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Requirement Analysis and Design of RFID and Mobile Application based Attendance Management System: A Case Study of Ordinary Level Schools

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ABSTRACT
Mobile phone technology has continued to grow in terms of computation power, memory sizes and efficiency power utilization. The emergency of Smartphone has facilitated many applications for different activities to be developed. Smartphone are mobile phone with an advanced operating system and capable of running third-party applications [1]. Industry analysts estimate that there are more than 250,000 applications available through the various stores and marketplaces, some of which are available for multiple types of device[2].This paper presents requirement specifications and system design for RFID and mobile application based attendance management that can be useful in our ordinary schools and hence substitute the manual method of Attendance management which is tedious and error prone.

Keywords
Android, Mobile Application, Attendance Management, Use cases, UML, Requirement specifications, RFID

1. INTRODUCTION
Before implementation of any engineering project, it is a good practice to collect and analyse the requirement and produce a blue print design of the system. In software development, System requirements are the statements of what the system must do for its user in normal condition. They are categorized into functional and non-functional requirement. System requirement gathering and design are the early stages in software/system development life cycle (SDLC).

A mobile application is a computer program designed to run on Smartphone, tablet computers and other mobile devices[5] This paper presents functional and non-functional system requirements as well as design for developing an RFID and Mobile application based attendance management. Requirement specification for an information system is important for several reasons: it serves as a means of communication between the user and system developer; as a result, the right system will be developed. It also represents in a systematic fashion the current state of the real world, its problems and future requirements. Additionally, it enables the system developer to turn real world problems into other forms which are more manageable in terms of size, complexity, human understanding and computer process ability. Lastly, it serves as the basis for the design, implementation, testing and maintenance of the target system [6].

2. MOBILE PHONE OPERATING SYSTEMS
The most common operating systems used in smart mobile devices include the operating system Android (Google), iOS (Apple), Symbian (Nokia), BlackBerry OS (RIM), Samsung Bada, Microsoft Windows Phone, webOS (Hewlett-Packard) and Linux Maemo and MeeGo [8]. Operating systems that monopolize the mobile market are Android (by Google) with a share of 69.6% of installations and iOS (by Apple) with 20.9%. The shares for the rest operating systems are much smaller: 3.5% for RIM; 2.9% for Microsoft; 1.2% for Symbian; and 1.9% for the rest [9]. It shows that the market share for android platform is very large therefore the application developed based on this Operating system is likely to be used by many users in their mobile phones

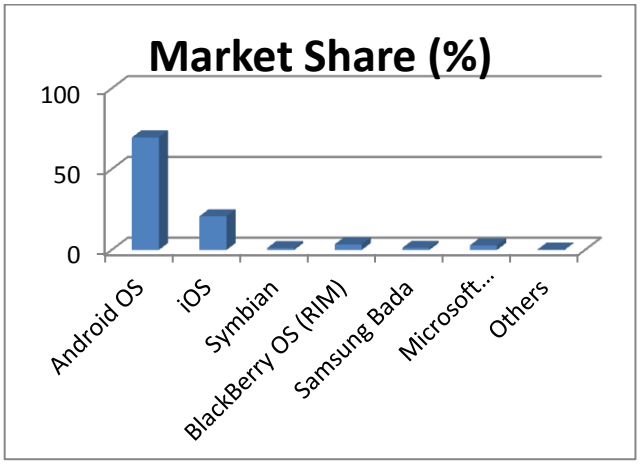
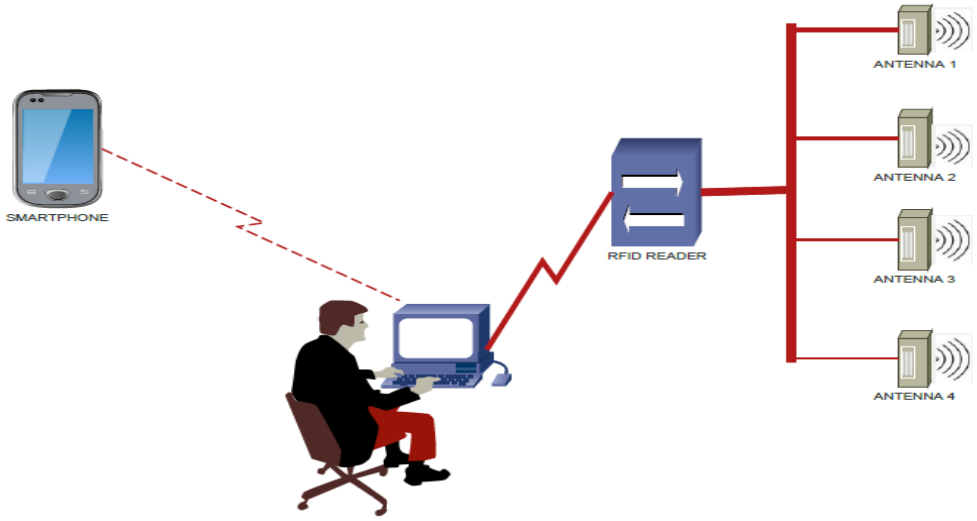


