Universal Student Identification Using RFID

Software Requirements Specification

Version 1.0

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The Great Mind Challenge'12
Initiate Collaborate Innovate

Revision History

Date	Version	Author
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1.0 Introduction

1.1 PURPOSE

The main aim of this project is to simplify the process of managing student and faculty functions in a university. In this project we implement Automated Attendance Marking, Faculty Salary Issue, Internal Marks Calculation and Performance Report Generation. An automatic email would be sent to the parents, students and faculty of the department regarding the monthly reports.

Hence the basic idea is to develop a system which provides fool-proof means of attendance marking and also integrates all student and faculty activities in a university.

1.2 SCOPE

Today, a lot of time is spent during class hours for attendance in the form of roll-calls. In this system, each student and faculty is given an RFID tag. The card can be swiped at a card reader to mark their presence. Also, the faculty can enter the Unit Test/ Internal Assessment scores and the Internal Marks will be automatically calculated based on the Attendance and Lab marks. This saves a lot of time for the faculty in a university.

There are four basic users: Student, Faculty, Administrator, and Parent. The following are the goals of the system:

* The students use their RFID cards to mark their attendance.
* The faculty updates the Unit Test scores periodically and the Internals Marks will be calculated automatically according to the guidelines set by the Admin.

* Automatic emails and SMS would be sent to the students, parents and faculty regarding Monthly Performance Reports or Salary Issue. An email and SMS would be sent to all faculty members when the salary has been issued.
* Admin can add new students, courses and faculty. Each student, parent and faculty would be given a Username and Password by the Admin.
* The entire system is configured by the Admin, that is, he/she sets the hierarchy of the institution and the basic guidelines of the university.

1.3 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

- **RFID** – Radio Frequency Identification. It is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking. This system uses *tags*, or *labels* attached to the objects to be identified. Two-way radio transmitter-receivers called *interrogators* or *readers* send a signal to the tag and read its response. The readers generally transmit their observations to a computer system running RFID software or RFID middleware.
- **RFID cards** – Refers to the RFID tag given to every student and staff at the University
- **Card Reader** – Refers to the interrogator needed to read the RFID cards/tags.
- **Admin** – Refers to the Administrator
- **Faculty/ Faculty member** – All refers to the Faculty of the University
- **Alumni** – Refers to ex-students of the University
- **InEntry –** it is marked when the student/faculty enters the classroom/department
- **OutEntry –** it is marked when the student/faculty enters the classroom/department
- **InEntry Session –** The time duration for marking the InEntry

- OutEntry Session – The time duration for marking the OutEntry
- Unit Test/Periodic Assessments – The tests conducted by the college every month on a small portion of the syllabus to test the understanding of the students
- Internal Marks – Usually the university norms are such that the total score obtained by a student in a semester for a subject is the total of the Internal and External marks. The external marks are a direct conversion of the marks scored in the End Semester examinations. The Internal marks usually account for a smaller proportion of the total score and they are calculated by taking the Unit Test marks and the Attendance marks into consideration.
- HTML (Hyper Text Markup Language): It is used to create static web pages.
- JSP (Java Server Pages): It is used to create dynamic web content.
- J2EE (Java 2 Enterprise Edition): It is a programming platform, belonging to the Java platform, which is used for developing and running distributed java applications.
- WASCE(WebSphere Application Server Community Edition):

It is an application server that runs and supports J2EE and web service applications.

- DB2(Database_2.): A database management system that provides a flexible and efficient database platform to maintain records of students, faculty, admin and dm.
- XML (Extensible Markup Language): It is a markup language that was designed to transport and store data.
- AJAX (Asynchronous Java Script and XML): It is a technique used in java script to create dynamic web pages.
- Web 2.0: It is commonly associated with web applications which facilitate interactive information sharing, interoperability, user-centered design and collaboration on the World Wide Web.

1.4 REFERENCES

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* Software Engineering, Seventh Edition, Ian Sommerville
* Software Engineering : A Practitioner's Approach, Roger S. Pressman
* Database System Concepts, Fifth Edition, Abraham Silberschatz,Henry F. Korth and S. Sudharshan
* Fundamentals of Database Systems, Fourth Edition, Ramez Elmasri, Shamkant B. Navathe
* The Complete Reference: J2EE , James Keogh
* Getting Started with DB2 Express-C, Raul F.Chong
* IBM Red Books.
* IBM Product Support
* DeveloperWorks Tutorials – www.ibm.com/developerworks
* Wikipedia - www.wikipedia.com

1.5 TOOLS AND TECHNOLOGIES TO BE USED

- **J2EE:** (Servlet, JSP, JAXP, Java Beans) Application architecture.
- **JAVA:** Application architecture.
- **Ajax:** Asynchronous Java Script and XML
- **XML:** Extension Markup Language.
- **Web 2.0:** RSS Feed 2.0.
- **DB2 10.1:** IBM Database.
- **IBM Data Studio 3.2.0 Client:** For handling Database Operations
- **Eclipse Helios IDE:** For convenient programming
- **IBM Rational Software Architect 8.0.3 :** For modeling
- **IBM Rational Application Developer for WebSphere :** To be used as an IDE
- **NetBeans 7.3 IDE** -another prospective IDE considered while development
- **Apache Tomcat 7 -** Used as Web Server

1.6 OVERVIEW

The SRS will include two sections, namely:

*Overall Description: This section will describe major components of the system, interconnections, and external interfaces.

*Specific Requirements: This section will describe the functions of actors, their roles in the system and the constraints faced by the system.

2.0 Overall Description

2.1 PRODUCT PERSPECTIVE

This system is implemented as a website hosted on a server. The browser loads the web page through HTTP protocol. The website will be hosted on Apache Tomcat Server. JavaServerPages and Servlets can be used to retrieve the data from the server. IBM DB2 Express-C will be the database used. It can be connected to the Java program using Java DataBase Connectivity (JDBC).

2.2 SOFTWARE INTERFACE

- Front End Client

  Any web browser: IE, Chrome, Firefox etc.

- Web Server

  Apache Tomcat Version 7.0

- Database Server

  IBM DB2 Express-C 10.1

- Development End

Eclipse Helios IDE (Java, J2EE, Java Bean, Servlets, HTML, CSS, XML, AJAX),Rational Application Developer for WebSphere, DB2, OS (Windows, Fedora)

2.3 HARDWARE INTERFACES

Client Side:

Machines with

- At least 2 GB RAM
- At least 64 GB Hard Disk
- Intel Pentium /Core or AMD processor
- Any Windows/Linux OS
- UPS Back-up for laptops in the classroom

RFID Reader Kit:

Serial Interface	
Interface	Interface RS232 and Wiegand
Connector	Berg pins and RMC for Wiegand (Optional)
Baud	9600 BPS
Data	8 bits
Parity Check	None
Stop Bits	1
Data Format	Send Tag ID HEX Value in ASCII format with Carriage Return & Line-Feed
Frequency	125 KHz
Read Range	up to 10 cm
Supported TAG	Supports reading of 64 Bit Manchester Encoded cards
Wiegand	26-Bit format
Indication	
Audio	Single BEEP for TAG read.
Power	
Input	5V DC (± 5 %)
Consumption	max 50 mA

Environmental Conditions	
Operating temperature	-20 ... +65° C
Storage temperature	-40 ... +75° C
Dimensions (LxWxH)	22 x 28 x 8 mm 25x25mm Antenna Board
Weight	100 gms

Active RFID Tags/Cards:

Type	Contactless read/write
Frequency	125 kHz
Color	White - silk screen or offset printing are available
Standard deployment	Wallet size tag with slot for attaching lanyard
Material	ABS or PVC
Encoding	Manchester
Operating Temperature	-10 °C to 50 °C
Dimensions	86 mm x 54 mm x 1.8 mm
Weight	9 g ±0.5 g

Server Side:

Server Machines with

- At least 4 GB RAM
- 500 GB HDD
- DB2 and WASCE installed.
- Intel Core/Xeon or AMD K8/K10 processor
- Any Windows/Linux OS

2.4 PRODUCT FUNCTIONS

The following are the functions of the system:

* Mark the student attendance. This is done by marking the InEntry when the student enters the classroom and the OutEntry is marked when the student leaves the classroom. The student is marked as present for the period only if both his/her InEntry and OutEntry are marked.
* The faculty will come into the class 10 minutes in advance and will start the InEntry Session. The students can swipe their cards for InEntry only during this sessionThe faculty manually stops the InEntry session. After the duration of the class, the OutEntry session will be started. The students can swipe their cards for OutEntry only during this session. This session will also be manually terminated by the faculty.
* The faculty can update the Unit Test/Periodic Assessment scores. The Internal Marks is the average of the tests conducted so far and also after considering the attendance marks.
* A monthly report is generated regarding the performance of the student in the Unit Test. An automatic email is sent to the parents and students regarding the same.
* Automatic emails are sent to the faculty when the salary has been issued.

