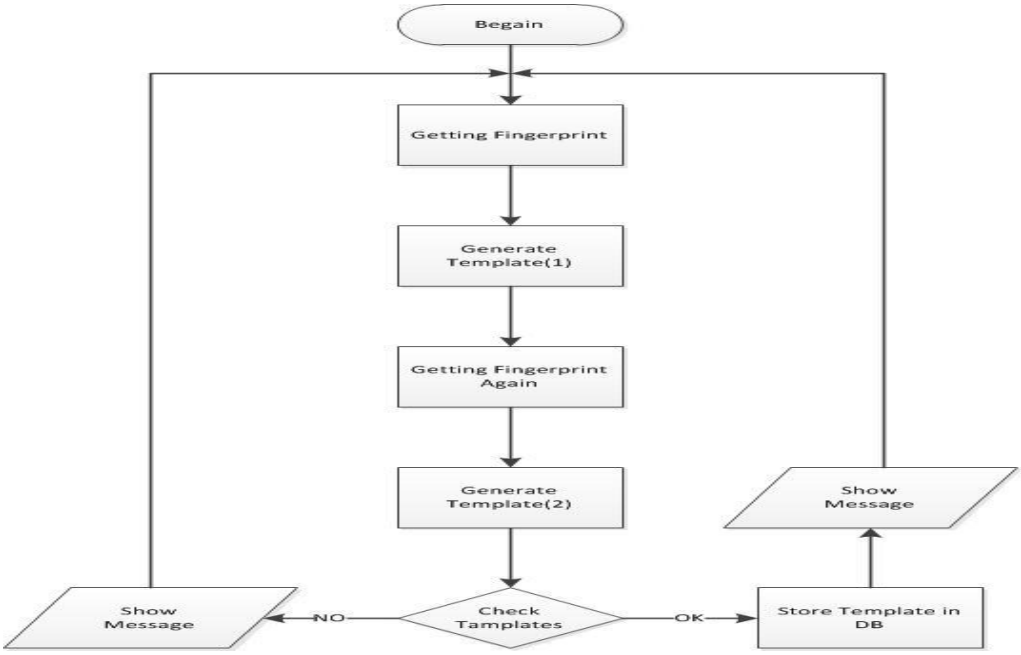

Figure (5): A Student Enrollment Chart.

Figure 6 describes the chart for process of logging of attendance. It starts by putting fingerprint for a student to match his fingerprint template that was registered before, when the current fingerprint template matches the stored template that was registered before, the fingerprint device records a logging of attendance for a student by his

academic ID, date and time. The algorithm of chart in figure 6 is used in the fingerprint device.

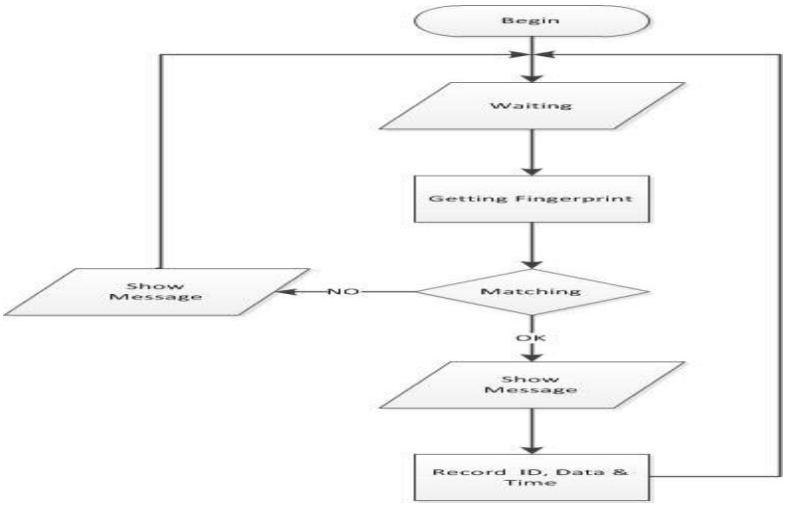

Figure (6): A Logging of Attendance Chart.

