

Design And Implementation Of Class Attendance Management System Using Fingerprint Recognition

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ABSTRACT

Attendance is the action or state of going regularly to or being present at a place or event. Attendance in an organization is important to ensure the continuous operation as it determines the strength of the organization. In most institutions the current attendance monitoring system for students is still being manually done. This method is time consuming, error prone and fosters laziness on the part of students, nonchalance attitude to classroom lectures and activities, student nepotism and deliberate lecture skipping which may prevent students from obtaining good academic performance. One reliable and efficient way to curb and totally do away with the error prone, student nepotism etc. is employing computerized fingerprint recognition attendance monitoring system which will enable management of the department ascertain the academic strength of each student in terms of student punctuality, regularity, commitment to classroom lectures and generate reliable attendance report for each student stored in a secured database. The system will also enable parents/guardian to monitor their wards as attendance report will be sent to them via email anytime the student misses a class. This paper presents an attendance system was designed using Visual Basic.Net which was used to connect the text field to database and MySQL was used for the database solution.

KEYWORD: DATABASE, ATTENDANCE SYSTEM, FINGERPRINT, FINGERPRINT RCOGNITION,
STUDENT REGISTRATION

INTRODUCTION

Attendance register system is very important in the learning process and one of the main aspects that determine students' performance. Even though there is no causal relationship between students high attendance and good academic performance, but there is a positive link between them. Usually, students with good or excellent academic performance have high attendance rate (kamal 2015). The student's academic information consists of monitoring their performance and progress periodically which seems to be a huge workload on lecturers to handle and update on the progress of subjects for the respective classes (**Somasundaram et.al 2016**). Keeping these issues in mind a system is designed to overcome the problems associated with attendance system. Biometric systems have been widely used for the purpose of recognition (**Tabassam 2009**). These recognition methods refer to automatic recognition of people based on some specific physiological or behavioral features such as facial, iris/ retina, voice, DNA and fingerprint. fingerprint recognition has a very good balance of all the desirable properties. Every human being possesses fingerprints with the exception of any hand related disabilities. Fingerprints are very distinctive fingerprint details are permanent, even if they may temporarily change slightly due to cuts and bruises on the skin or weather conditions. Live-scan fingerprint sensors can easily capture high-quality images and they do not suffer from the problem of segmentation of the fingerprint from the background. The deployed fingerprint-based biometric systems offer good performance and fingerprint sensors have become quite small and affordable because fingerprints have a long history of use in forensic divisions worldwide for criminal investigations. A fingerprint is the pattern of ridges and valleys on the surface of a fingertip. The end points and crossing points of ridges are called minutiae. It is a widely accepted assumption that the minutiae pattern of each finger is unique and does not change during one's life. Ridge endings are the points where the ridge curve terminates, and bifurcations are where a ridge splits from a single path to two paths at a Y-junction. an example of a ridge ending and a bifurcation is illustrated in Figure 1. In this example, the black pixels correspond to the ridges, and the white pixels correspond to the valleys.

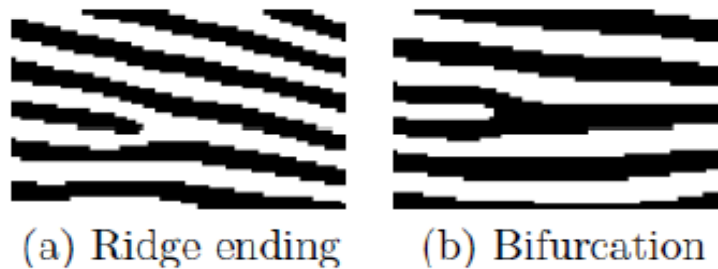


Figure 1 Example of a ridge ending and a bifurcation (Rishabh & Prashant 2011)