2.5 USER CHARACTERISTICS

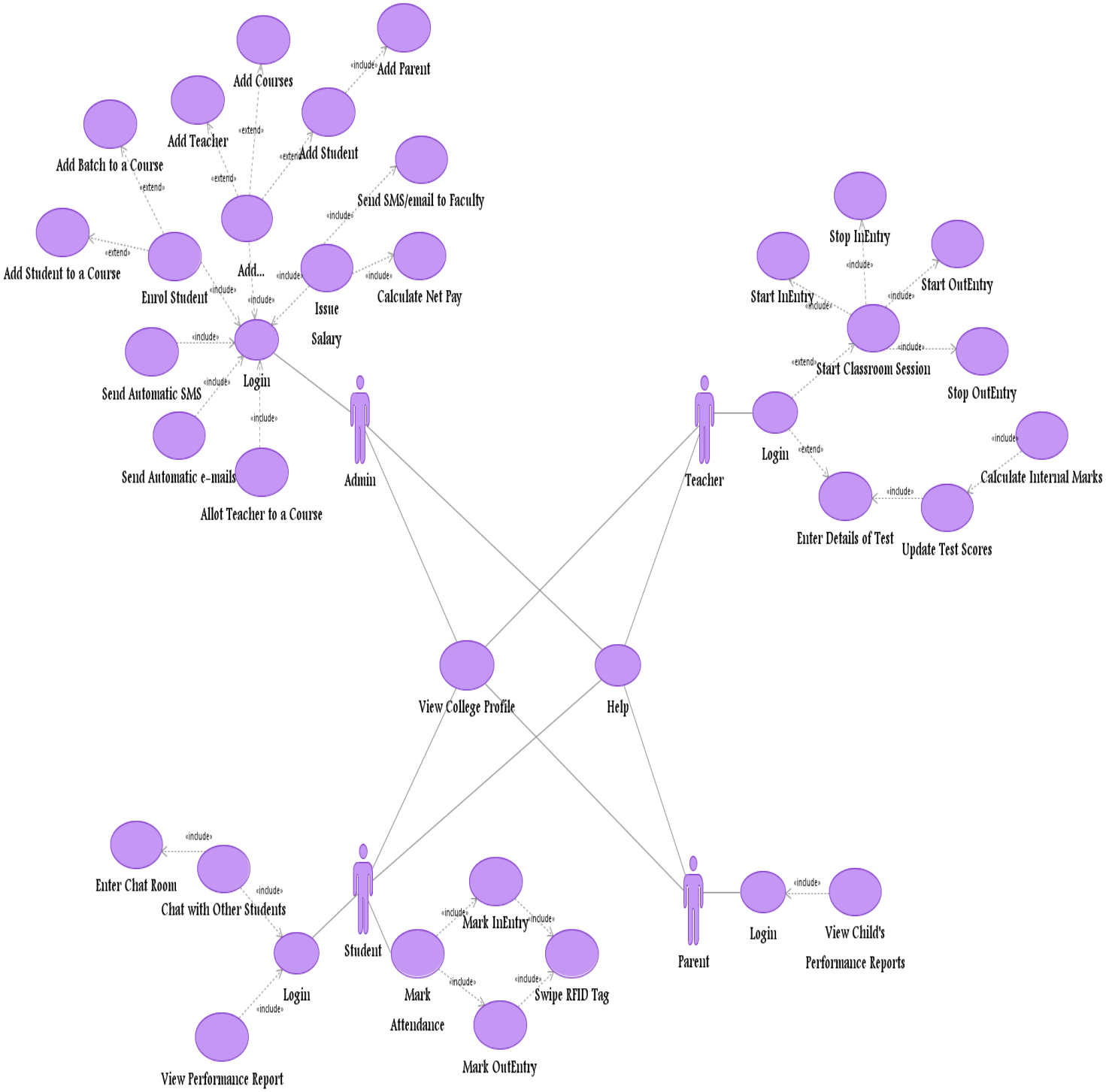
The following assumptions are made about the users of the system:

- The user should know how to use a computer and should be familiar about working with websites.
- The user should understand the English language.
- The students and faculty should know how to swipe their cards at a RFID card reader.
- The admin should be familiar with the working of the system and must be able to do a certain amount of trouble-shooting activities.

2.6 CONSTRAINTS

* Each user should have a valid username and password and must successfully login to the system to avail the functionalities.
* The system is limited to HTTP/HTTPS
* There should not be too much interference near the RFID card readers.
* For best viewing experience, browsers should be updated to their latest versions.
* The teachers must have a basic knowledge about working with computers

2.7 USE CASE DIAGRAM OF THE WHOLE SYSTEM



USE CASE MODEL DESCRIPTION:

STUDENT:

A student can mark his attendance by swiping his/her RFID tag. He/she can login with username and password to view their monthly Performance reports, or to chat with other students. The student can also access the help facility.

FACULTY

The faculty comes into the classroom about 10 minutes in advance and logs in to start the Main session. Then he/she can start the InEntry session. The students mark their InEntry by swiping their RFID cards while entering the classroom. The students have to mark their InEntry only during the InEntry Session. If any student swipes his card after the expiry of the InEntry Session, his InEntry will not be marked. Similarly, after the duration of the period, the OutEntry Session is started by the faculty. The students can swipe their cards and register their OutEntry while leaving the classroom. Only those students whose InEntry and OutEntry are marked will be considered present for the period.

The faculty also logs in to update the Unit Test scores or to calculate the internal marks. The faculty can also view the events happening in the college. Online help is always available to be used by the faculty at any time.

ADMIN:

The Admin is the Super-User who configures the system for the first time. He/she logs in to add new courses, faculty and students into the system. The Admin can enroll students a course and also allot teachers to courses. He/she sets the organizational details and the guidelines of the university during the first time installation and can be modified later by the Admin.

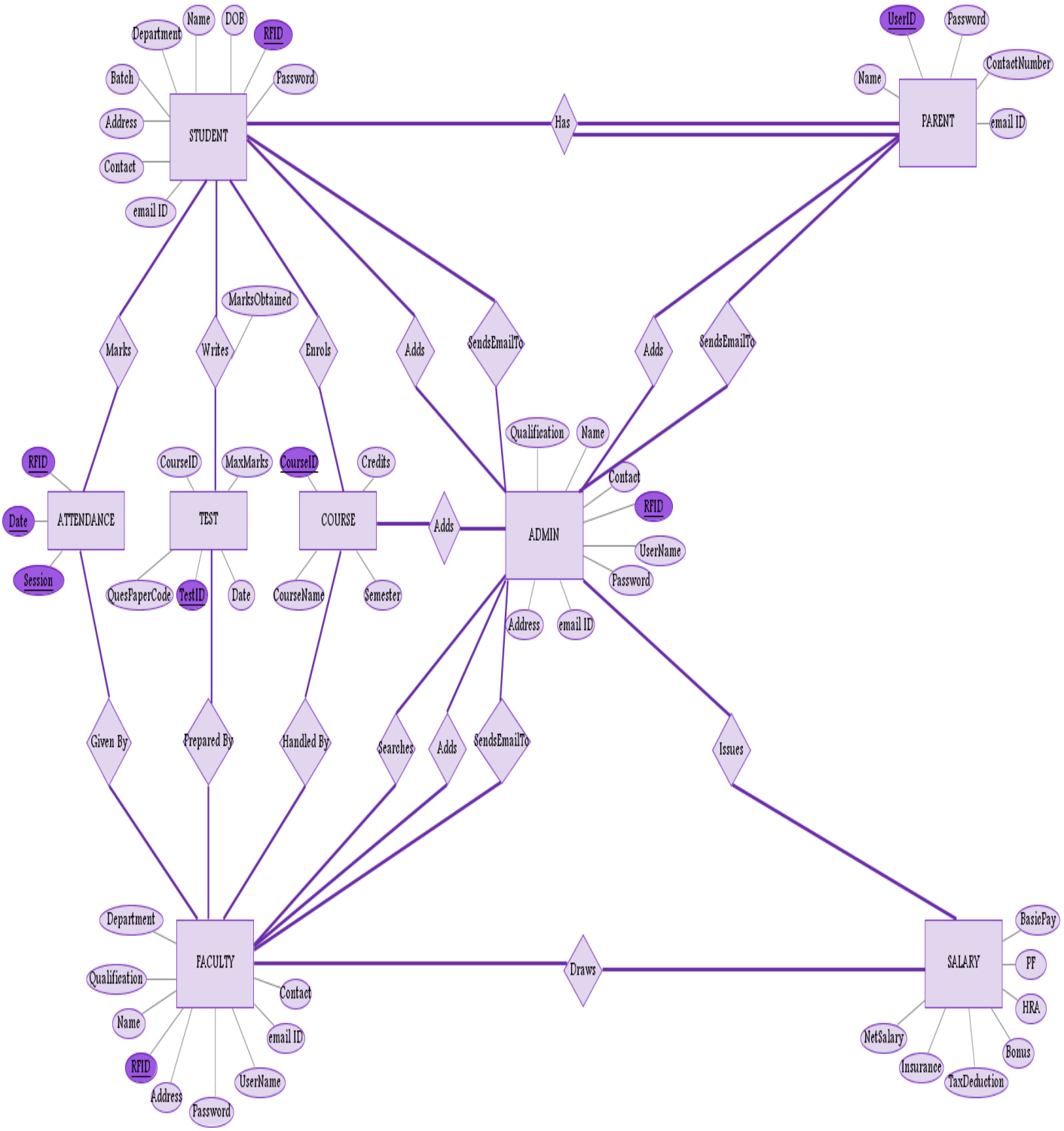
The Admin issues the command for automatic emails and SMS to be sent to the other users of the system. The admin sends e mail notifications about availability of monthly test performance reports. The faculty receives emails and SMS after the salary has been issued.