Figure 7 describes the algorithm of data transferring process between fingerprint device that located in classrooms and server.

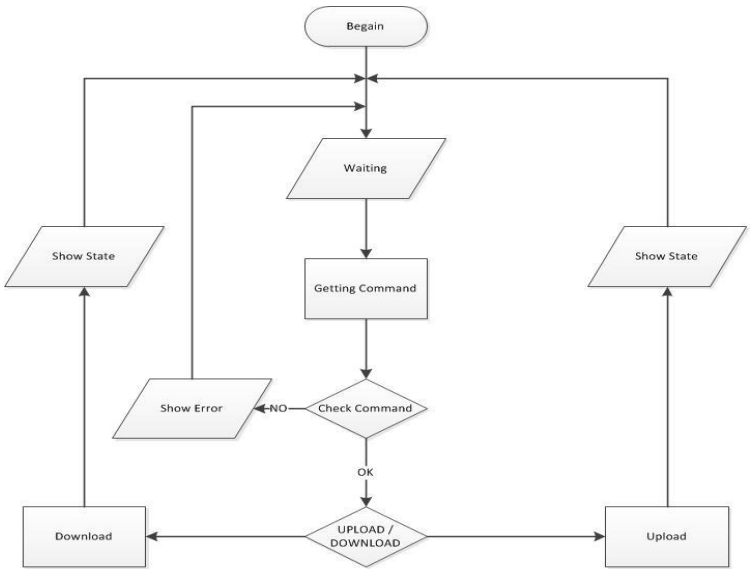

Figure (7): The Commands Checking Chart.

The download part in the previous figure moves students' fingerprint template to the fingerprint device according to timetable of the lectures, while the upload moves logging attendance recorders to the server to analyze them and generate attendance's reports.

5. System Testing

This system is applied to the University of Science and Technology, Faculty of engineering. The faculty timetables of courses are used in this test. The following figures describe some of the windows that are designed for this system's applications.

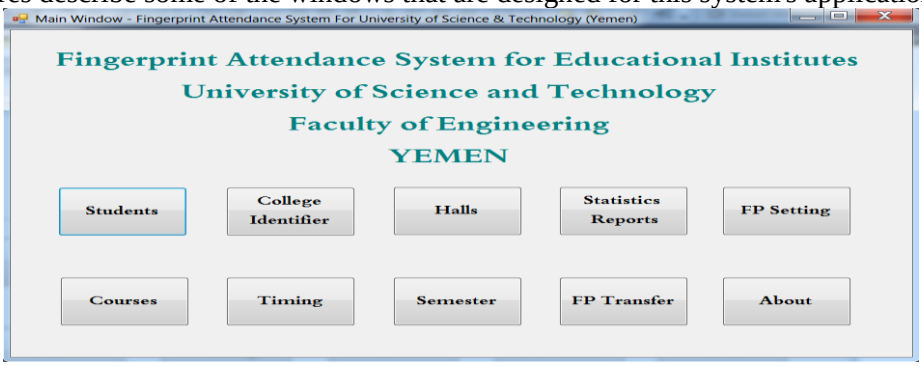

Figure (8): The Main window for Fingerprint

Figure 8 describes the main window that allows to access to all functionalities.