Attendance Management System is software developed for daily student attendance in schools, colleges and institutes (Saurabh et. al 2017). An attendance management system is a combination of software and hardware system developed for daily student attendance in schools and institutions. This facilitates access to the attendance of a particular student in a particular class. This system will also help in generating reports and evaluating the attendance eligibility of a student (sogbaike et.al 2018). The students tend to sign for their friends who are not present for that day. Manually computing for the total percentage of attendance a student meet is as tedious as the attendance sheet could be irregular or even misplaced. The verification and authentication of student to determine the student eligibility for exam with the use of identity cards can be inadequate since the plastic identity cards can be forged. The use of hand held attendance management device as presented in sogbaike et.al 2018 has drawbacks such limited attendance space of 100 students (small size memory), the device has an operation time of maximum fifteen minutes caused by limited power supply (device is battery powered). All of these problems present in sogbaike et.al (2018) this paper seeks to solve.

Review of related works

Tabassam et.al 2009 developed an Academic Attendance Monitoring System Using Fingerprint Identification for four (4) courses and fifty (50) students. The system was developed using Digital Persona's Software Development Kit, Microsoft Visual Studio 2008 and Sql Server 2005, interfaced with a fingerprint scanner for

biometric Identification. There are five algorithms implemented in this system firstly, Capture the student's fingerprint sample and create a feature set i.e a set of unique features created to match fingerprint, secondly, Retrieve the stored templates from the repository (database), thirdly, Perform a one-to-n comparison between the fingerprint feature set and the fingerprint templates stored in database, make a decision of match or non-match. Fourthly, if match is found retrieve student's information (Registration number, Department, Subjects) from the database. And finally obtain the scheduled lecture from the database and mark attendance if student is within the specified time i.e. within 30 minutes of the lecture's starting time. If verification is not done or there is some error in enrollment of fingerprint, system goes back to its initial state without marking the attendance. Upon testing of the system there where 50 (fifty) identifications forty nine had successful identification one was unsuccessful meaning 98% performance but the system didn't incorporate a feedback mechanism In the presence of impersonation.

Kamal 2015 in a project titled development of academic attendance management system using bluetooth technology, designed and developed a system that manages attendance of students. The system consist of Arduino UNO, Adafruit Fingerprint Sensor , HC-05 Bluetooth Module (Master/Slave), and a laptop computer. The aforementioned components are connected together to obtain attendance from the student which is transmitted through the Bluetooth to the laptop for collation. The drawbacks of this system is that the operation time for the hand held device is not stated, the attendance size was not stated and the Bluetooth device has a communication distance of 10 meters thus exceeding 10 meters there will be no communication.

Somasundaram et.al 2016 in a paper titled Mobile based Attendance Management System, deployed an attendance management system where students takes attendance by first login on to a webpage to register and then after registration attendance taking process begins. The student on the other hand uses a mobile phone with an android mobile application which enable communication between the lecturer and students via sms. A significant draw back is if the server is down attendance for the day using the system is not realizable.

Neha et.al 2013 in a paper titled an efficient automatic attendance system using fingerprint reconstruction technique developed an attendance management system using finger print recognition system. The attendance system consist of Fingerprint Scanner, LCD/Display Module, Computer (4)LAN connection . This attendance system consists of 100 fingerprint scanners , 100 desktop computers and a LAN infrastructure. Fingerprint scanner will be used to input fingerprint of teachers/students into the computer software. LCD display will Software will be interfacing fingerprint scanner and LCD and will be connected to the network. It will input fingerprint, will process it and extract features for matching. After matching, it will update database attendance records of the students.

Ikuomola (2015) designed and developed an Educational Time and Attendance Management System (eduTAMS). The system is fingerprint-based comprehensive attendance management system for universities and colleges. It employs the use of electronic fingerprint scanner interfaced to the digital computer system for verifying student identity. The student Identity is authenticated by the fingerprint-based biometric system which compares the captured fingerprint image with fingerprint templates stored in a database. The student is granted or denied specific lecture attendance based on the result of the comparison by the backend software system running on the PC to which the fingerprint scanner is interfaced. The main purpose of this system is to take attendance of the students for lectures, calculate the attendance rate of each student and use this record with specified percentage requirement to perform authentication for access into examination venues. eduTAMS was implemented on a network environment using C# and Microsoft SQL Server 2008. Testing of eduTAMS showed no false acceptance or false rejection but showed true rejection and true acceptance.

