Research Article

Design of a University Portal with Biometric Lecture Attendance Monitoring System

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Abstract: Management of information is a herculean task for most institutions. The advent of web portal technology proved promising as it provided ways to curb the difficulties in effectively managing data and information transfer within and outside the university community. This project was embarked upon to review the features of a university portal addressing the successes, flaws and challenges faced by the user group consisting of staff members, students and the general public when using the portal. Course registration and result computation modules are at the core of this design. It further introduces a new feature of integrating a lecture attendance monitoring system using a developed biometric (Fingerprint) module which has a real-time synchronization with the web portal. This project provides opportunities for the university community to upgrade the existing portal system through the adoption of this project and its rich features.

Keywords: internet, university, student, lecturer, staff, portal, lecture, course registration, result, modules, efficiency, programming, user experience, monitoring, system, and technology.

INTRODUCTION

Internet technology has continued to revolutionize our global community. It has positively affected every facet of human endeavour ranging from the way we live to how we carry out our activities and communicate. The education sector is not left out. With increase in the volume of data managed within the university community, it is very important to develop systems which are reliable and capable of reducing the errors or manual processing and burden. In the 21st century, traditional management of records of students is now been phased out and globally, tertiary institutions adopt the practice of developing an online platform called a web portal. A web portal is most often one specially-designed Web page which brings information together from diverse sources in a uniform way [1]. This project uniquely defines a web portal as an online platform that provides a starting point or gateway to other resources on the internet or intranet with features such as: a single point of entry (homepage or login page), the ability to communicate and collaborate, personalization (user account and profile) and integration of services or data from other platforms.

Most universities have adopted the web portal technology to a great extent. To an administrative personnel, this is a huge relief as a piece of software running on a server could easily help in storage, accessing and transmission of information over short or long distances which would have been done manually; by post or print media. Thus, processes were faster, more efficient and reliable. It is also critical to note that in rating a university, most standards take into cognizance the amount of internet technologies deployed to facilitate teaching and how consistent and reliable such services are and also the internet presence of the university in question [2].

However, this project bemoans the poor implementation of web portal technology in universities and proposes a more robust implementation that uses a modular approach with clear separation of concerns in the design evident in the model and frameworks used. This new portal project introduces a novel feature of fingerprint based lecture attendance monitoring system for lecturers.

REVIEW OF EXISTING PORTAL; FEATURES AND CHALLENGES

Many universities have adopted the use of portal technology as a management tool to processing students' records and also to deliver education to

students. University of Nigeria, Nsukka (UNN) as a case study, adopted this technology in 2006 and ever since deployed it usefully in the realization of her administrative and academic functions. Since the development of the first portal in 2006, the task has been to develop a scalable and customizable internet platform to facilitate the acquisition and management of student data, enable online registration of courses for each semester, and ensure regular payment of school fees.Some of these basic functionalities are listed below.

- Record and share grades with students electronically
- Create online communities for students, faculty, administrators, and alumni to collaborate
- Enable students, faculty, administrators, and alumni to access your institution's resources anytime from any connected device
- Post lesson plans, coursework, research content, and more to online document libraries

- Provide Web-based class registration, tuition and financial aid payments, and other services
- Create dashboards that show up-to-date student performance data to inform instruction and decisions
- With modifications and optimization over time, UNN portal currently ranks 4th[3] on *webometrics;* a ranking of world universities according to web presence. This primarily informed the scope of this project as a comparative analysis was done to ascertain why other varsities ranked better than others. The major difference was the failure of some processes on some portals. Results from questionnaires circulated (**Appendix A)** to students showed that processes like course registration were not thoroughly implemented with cases such as missing courses, invalid course codes or titles and even students getting deregistered as a result of hacks or malicious activities. The latter is due to the uniform password provided to all students.Figure 1 shows a chart of the collated data.
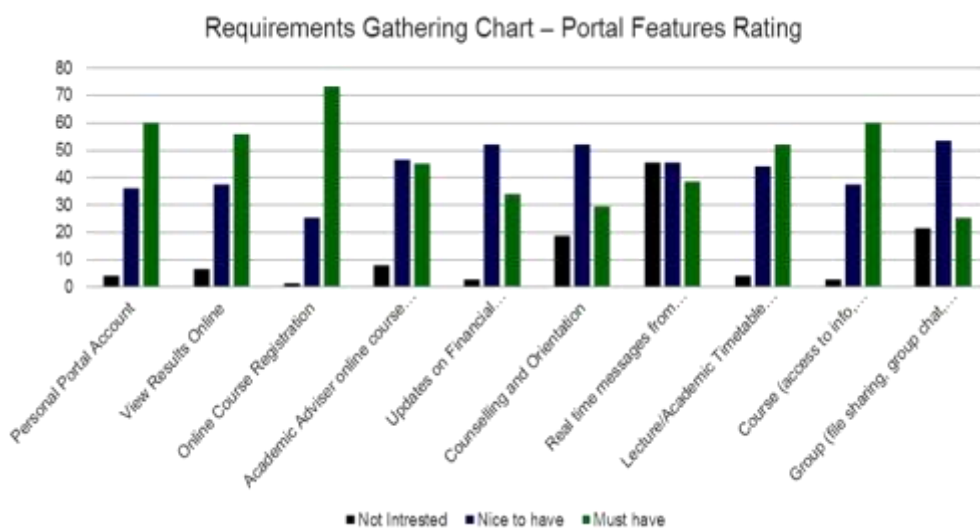