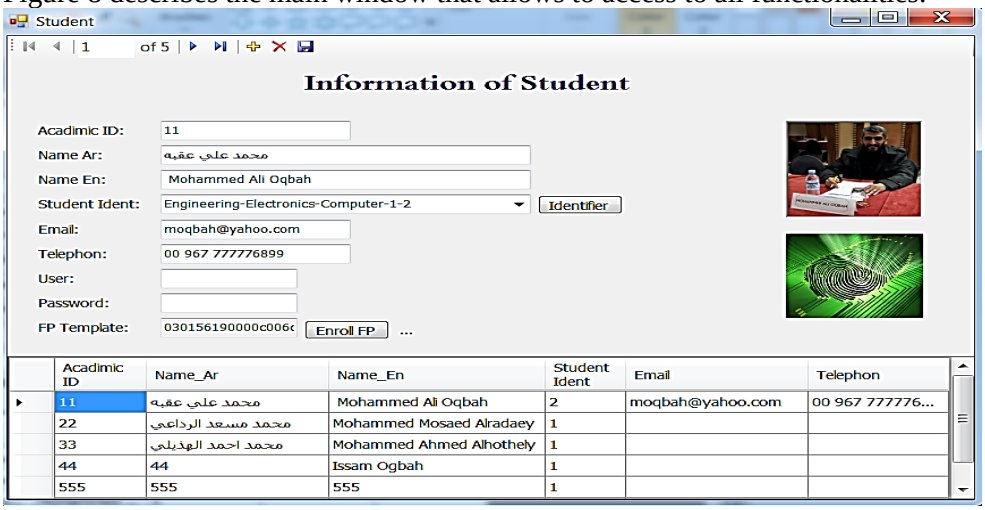

Figure (9): The Information of Students

The window, that is shown in figure 9, can manage a registration process (added, modification, deleting) for students' information. Also, it is included pictures and fingerprint templates.

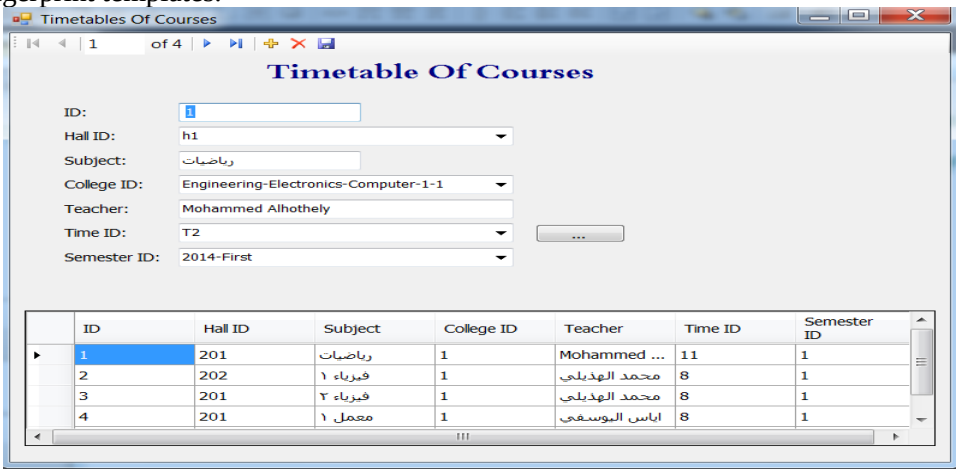

Figure (10): The Timetable of

All information about students' courses is managed by the window that is shown in figure 10.Also, there is a window forhalls'(classrooms) information shown in figure 11.