Figure 1: Operating Systems market share [9]

3. REQUIREMENT ANALYSIS AND SPECIFICATIONS
Requirements specify a set of features that the system must have. A **functional requirement** is a specification of a function that the system must support, whereas a **non-functional requirement** is a constraint on the operation of the system that is not related directly to a function of the system. The system abstraction in the figure below shows the

complete setting of the system with four RFID catchment areas represented by four antennas.



3.1 Functional Requirements

The attendance management system to be developed is expected to facilitate the process of recording attendance through mobile phone and RFID, viewing attendance for different interval of time and be able to send the attendance information to the parents/Guardians through mobile phone. The table 1 and 2 below shows the functional requirements for the Attendance management system and Mobile application respectively.

Table 1: Attendance Management System Functional Requirements

ACTORS	REQUIREMENT	DESCRIPTION
RFID Reader	Record Attendance	RFID reader will be recording the attendance by detecting the Tags attached to student's uniform.
Mobile Application	Record Attendance Send Attendance info	Mobile application acts as a backup for recording attendance It will also be used to send attendance information to parents or Guardians
Class Teacher	Login View Attendance Edit Student Register Student	Class teacher will login into the system and upon successful, he/she will be able to view attendance information, Edit student details and Register new students.
Head Master	Login View Attendance Edit Student Register Student Delete Student	The Head Master will login into the system, view attendance, Edit students, Register Students and Delete Students.
Parent/Guardian	Receive Attendance info	Parents or Guardians will be receiving attendance information for their kids in case of truancy.

Table 2: Functional Requirements for Mobile Application

ACTOR	REQUIREMENT	DESCRIPTION
Class Teacher	• Take attendance • View attendance • Upload attendance • Login	• The class teacher/master is required to be able to take student attendance and upload to the back end database in case the RFID part is not working or not deployed. • The class teacher/master should be able to view student attendance for different interval of time.
Head Teacher/ master	• Edit student • Register student • Delete student • View attendance • Login	• The head Master/Teacher monitors the registered students and their attendance. She/he is also responsible for registering or deleting student.