Figure-1: A survey showing students' rating for some features on the portal.

The survey also showed that students were not comfortable with the grade of user experience (UX) of the current portal and wished if it was possible to have results updates on the portal and active interaction features integrated. To help boost the universities webometrics ranking and improve the time lecturers devote to lectures, it was also gathered from the survey that student wanted a platform where administrative personnel such as HOD can monitor the lecture progress for different courses. The current system lacks this functionality. Below is a summary of some of the problems inherent in the existing systems.

i.   Difficulty in navigating, not user friendly and unattractive graphical user interface (GUI).
ii.   No access to results.

iii.   Incorrect course codes and units during course registration.
iv.   Required courses not present during course registration.
v.   No online feedback medium of students to report their challenges.
vi.   Security problems in terms of student's login detail.
vii.   Network congestion.
viii.   No privacy. All students share the same password.
ix.   Poor data management. (Students data are often misplaced).

x.   No ability to see details of course such as description, tutor, class size, location, time and dates.

The aforementioned drawbacks set the wheels of this project into motion. The core focus of this project is to develop a robust university portal and to integrate a fingerprint enabled lecture attendance monitoring system.

DESIGN AND IMPLEMENTATION

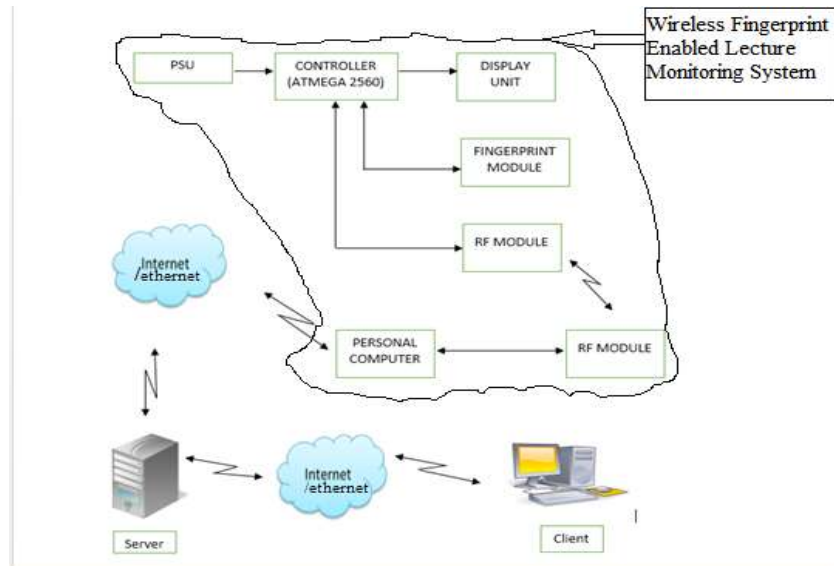This work is in two parts; a university portal resident on the server and a wireless fingerprint enabled lecture monitoring system as shown in figure 2.

Fig-2: Block representation of the two parts of this work.

The university portal provides the university community with the features needed to carry out most academic processes while the fingerprint module provides a wireless integration for real-time monitoring of lectures in classrooms to know when lecturers clock-in and clock-out.