Akinduyite et.al (2013) developed a Fingerprint-Based Attendance Management System that consists of two processes namely; enrolment and authentication. During enrolment, the fingerprint of the user is captured and its unique features extracted and stored in a database along with the users identity as a template for the subject. The unique features called minutiae points were extracted using the Crossing Number (CN) method which extracts the ridge endings and bifurcations from the skeleton image by examining the local

neighborhoods of each ridge pixel using a 3 x 3 window. During authentication, the fingerprint of the user is captured again and the extracted features compared with the template in the database to determine a match before attendance is made. The fingerprint-based attendance management system was implemented with Microsoft's C# on the .NET framework and Microsoft's Structured Query Language (SQL) Server 2005 as the backend. The experimental result shows that the developed system is highly efficient in the verification of users fingerprint with an accuracy level of 97.4%. The average execution time for the developed system was 4.29 seconds as against 18.48 seconds for the existing system. Moreover, the result shows a well secured and reliable system capable of preventing impersonation.

System design

In figure 2 is the architectural diagram of the students' attendances management system using fingerprint recognition

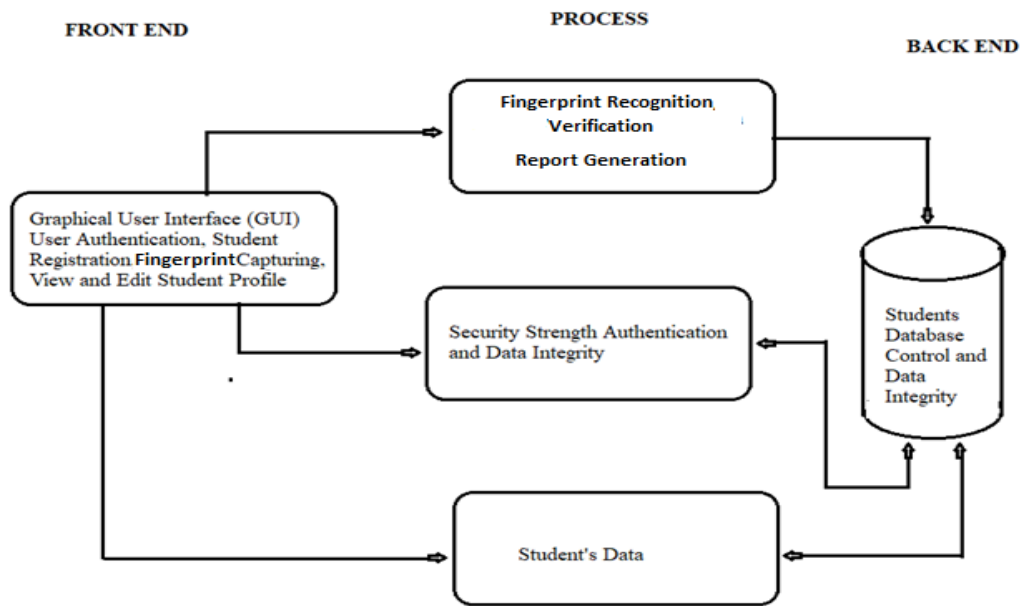


Figure 2 Architectural Diagram

The system design is more reliable and robust than the existing system as in sogbaike et.al 2018 in terms of taking attendance. Here the admin/lecturer accesses the application on the computer system and can view

student data including capturing of their fingerprint. Once this is can be done, the software recognizes the student based on the biometric (fingerprint) data entered

SYSTEM REQUIREMENT

Computer system is made up of units that are put together to work as one in order to achieve a common goal. The requirements for the implementation of the new system (student attendance management system) are:

- a) The Software
- b) The hardware

Software Requirement

For the effective implementation of the new system, the following software has to be installed on the computer system.