PARENT:

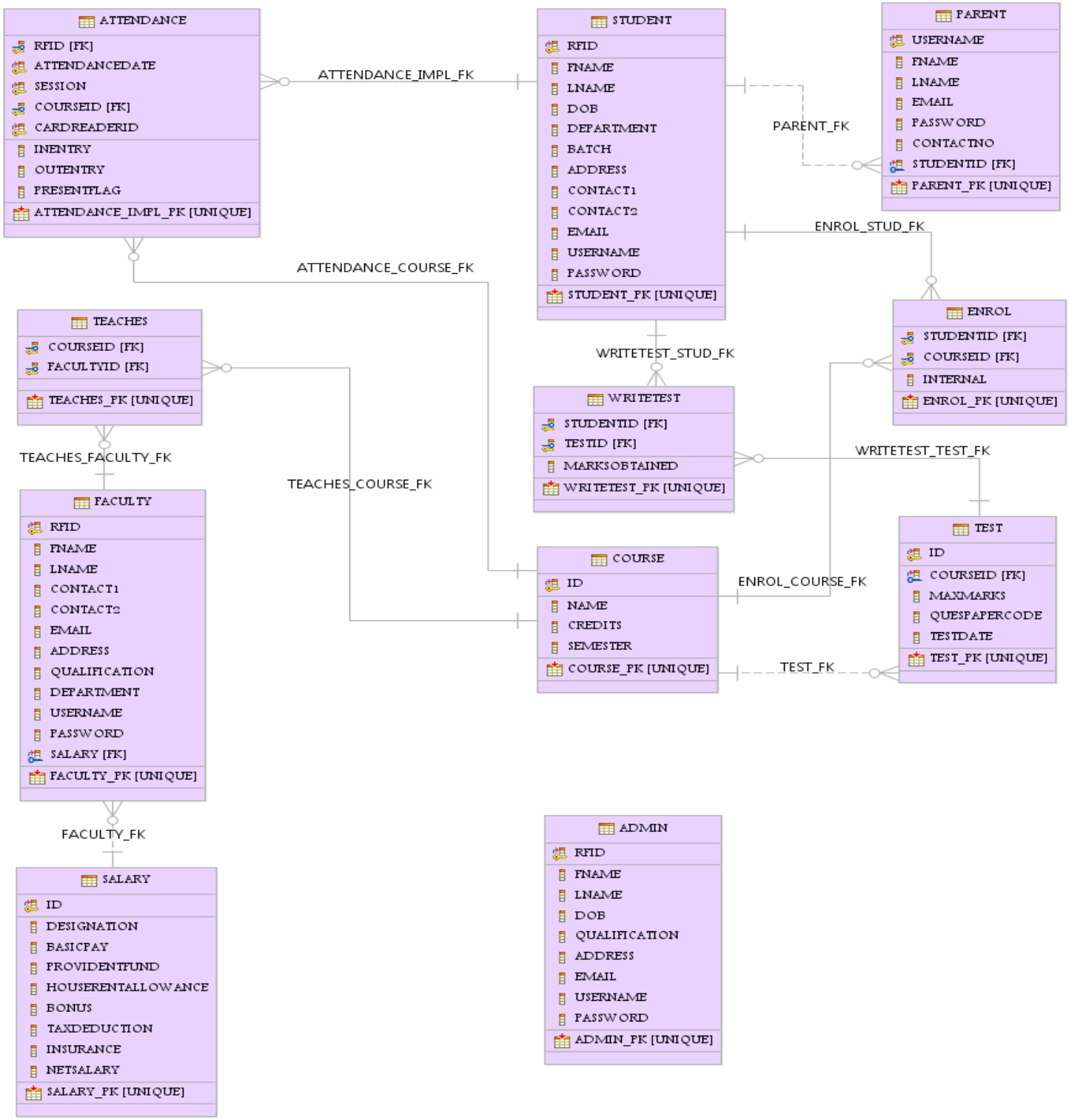
The parent can login to view the performance and attendance reports of their children.

The help facilities can be accessed anytime.

2.8 ER DIAGRAM



2.9 DATABASE DESIGN



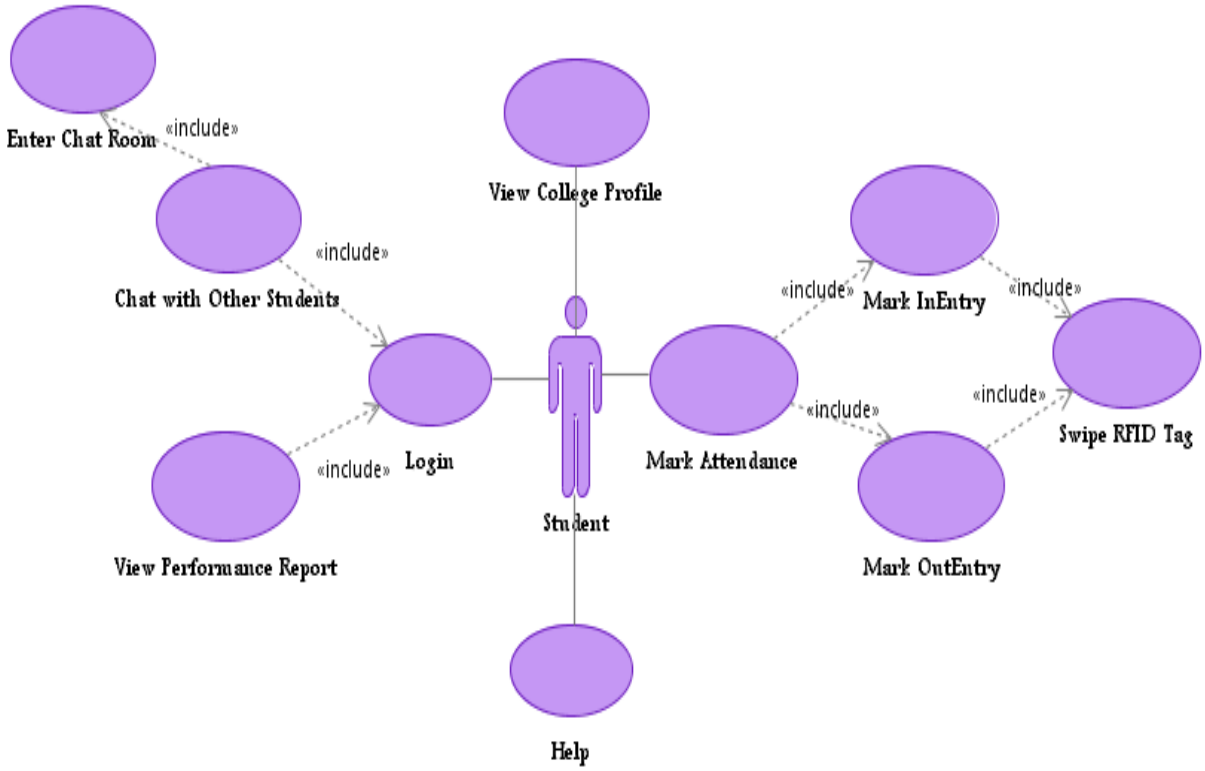
2.10 ASSUMPTIONS AND CONSTRAINTS

* The product must have a user friendly interface that is simple enough for all types of users to understand.
* Due to the small form factor, only limited graphics can be supported on the display screen.
* Response time for loading the software and for processing a request should be no longer than five seconds.
* The central database server and backup database servers should be updated regularly. This updating and replication of data from central database server to the backup database server can introduce additional latency in the working of the system.