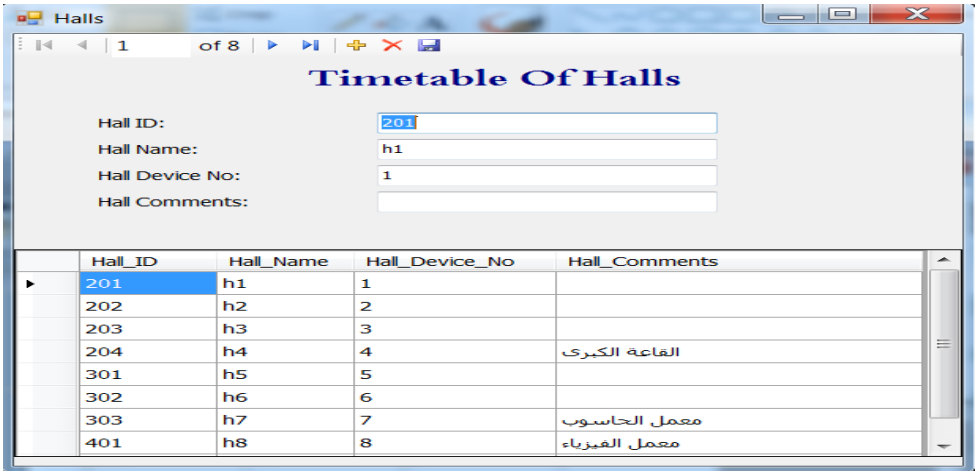

Figure (11): The Timetable of Halls

The system can review the presence of students in the form of statistics at the college level, department or field or a student, according to the selection, as shown in figure 12.

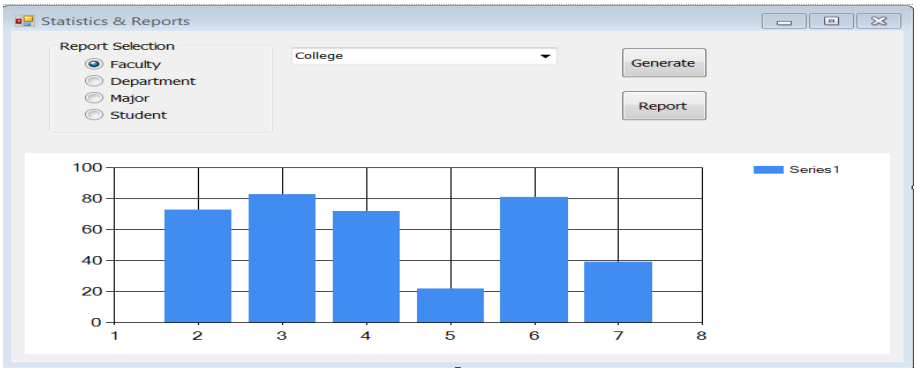

Figure (12): Statistics and Reports window to evaluate percentage of attendance for each item (college, Department, Major and

Also, the system can review the student's attendance on a web page, especially for guardians in brief or detailed, as shown in figures 13 and 14.

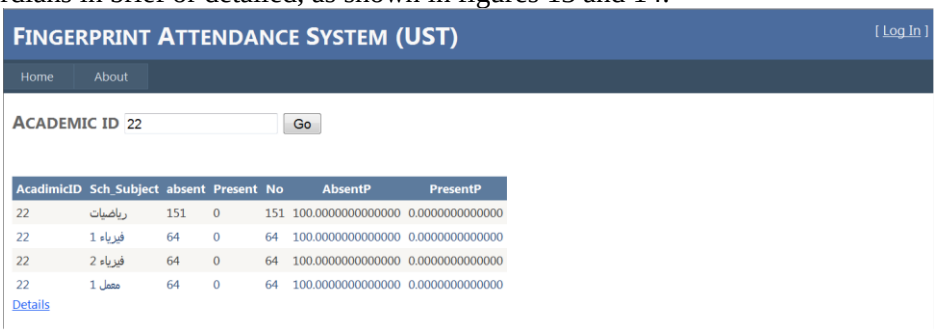

Figure (13): WEBPAGE shows percentage of attendance

Figure (14): WEBPAGE shows details for attendance of student

6. Conclusion

The proposed designed of the fingerprint attendance system solves the attendance issues by the following means: no time waste as the attendance is taken during lecture without intervention of teacher, flexibility to use schedules of college, managing the attendance is automated, no chance for fake attendance marking, evaluate level of attendance for students automatically, show students' attendance reports on web and sending reports by E-mail to guardians. Also, this system can apply easily for staff of teaching to evaluate state of teachers' discipline at dates of lectures. Furthermore, it can be extended to include all information about students to be show on the web. The main feature of the proposed system is the low cost.

7. References

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