- i. Windows 7 operating system or later
- ii. MySQL
- iii. Visual basic.NET

Hardware requirement

- i. Pentium VI and above
- ii. 256 MB RAM and above
- iii. 40GB HD and above
- iv. CD-ROM drive

The design language is VB.NET and for the database administration system, MySQL database was utilized as a part of dealing with information's inside the system. With this system Security is ensured: Student won't have the capacity to stamp attendance for their kindred colleague since it requires understudy's fingerprint to check attendance. Data put away in the new system will be exceedingly secured. There will be no removal of

information and data or misusing of information and data which will prompt harm. Just approved clients will be permitted to approach the database system

The database name is Attendance and consists of five tables some of the tables are shown below:

1. fingerprint_capture
2. Attendance
3. Departments
4. faculty
5. levels
6. table person

Table 1.1: Fingerprint_capture

Column	Type	Null	Default
<i>gu_id</i>	varchar(50)	No	
Fingerprint image	Longblob	Yes	NULL
FingerprintCode	Longblob	Yes	NULL
serial_number	bigint(20)	No	
Height	bigint(20)	No	0
Width	bigint(20)	No	0
server_date_time	Timestamp	No	CURRENT_TIMESTAMP

Table 2.2: Attendance

Column	Type	Null	Default
gu_id	varchar(50)	No	

<i>SN</i>	int(11)	No	
Fullname	Text	Yes	NULL
Department	Text	Yes	NULL
Faculty	Text	Yes	NULL
Level	Text	Yes	NULL
Matric_No	Text	Yes	NULL
Posting_Staff	Text	Yes	NULL
Attendance_Date_Time	datetime	Yes	CURRENT_TIMESTAMP
Server_Date_Time	datetime	Yes	CURRENT_TIMESTAMP

Table 3.3: Departments

Column	Type	Null	Default
<i>department_id</i>	int(11)	No	
Department	text	Yes	NULL
Faculty	text	Yes	NULL
faculty_id	int(4)	Yes	NULL

Table 4.4: Faculty

Column	Type	Null	Default
<i>faculty_id</i>	int(11)	No	
Faculty	varchar(50)	Yes	NULL
faculty_abbrev	varchar(10)	Yes	NULL

Table 5.5: Levels

Column	Type	Null	Default
SN	int(11)	No	
Level	varchar(10)	No	
posting_staff	varchar(200)	No	
server_date_time	Timestamp	No	CURRENT_TIMESTAMP

A use case diagram as shown in figure 3 graphically depicts the interactions between the system, the external system and the user. Use case diagrams play a major role in system design because it acts as a roadmap in constructing the structure of the system