3. Specific Requirements

3.1 USE CASE REPORTS

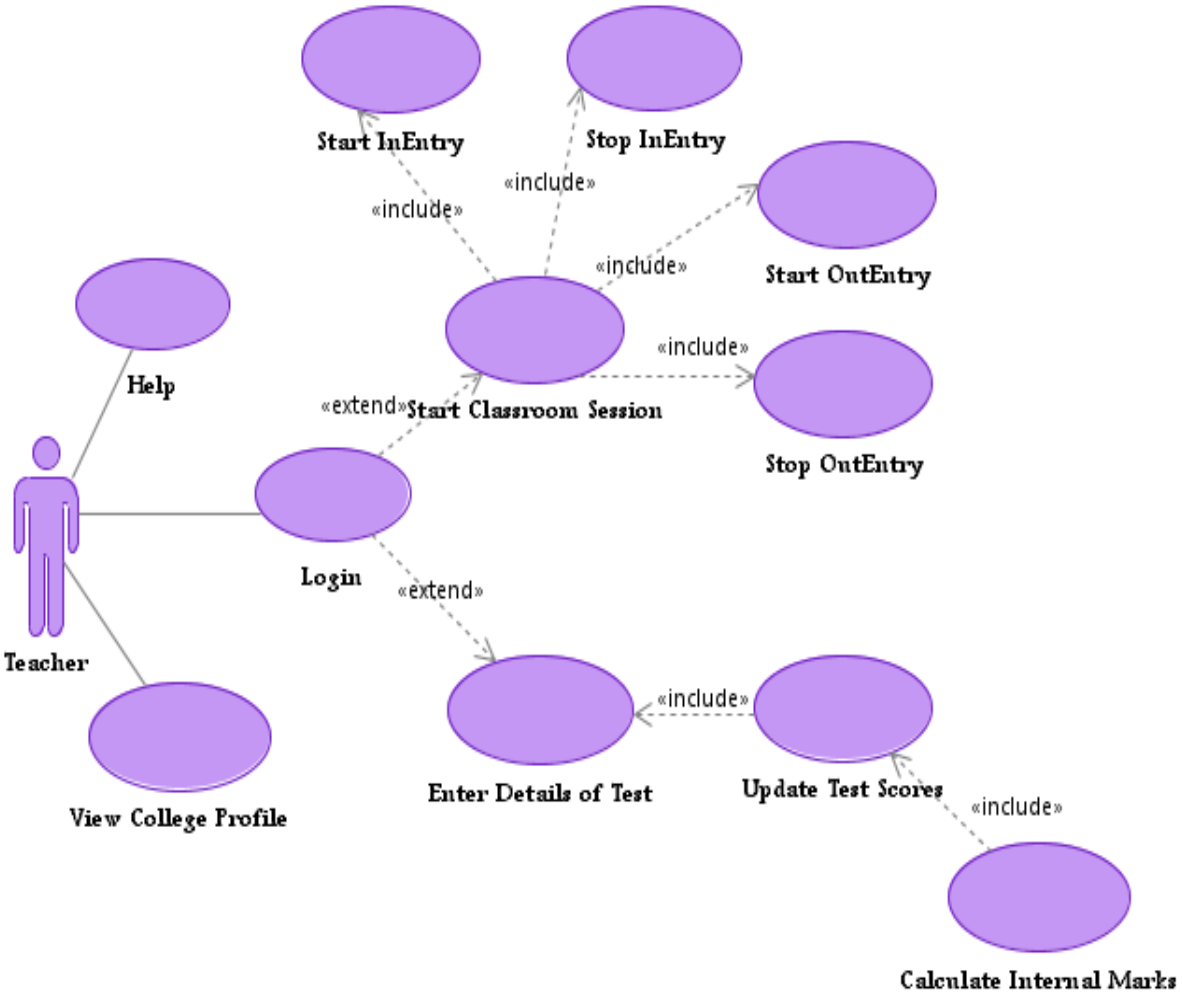
3.1.1 STUDENT USE-CASE REPORT:



USE CASE DESCRIPTION

USE CASE	DESCRIPTION
Mark attendance	The Student marks his/her InEntry and OutEntry before and after a period
Mark InEntry	The student marks the InEntry by swiping his/her RFID card during the InEntry session(while entering the class)
Mark OutEntry	The student marks the OutEntry by swiping his/her RFID card during the OutEntry session(while exiting the class)
Login	The Student logs in with UserID and Password
View Performance Report	After login, the student can view Performance Report which contains the Attendance Report
Chat with other students	After login, the student can chat with other students by entering the Chat Room.
Enter Chat Room	The student enters the Chat Room to chat with other students present here by logging in and giving a screen name
View College Profile	The student can view the details about the college
Help	The student can access the online help facilities at any time

3.1.2 FACULTY USE-CASE REPORT:

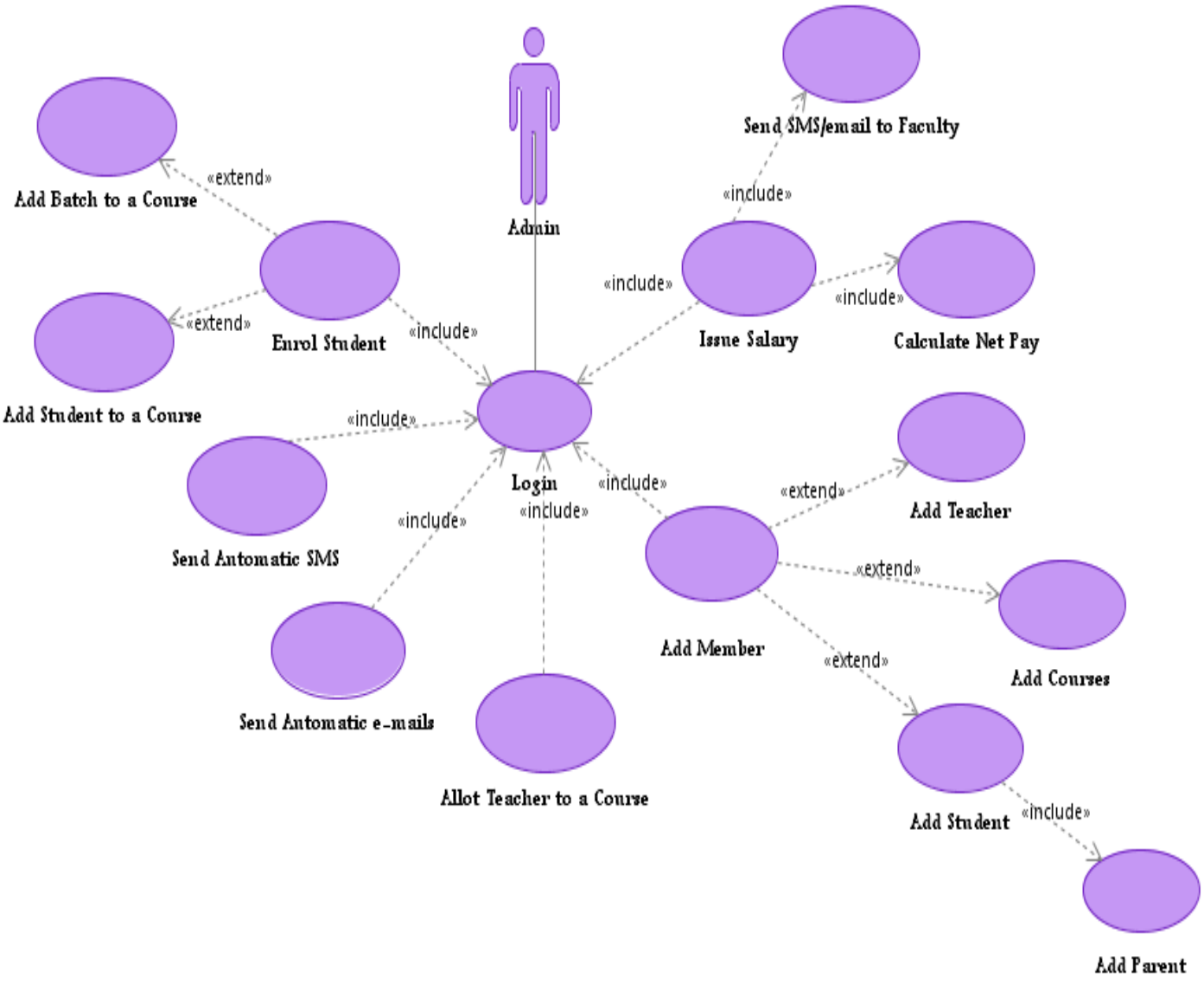


USE CASE DESCRIPTION

USE CASE	DESCRIPTION
Login	The Faculty member log in with UserName and Password
Start Classroom Session	The Faculty starts the classroom session
Start InEntry Session	The Faculty starts the InEntry Session during which the students mark their InEntry by connecting the RFID kit to

	system and setting a new HyperTerminal connection.
Stop InEntry Session	The Faculty stops the InEntry when all students have finished marking their InEntry after ensuring that all the swiped RFIDs are available in the InEntry log file.
Start OutEntry	The Faculty starts the OutEntry Session once the class is over by initiating a new HyperTerminal session to capture input RFIDs to OutEntry log file
Stop OutEntry	The faculty stops the OutEntry after all students leave the class by using the OutEntry log file
Enter Test Details	The faculty can enter the test details like the Course ID, Maximum Marks, Test Date
Update Test Scores	The faculty updates the Unit test scores for each student
Calculate Internals	The faculty can click on this option to automatically calculate internals for each student based on test scores and attendance percentage