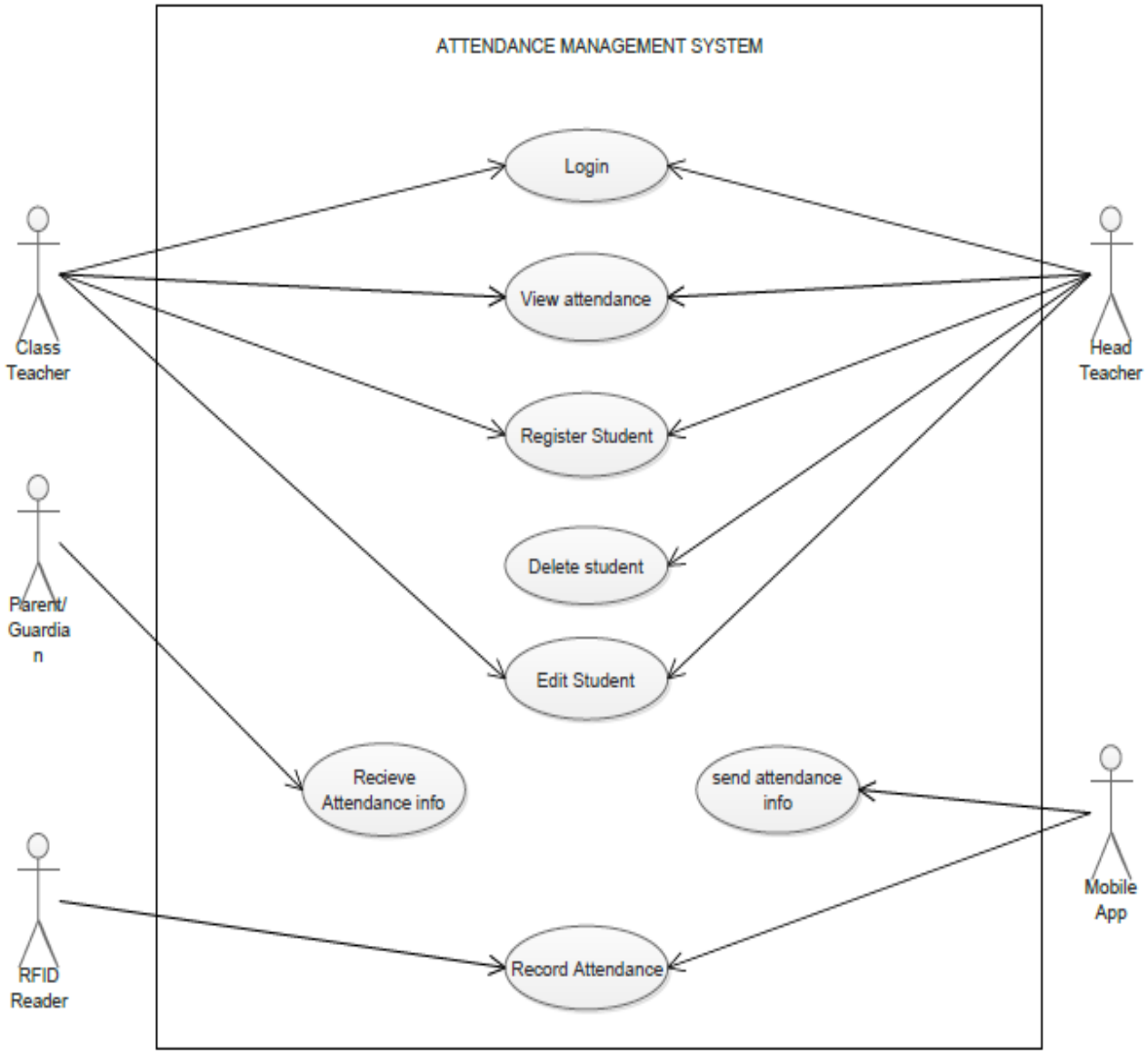
3.2 Non-functional Requirements

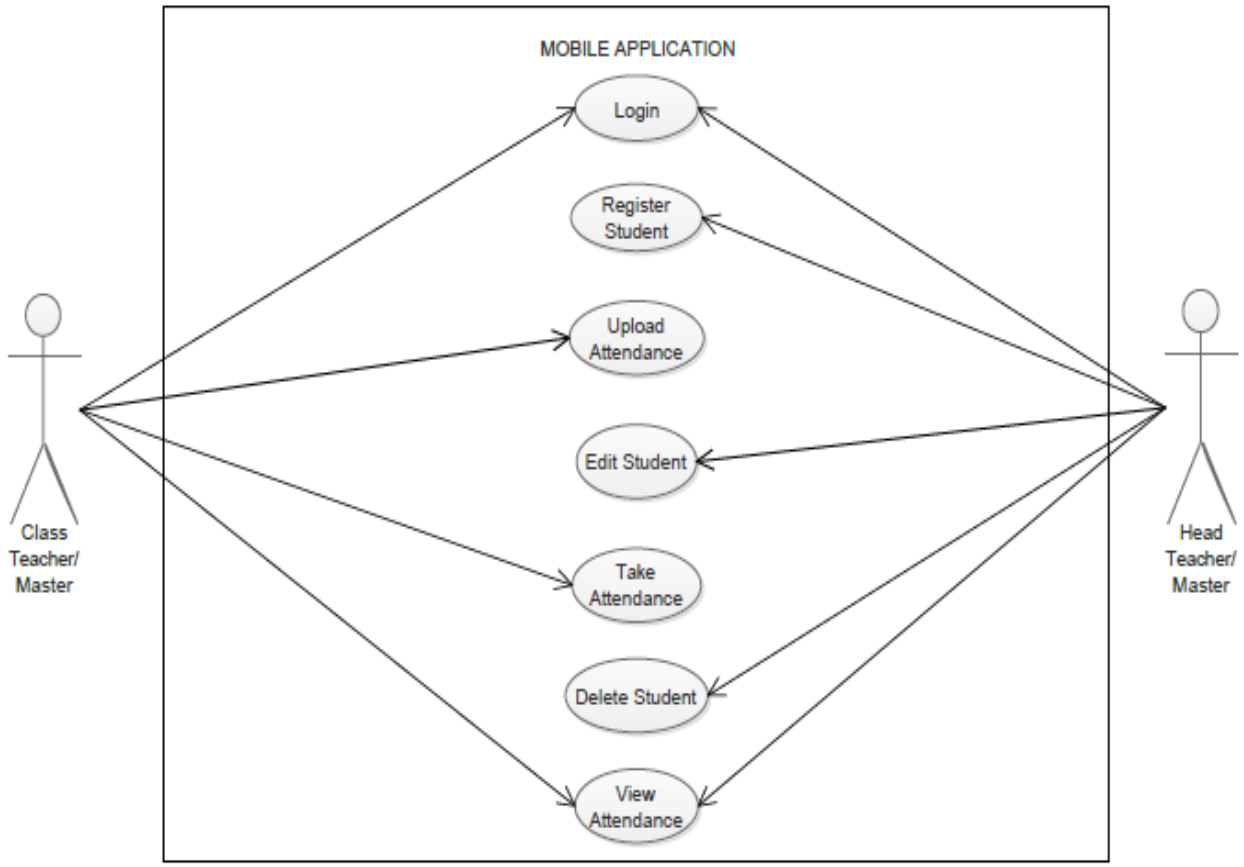
These are constraints on the operation of the system that are not related directly to a function of the system.

S/N	REQUIREMENT	DESCRIPTION
1	**Operability**	◊ The mobile application will be developed under Android platform. ◊ The application will run on Smartphone with android OS 2.2 and above.
2	**Maintainability**	◊ The application is specifically for android Smartphone
3	**Security**	◊ The system shall provide access to only registered users. The authorized users will login to the application
4	**Performance**	◊ The application will process attendance information as faster as possible from the moment of submission.

4. SYSTEM DESIGN

4.1 Use case Modelling





4.2 Detailed Use Cases

The tables below show the list of use cases with associated actors for attendance management system and the Mobile Application.

Table 3: Actors and associated use cases for Attendance Management System

PRIMARY ACTOR	USE CASE
1. RFID Reader	1.1 Record Attendance
2. Mobile Application	2.1 Record Attendance 2.2 Send Attendance Info
3. Class Teacher/Master	3.1 Login 3.2 View Attendance 3.3 Edit Student 3.4 Register Student
4. Head Teacher/Master	4.1 Login 4.2 View Attendance 4.3 Edit Student 4.4 Register Student 4.5 Delete Student
5. Parent/Guardian	5.1 Receive Attendance Info

Table 4: Actors and associated use cases for Mobile Application

ACTORS	USE CASE
1. Class Teacher/Master	1.1 Login 1.2 Take attendance 1.3 View attendance 1.4 Upload attendance
2. Head Teacher/Master	2.1 Login 2.2 Edit student 2.3 Register student 2.4 Delete student 2.4 View attendance