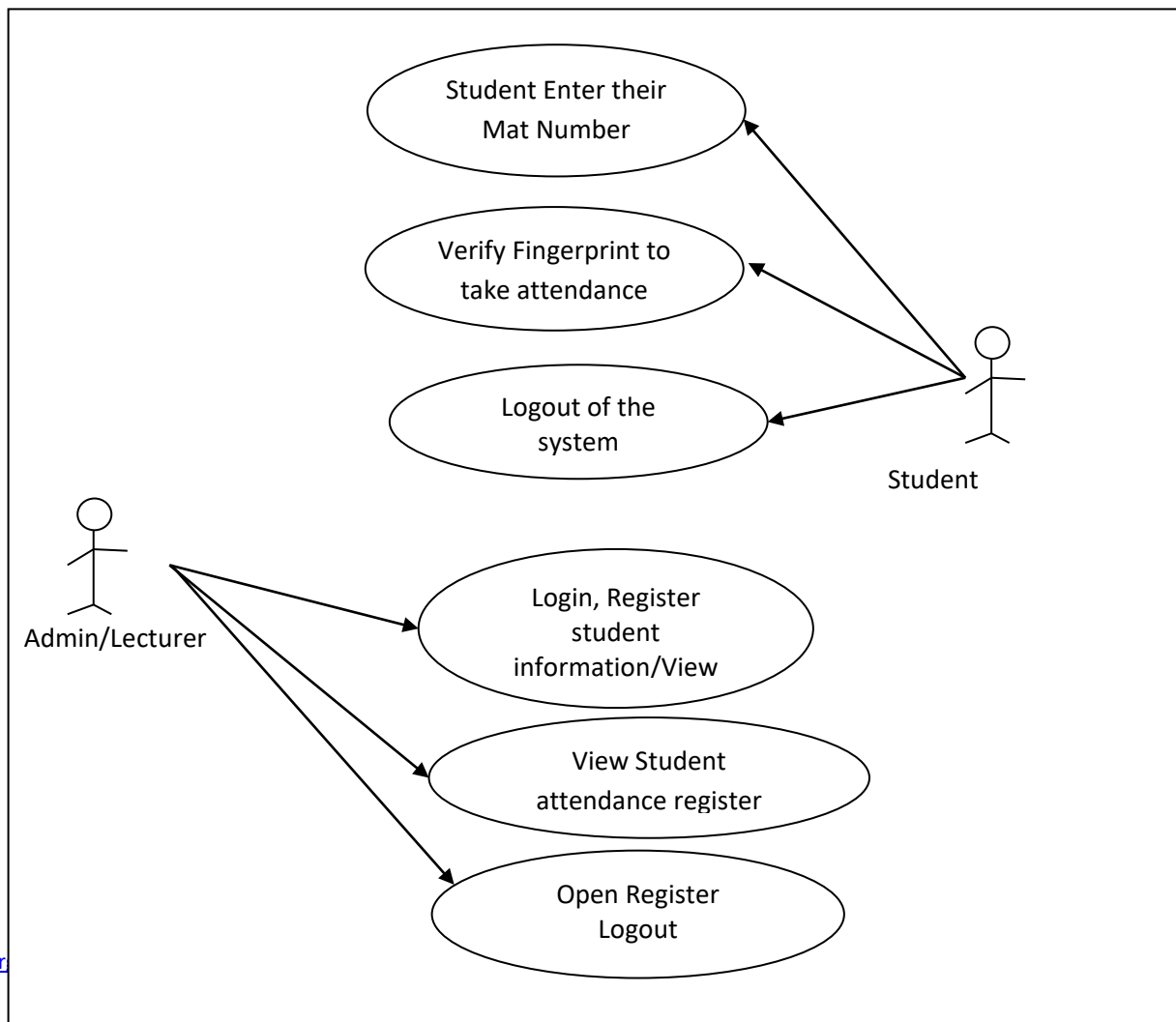


Figure 3: Use case diagram for the system

IMPLEMENTATION AND DOCUMENTATION

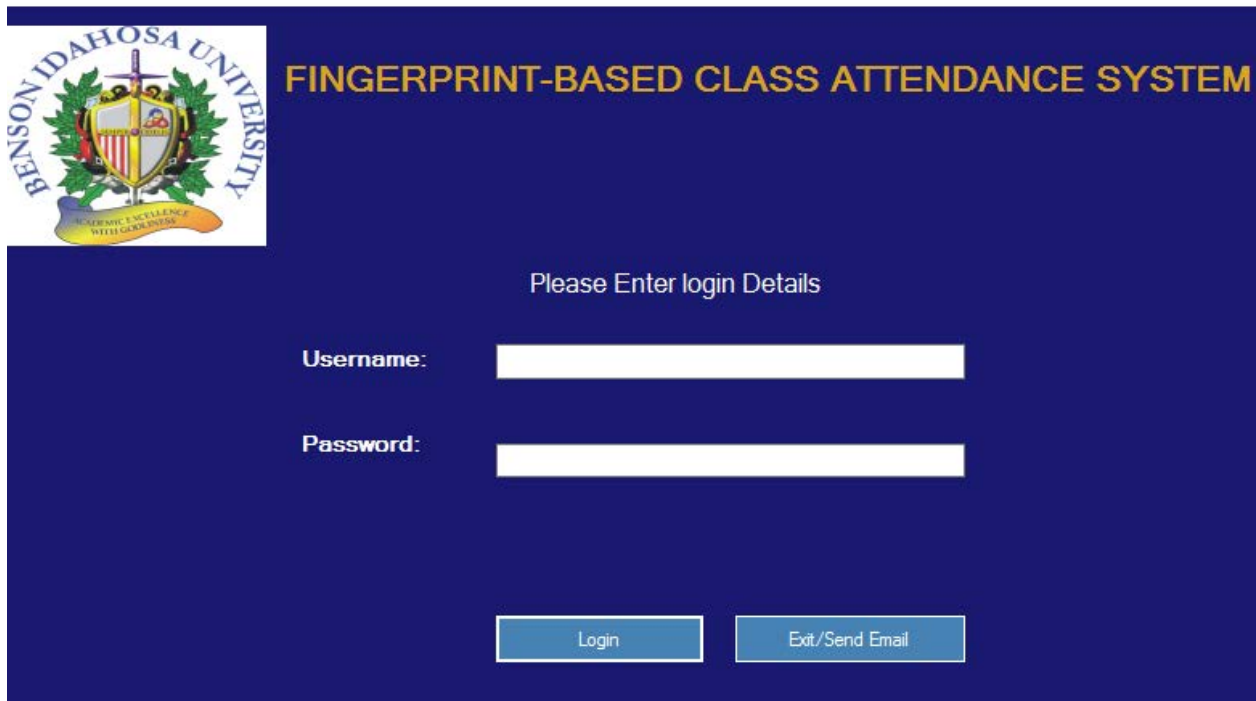
Figure 4 and figure 5 shows an implementation of the finger print based class attendance system showing student registration form and login interface respectively

The screenshot displays the 'Student Registration' interface of the 'FINGERPRINT-BASED CLASS ATTENDANCE SYSTEM'. On the left is a navigation sidebar with the university logo and menu items: 'Search For Students', 'Student Registration', 'Attendance', and 'Reports'. The main area contains a registration form with the following fields and controls:

- Matric No.: BAS/CSC/170019 (with a 'Cancel' button)
- Surname: ODILI
- First Name: NNIAMDI
- Other Names: LAWRENCE
- Guardian's Email: odilawrence6@gmail.com
- Gender: MALE (dropdown menu)
- Department: COMPUTER SCIENCE (dropdown menu)
- Faculty: BASIC AND APPLIED SCIENCES (dropdown menu)
- Level: 400 LEVEL (dropdown menu)
- Matric No.: BAS/CSC/170019

Buttons on the right side include 'Enrol Fingerprint', 'Save', and 'Exit'. A 'Sign Out' button is located in the top right corner of the header.

Figure 4 student registration form



The image shows a login interface for a system titled "FINGERPRINT-BASED CLASS ATTENDANCE SYSTEM" at Benson Idaho State University. The interface is set against a dark blue background. In the top left corner is the university's logo, which features a shield with a cross and a banner that reads "ACADEMIC EXCELLENCE WITH GRACIOUSNESS". The title of the system is displayed in large, bold, yellow letters at the top right. Below the title, the text "Please Enter login Details" is centered. There are two input fields: one for "Username:" and one for "Password:". At the bottom of the form, there are two buttons: a blue "Login" button and a blue "Exit/Send Email" button.