3.1.3 ADMIN USE CASE REPORT:

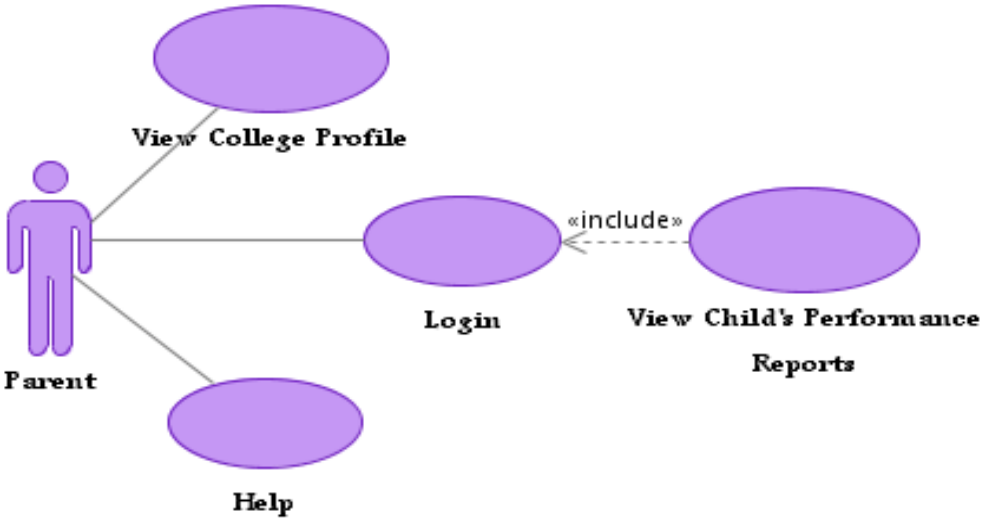


USE CASE DESCRIPTION

USE CASE	DESCRIPTION
Login	The Administrator logs in with his credentials

Add Member	The Admin can add a new Course, Student or Faculty
Add Faculty	The Administrator can add new faculty
Add Student	The Administrator can add new students. This includes adding the Parent Details
Add Parent	The Admin can add parents for students
Add Course	The Administrator can add new courses
Enroll Students	The Admin can enroll one student in a course or a full batch in a course
Issue Salary	Admin issues salary for faculty by ensuring proper communication with the bank. Then an email and SMS are sent to the faculty intimating them about salary issue.
Send emails/SMS	Admin sends the emails/SMS for the parents and students about the Monthly Performance, and any general announcement.

3.1.4 PARENT USECASE REPORT

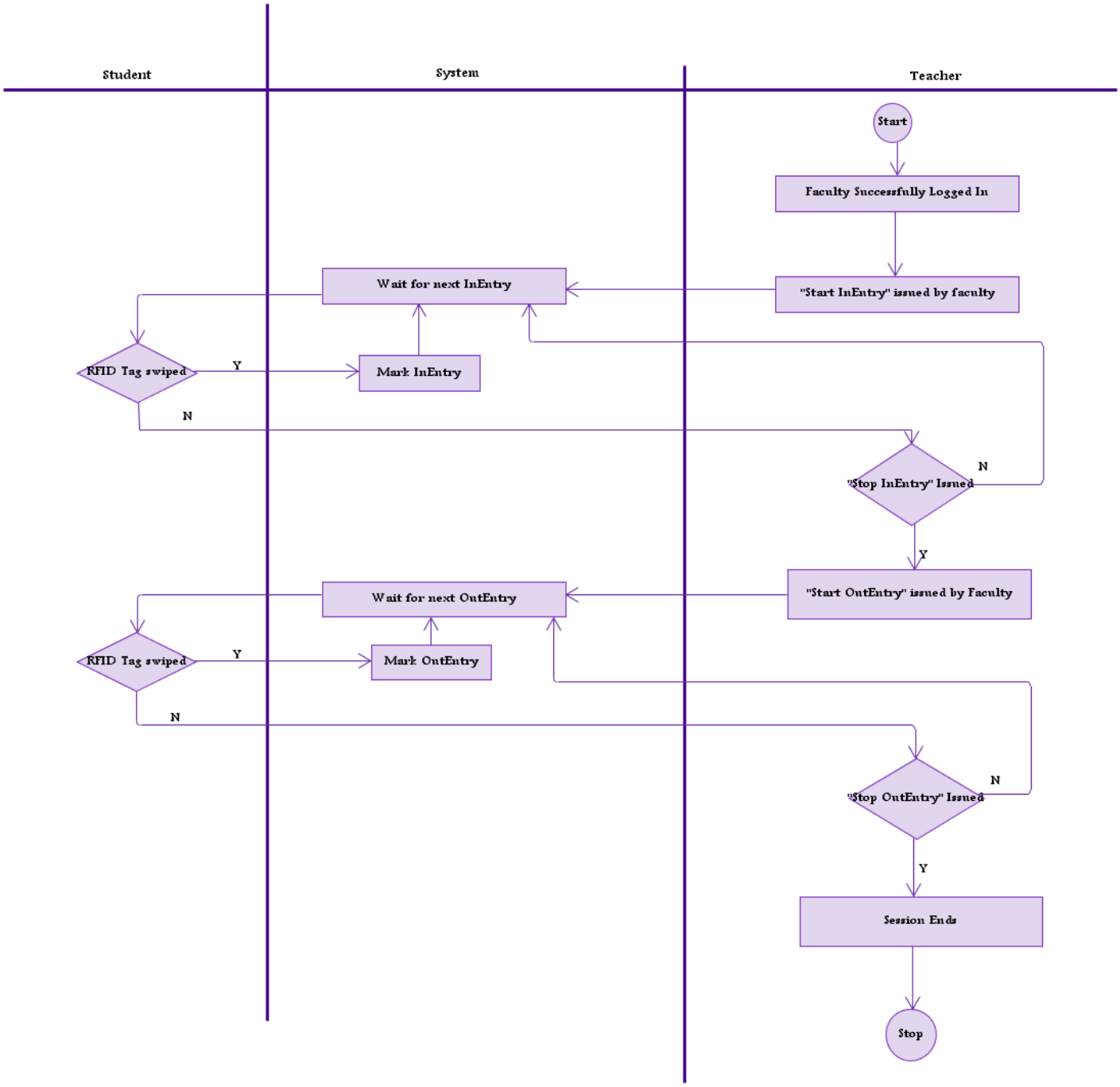


USE CASE DESCRIPTION

USECASE	DESCRIPTION
Login	The parent logs in with UserName and Password
View child's Performance report	The Parent can login and view their child's Performance Report
View College profile	The Parent can view the details about the college
Help	The Parent can access the online help at any time