UNIVERSITY PORTAL

We developed a portal with four categories of users in mind. These are students, lecturers, administrators and general public. Each of these users has a unique interface except for the general public interface which is the portal homepage accessible to all. Figure 3 shows the different interfaces and the sub modules integrated in each of them.
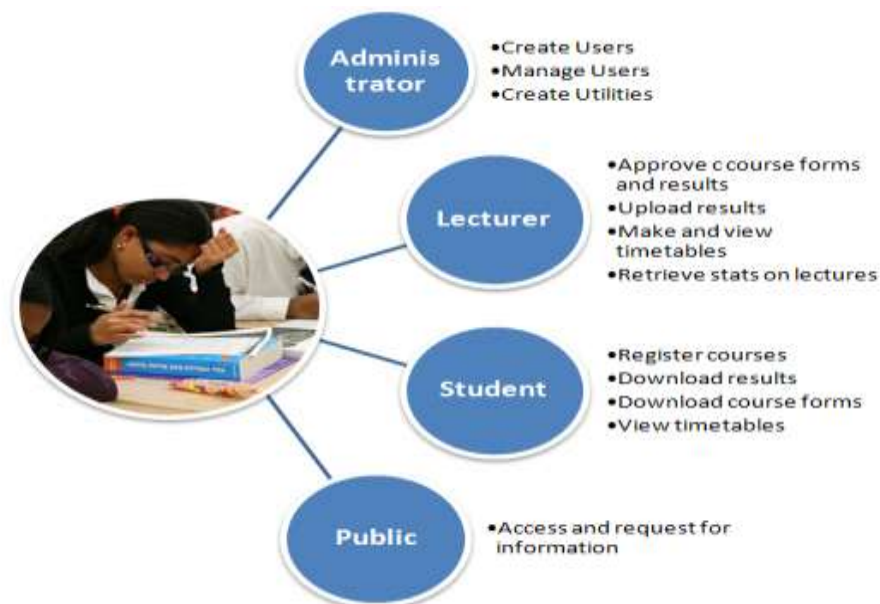

Figure-3: Portal Interfaces and sub Modules

The administrator interface (figure 4) provides the portal administrator with sub modules to carry out actions such as creating portal users (lecturers and students), academic sessions, and defining degree requirements and if designated, assign courses to lecturers as required or deemed fit by the departments.

Other modules provided on this interface include courses, faculties, and departments creation and editing modules. The design of this was done to permit scalable integration for existing platform through provision of features that would allow database migration.
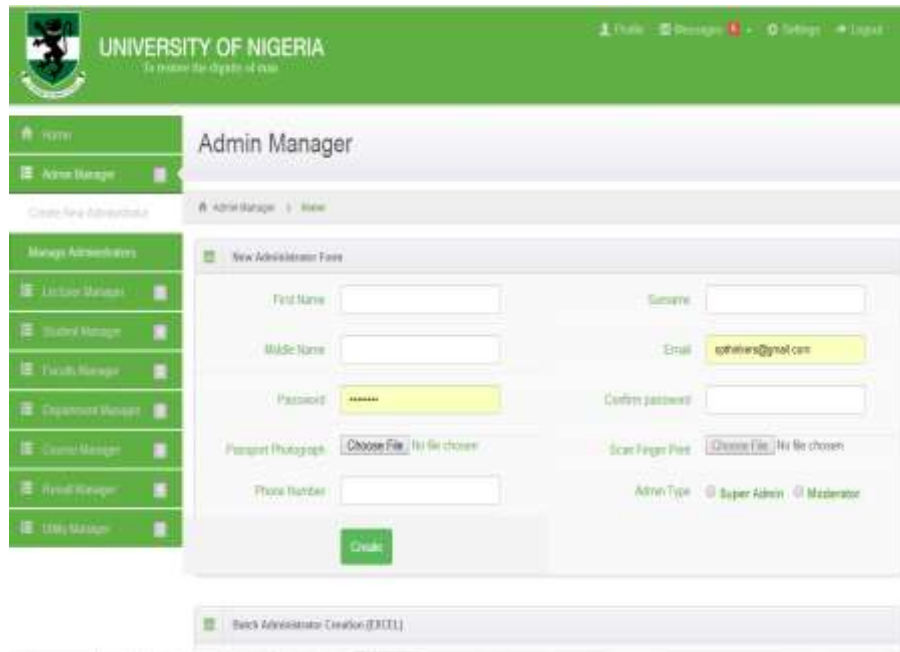

Fig-4: Administrator Interface.

Lecturer Interface (figure 5) serves the different needs of the lecturers with respect to their academic roles. For a lecturer that teaches a course or courses, he or she can download the list of students offering his/her course(s) according to their department. The downloaded file which is in Microsoft Excel format also serves as a template for results. Upon completion of the course, the lecture can insert the scores of the

students into the columns provided and upload back on the portal. Subject to approval, the results will then be propagated to the accounts of the students in questions for onward download. A lecture assigned with the duties of approving results, course forms or making new timetables will have the privilege to access the modules that will enable him or her carry out these functions.

Fig-4:Lecturer Interface

Access is also provided to view timetables and known if lectures for the day have commenced or not.

The student interface (figure 6) provide students with modules that can help to perform functions such as course registration, download of course forms and results and viewing of timetables. It also uniquely protects user data and ease of personalization of platform.

Timetable feature (figure 7) was integrated and made available on both the lecturers' interface and students' interface. This module provides information on lectures such as day of the week, time, view and for the current day; the status of the lectures whether started or lecturer was absent.

Figure-6: Student Interface

Java programming language with JSPs, CSS, JQuery and Bootstrap frameworks were used.

Dependency Injection was also leveraged on using Spring MVC framework.