Figure 5 Login form

Figure 6 is shows the attendance summary of the fingerprint class attendance system generated during the attendance process

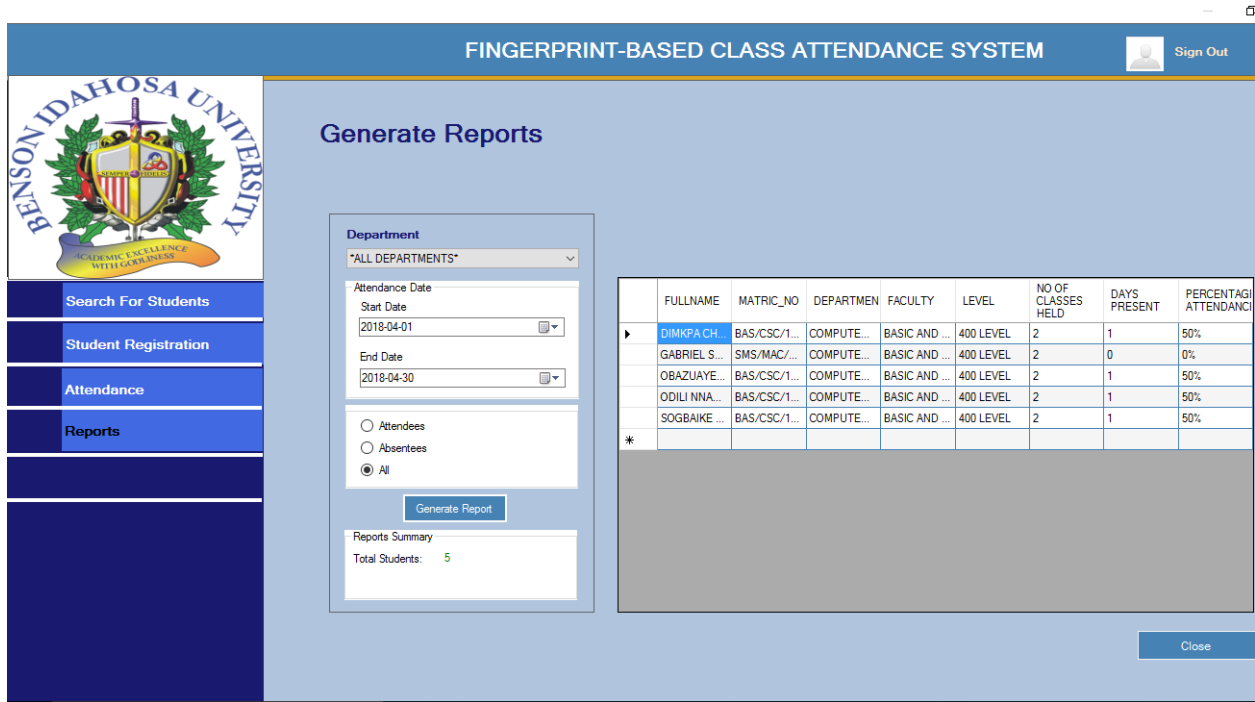


Figure 6 generated report

Test Result

This is the result obtained after testing the system with the test plan and test data. During the testing, the actual and expected results were compared to ensure they produced same result or if there is a difference, it should be slight and negligible. Hence the result:

Table 6: Comparison between expected and actual results

TEST CONDUCTED	EXPECTED RESULT	ACTUAL RESULT
Admin enters username and password	Admin should be able to access the main menu if the correct user name and password is entered properly.	Admin that enters the correct username and password was granted access to the main menu
Admin click on student	Admin enters a new student	Admin was able to login to the

information	Information to get his or her user details.	system and view student details
Lecturer/admin clicks on take attendance	A form will be displayed to the user, the form enables the students to capture and take attendance	The lecturer/admin was able to take students attendance.

Conclusion

The enhanced student attendance management system using fingerprint authentication solves the problem of buddy signing, lopsided records and impersonation. The system preregisters and authenticates student during attendance process, determines the eligibility of a student for exam based on the threshold number of times of attendance by each student and finally validates if there is a case of impersonation prior to examination and sends e-mail if there is such occurrence.

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