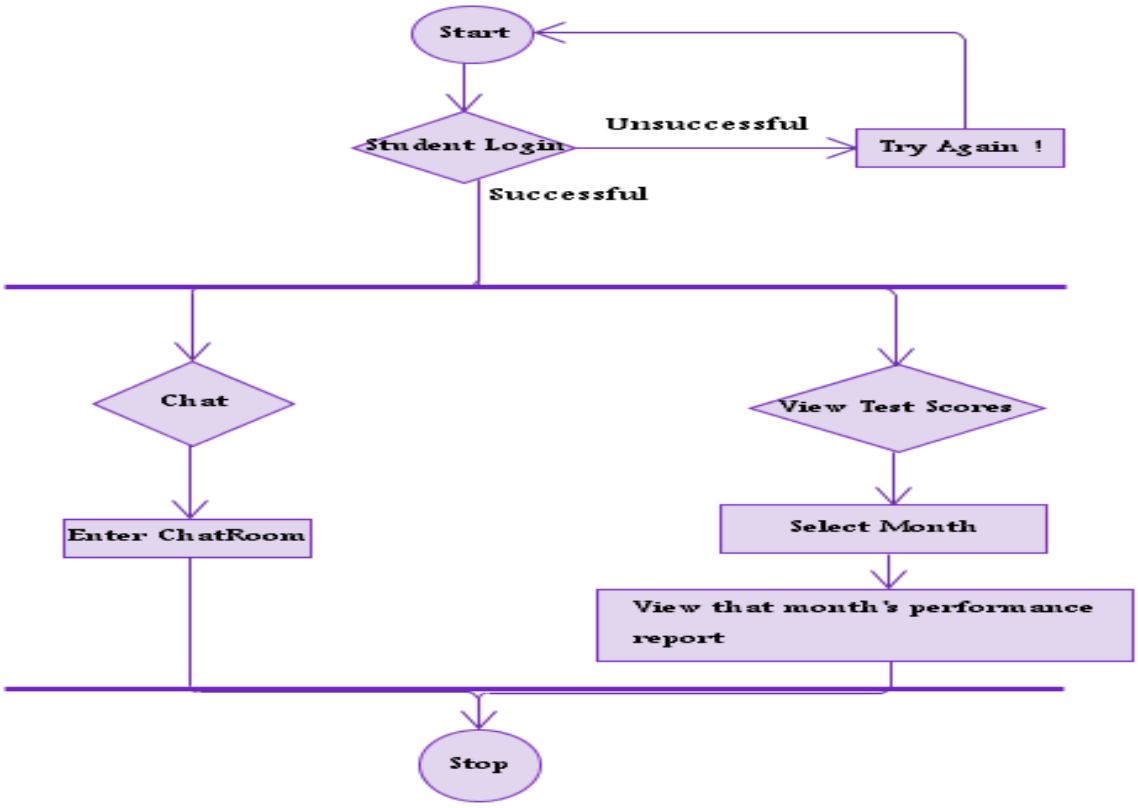
3.2 ACTIVITY DIAGRAMS

3.2.1 MARK ATTENDANCE ACTIVITY



The Mark Attendance activity starts with the faculty member logging in with his UserName and Password. On successful authentication, the faculty member starts the InEntry session by choosing the "Start InEntry" operation on the interface screen. It is during this session that the students swipe their RFID tag to mark their InEntry. She/he ensures that the RFID system is connected to the application by creating a network connection with radio frequency profile and issues a command to capture input tag values to a log file. Once he/she decides to stop the InEntry/OutEntry session, the faculty starts his/her class. When the period ends, the faculty member chooses the "Start OutEntry" option on the interface screen. She/he again ensures another new communication log session in HyperTerminal and issues commands to log the input entries to another log file during this session, students are required to swipe their RFID tags while leaving the class to mark their OutEntry. The system marks a student as present for the period only when both InEntry and OutEntry are marked. Once the faculty chooses "Stop InEntry", the session ends and attendance for that session gets marked.

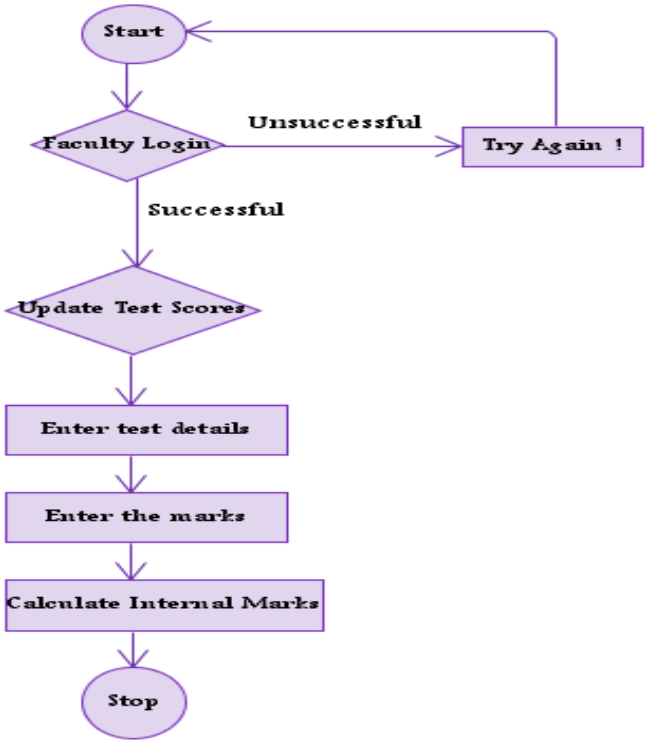
3.2.2 STUDENT ACTIVITY DIAGRAM



Any registered student of the university has a user name and password with which he logs into the system. If the user name or password is not valid, then the student is prompted to login again. On successful authentication, he/she has two options - Viewing the test score/attendance reports or enters a chat room to chat with other students.

If the student chooses "View Reports", then he/she has to select the month for which report is to be viewed. The consolidated score report (including details of Attendance) is generated for the selected month and displayed for viewing. Additionally the student can download the report as PDF file for future use. On selecting "Chat" option, he is directed to the chat room where he can chat with other students of the university.

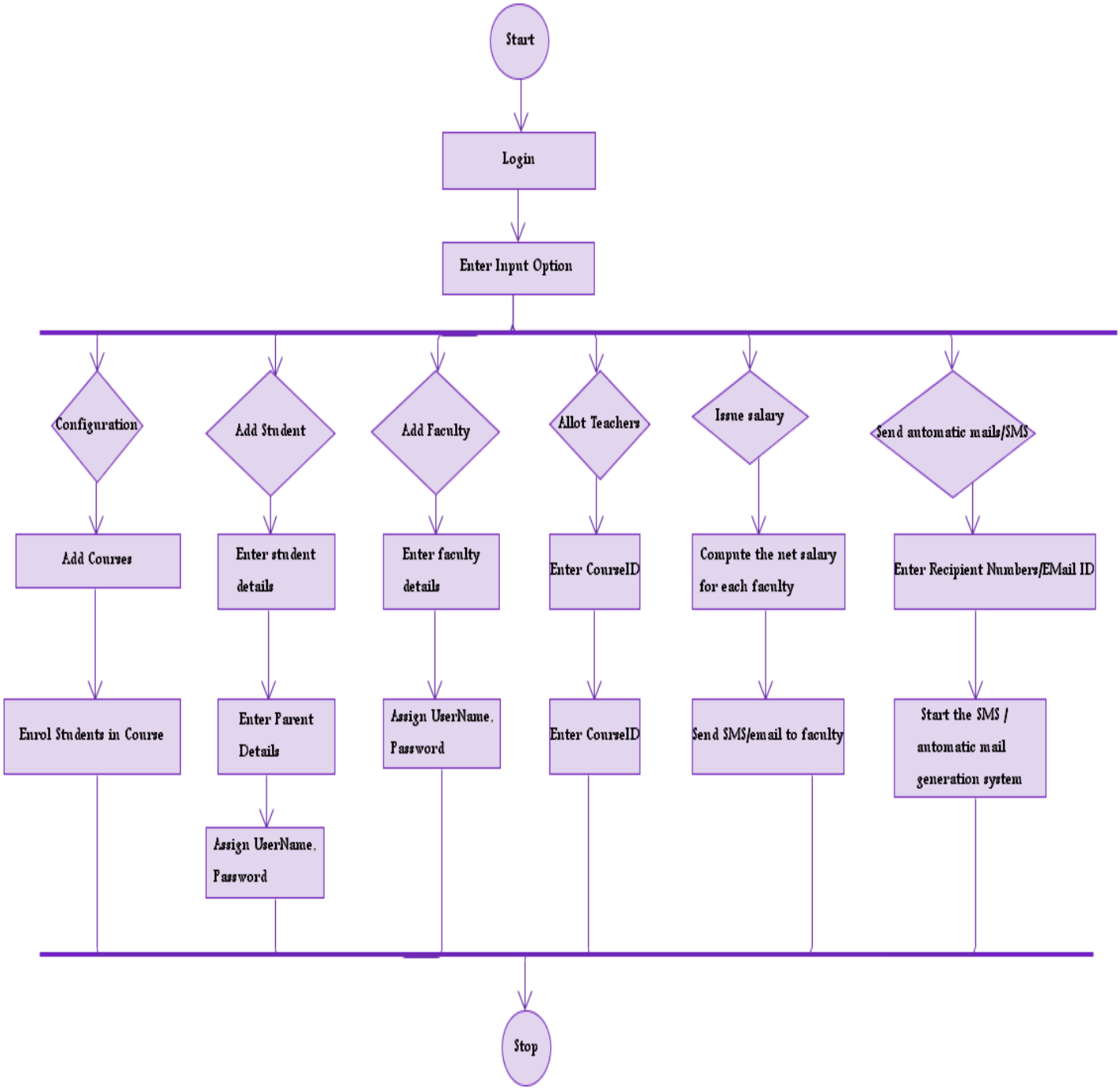
3.2.3 UPDATE TEST MARKS ACTIVITY



The faculty logs in with his user name and password. Once authentication is successful the faculty chooses one of the three options –create a test, update test scores or calculate internals

If the faculty chooses the Update test scores option, a page asking for the test details is displayed and he/she has to enter the details of the test like maximum marks, the question paper code etc. Then another page with names and roll numbers of all students registered for the course is displayed. Here the faculty member can enter the marks obtained by each student. Then, the faculty member can click on "Calculate Internals" to calculate the internal marks scored by each student according to the rules set by the Admin. The Internal Marks includes the attendance marks also.