4.3 Entity Relationship Diagram

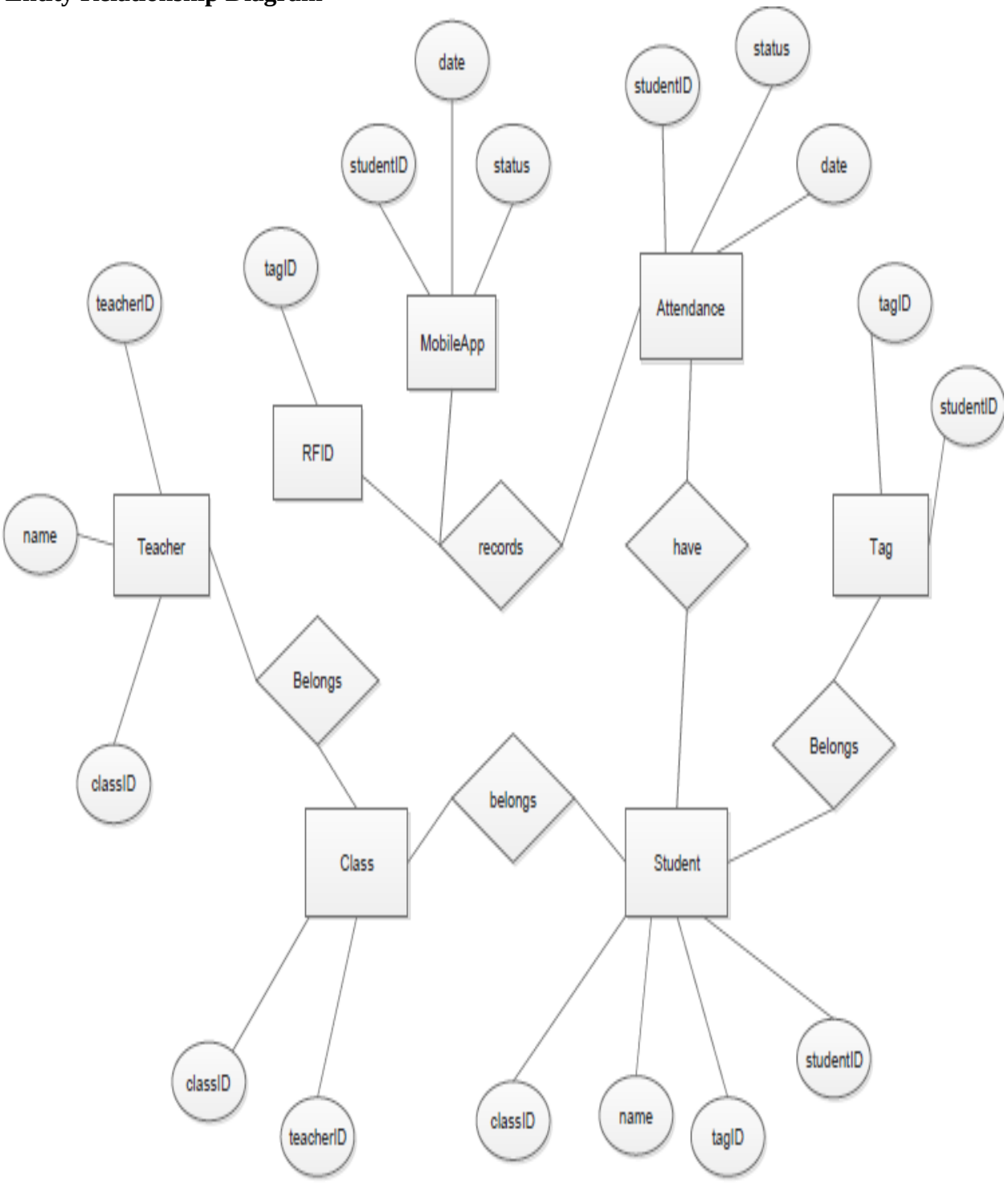


Figure 2: ERD of Attendance Management System

4.4 Class Diagram

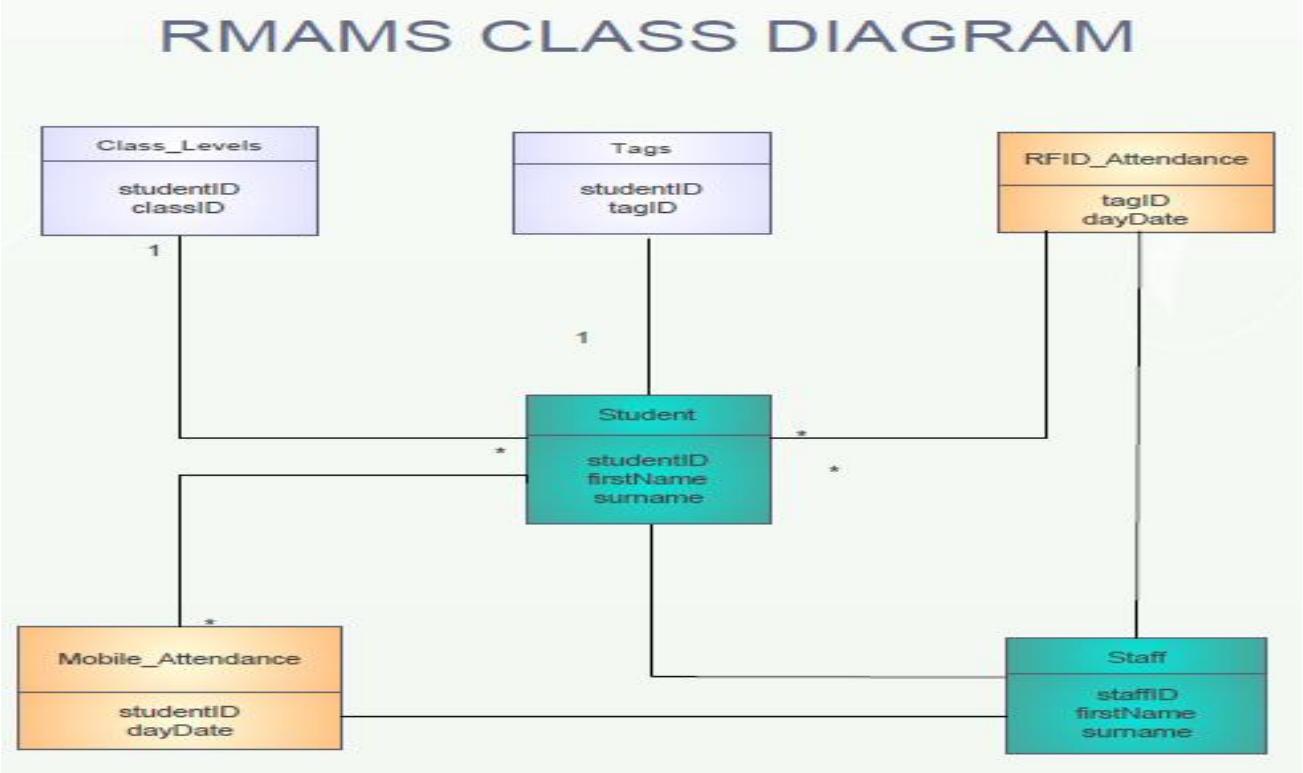


Figure 3: Class Diagram for Attendance Management System

5. CONCLUSIONS

The attendance management system tool whose specifications have been presented in this paper provides simple but efficient means of recording and communicating students' attendance information. We also see how requirement gathering and design are very critical in any software development to make sure that the project solves the right problem in a right approach. So long as many studies have shown that, mistakes at development stage often leads to project failure, care is needed when establishing the requirements in order to avoid any subsequent catastrophes. Results presented are a foundation for the design and development of a attendance management system which will also be improved through the feedback from the end users during testing and operation.

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