3.2.4 ADMIN ACTIVITY



The admin gains access to the system by logging in with his user name and password. On successful login, he is prompted to provide an option.

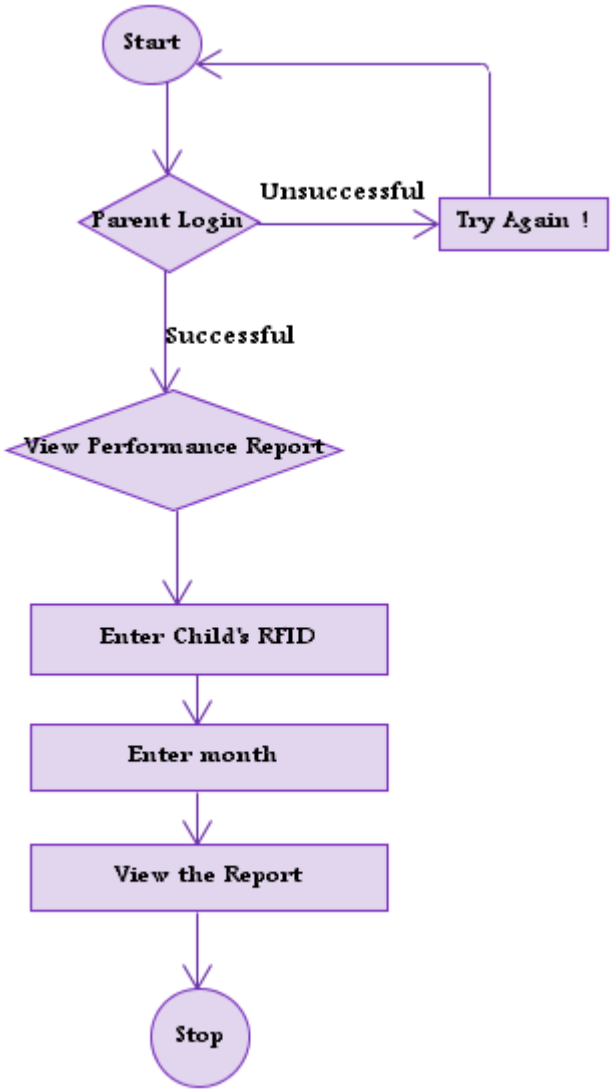
He adds the courses offered by the university.

If the option selected by the administrator is "Add Student/Faculty", he/she is prompted to enter the student/faculty details including the RFID tag number. He/she then allots a username and password for each student/faculty.

If the option selected by the administrator is "Issue Salary", after ensuring the salary amount is updated properly in the database and properly communicating with the bank, the automatic mail/SMS system is started to send the "Salary Issued" alert to the faculty member.

If the option selected by the administrator is "Send Automatic SMS", the Automatic SMS sub system is started; the admin specifies the contents and issues a "Send" command to send automatic mails/SMS to the intended recipients (faculty/students) with the given message which could be a general announcement/greetings.

3.2.6 PARENT ACTIVITY

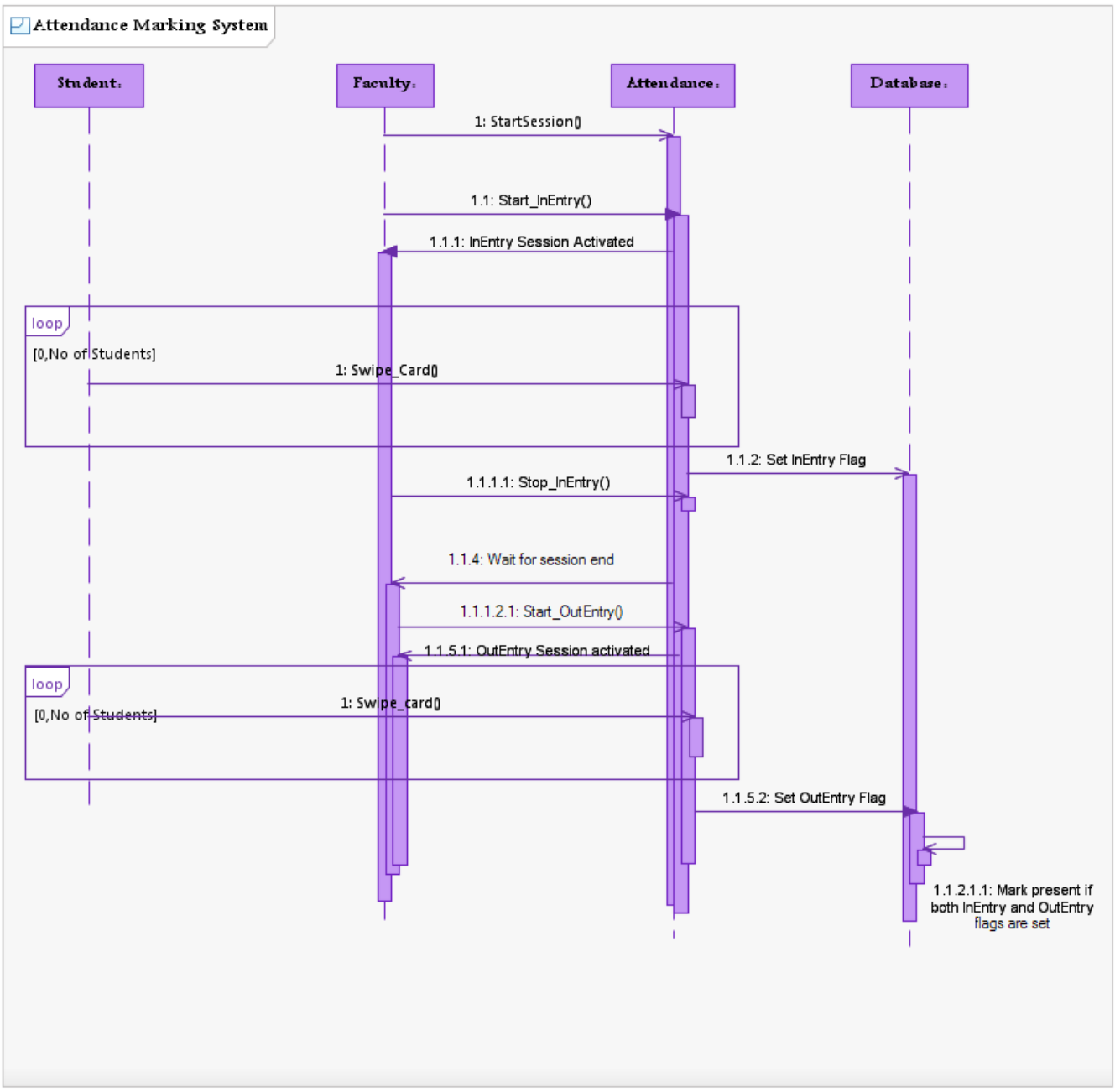


The parents login with their user name and password; on successful login they can either view the monthly reports of their wards for the selected month.

They can also see other details like college profile/access the help facility.

3.3 SEQUENCE DIAGRAMS

3.3.1 MARK ATTENDANCE SEQUENCE DIAGRAM

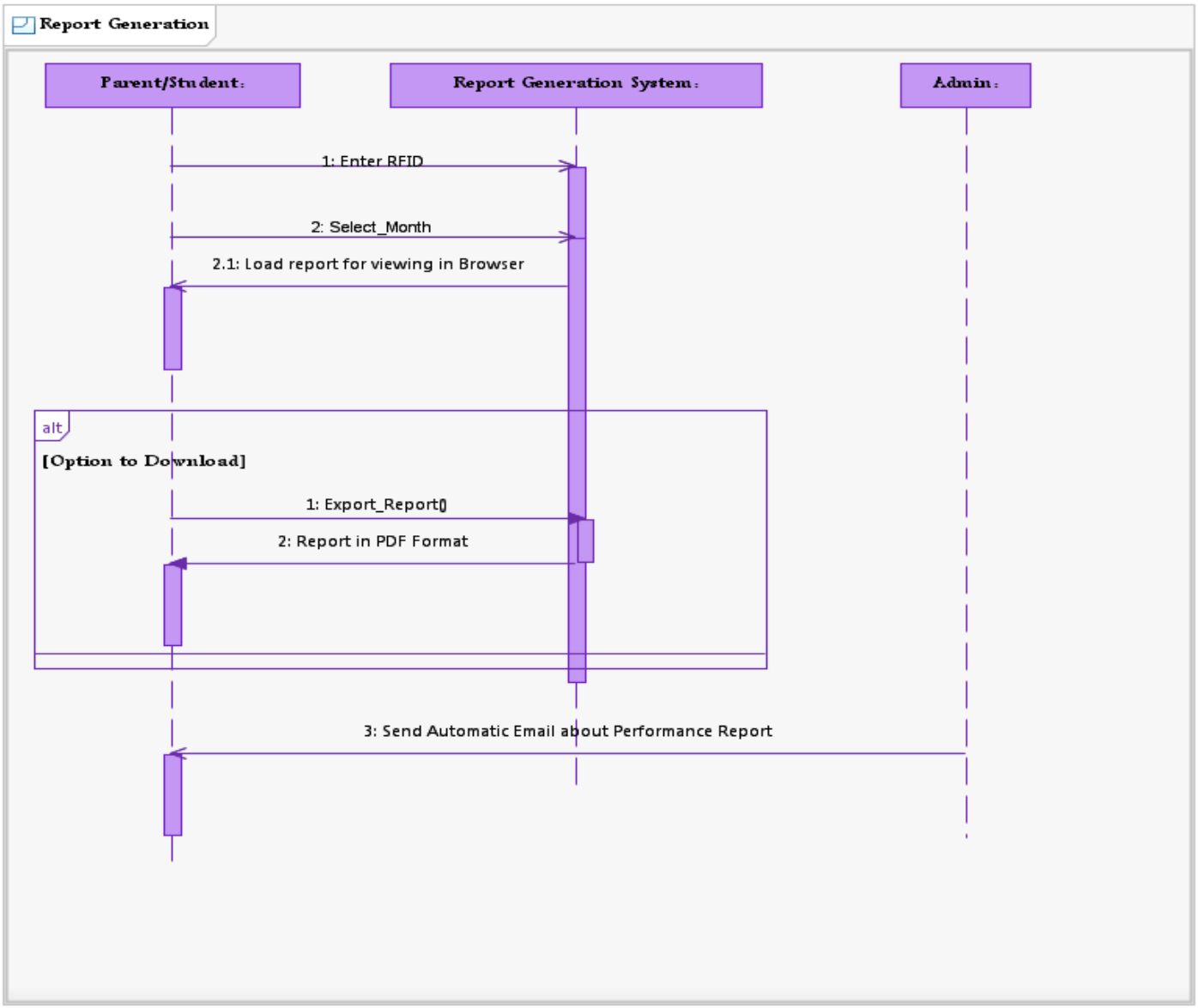


The faculty comes into the classroom about 10 minutes in advance and logs in to start a classroom session. He/she then requests the system to start the InEntry session. The system responds to this request by activating the In-Entry session. At this juncture he creates a new communication session and issues commands to record incoming COM port data to a log file using the HyperTerminal/some other communication application. During this session, students mark their InEntry by swiping their RFID card. When the card is swiped, the In-Entry flag is set for the corresponding student. Only during this session can the InEntry be marked. The faculty stops the In-Entry session when he/she feels that all students have entered the classroom. The InEntry will not be marked for those who swipe their cards after the expiry of the InEntry session.

Similarly, after the duration of the class, the faculty sends a request to start an OutEntry Session. The system responds to this request by activating the session. At this juncture he again creates a new communication session as it is done during start InEntry session and issues commands to record incoming COM port data to a log file using the HyperTerminal/some other communication application The students are then permitted to leave the classroom, after swiping their cards and thereby marking their OutEntry. The OutEntry flag for the corresponding student is set by the system for each swipe of the RFID card.

Only those students whose InEntry and OutEntry are marked will be considered present for that period.

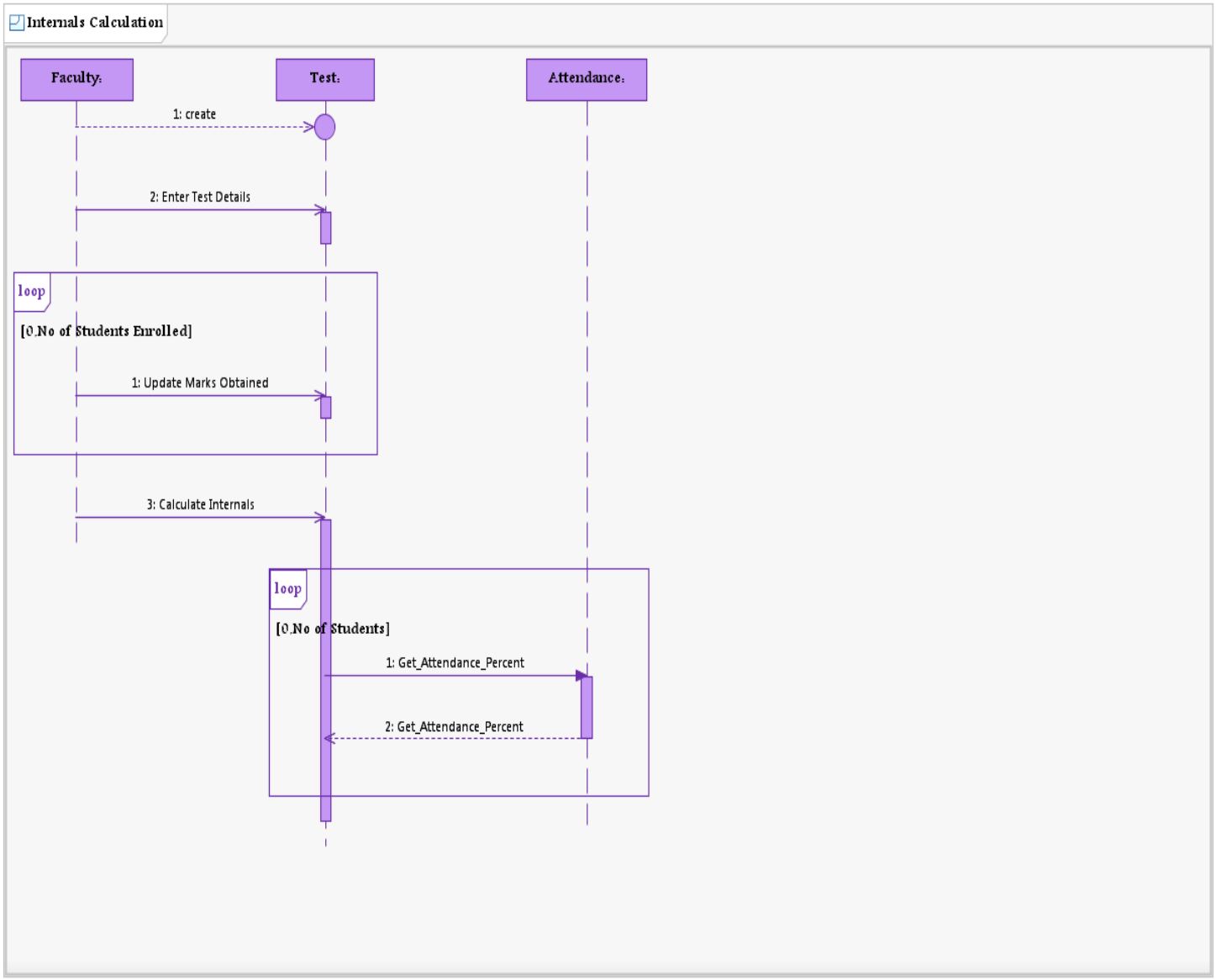
3.3.2 REPORT GENERATION SEQUENCE DIAGRAM



The admin first initializes the system and sets default values for all students. The Faculty can then update the test scores for each student and store it in the database. Internal marks are automatically calculated based on the test scores and attendance for each student and stored in the database. When a student requests to view a report for a particular month, the Report Generation System loads the report in the corresponding student's browser.

As an option, a student may prefer to download the report and save it to his system. For this, the student requests the Report Generation System to export the report. The System accordingly exports all information concerning that particular student as a document which is the PDF format as it is a general preference format for final reports.

3.3.3 CALCULATE INTERNALS



The faculty logs in and creates a test by entering the test details like Test ID, Course ID, Test Date, Course Name, Maximum marks and other details. Then the faculty can evaluate the scripts and come back to update the marks for each student enrolled in the course. Then the faculty clicks on "Calculate Internals" to calculate the internals for each student. This includes taking the average of the marks obtained by the student in each test in that course. The attendance percent for that course is obtained for that student; the marks are allotted and added to the test score average to get the internal marks.

4. CONCLUSION

The Software Requirements Specification document gives an overview of the various aspects of the project. Further improvements or additional features could include:

* Automated Library System
* Automated Computer Labs
* Introducing biometric scanning(like fingerprint scanning) for a more fool-proof system