Figure-7:Timetable Module

WIRELESS FINGERPRINT ENABLED LECTURE MONITORING SYSTEM

This system consists of the Remote Controller Unit (biometric authentication unit) and the Base Station. Remote Controller Unit here refers to the fingerprint scanner and the accompanying circuitry as

shown in figure 8. The base station refers to at least a computer provided in the vicinity of the classrooms were the remote controller is installed. This computer will communicate wirelessly with all remote controllers that belong to the department in question and also with the server upon which the university portal is hosted.
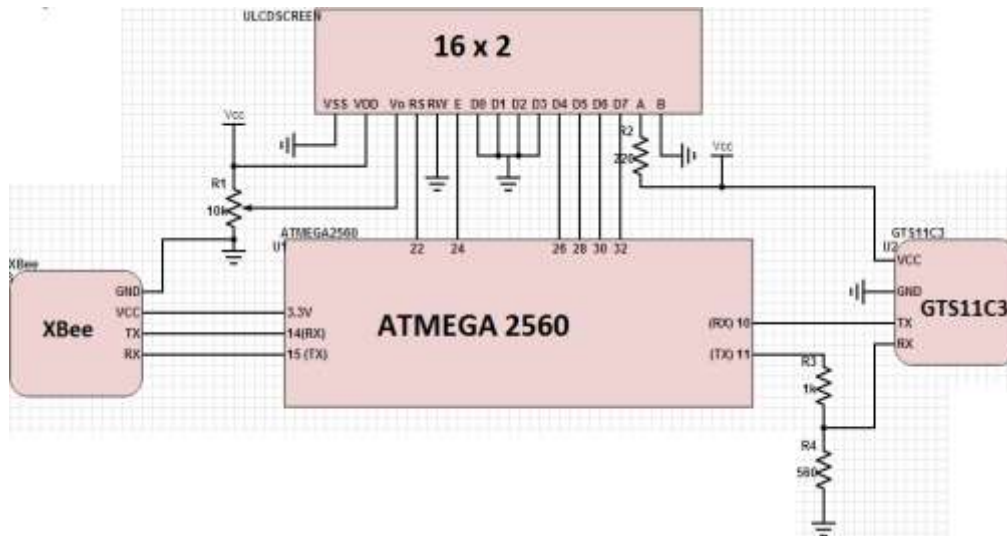
Figure 8:Remote Controller Unit Circuit

On the computer is a desktop application that ensures communication between primus database and the controller (ATMEGA 2560 driven arduino mega development board). This makes the biometric integration possible because it is at this interface that the fingerprint of a new lecturer is enrolled. The various attributes of the desktop application is show below.

Enroll

The enroll interface is used when the fingerprint (biometric detail) of a new lecturer is to be obtained. At this interface, details obtained are; name of lecturer, department, e-mail and the mobile location. The mobile location is the place where the lecturer is to take his/her lecture (fingerprint scanner's location). A screenshot is shown in figure 9.

Figure-9: Enroll Interface

Lectures

The lectures interface shows the ongoin lectures during the day. The interface has fields as

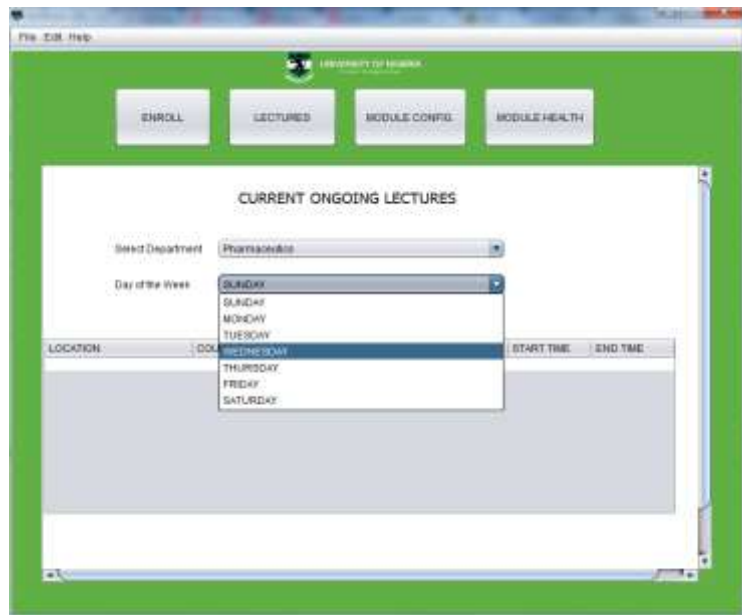shown below which makes this feature possible. A screenshot is shown in figure 10.

Figure-10: Lectures Interface

Module Configuration

The module configuration interface has the moduile version, mac address and module address sub-

module. This interface help in the installation of a new biometric module in a classroom. A screenshot is shown in figure 11.
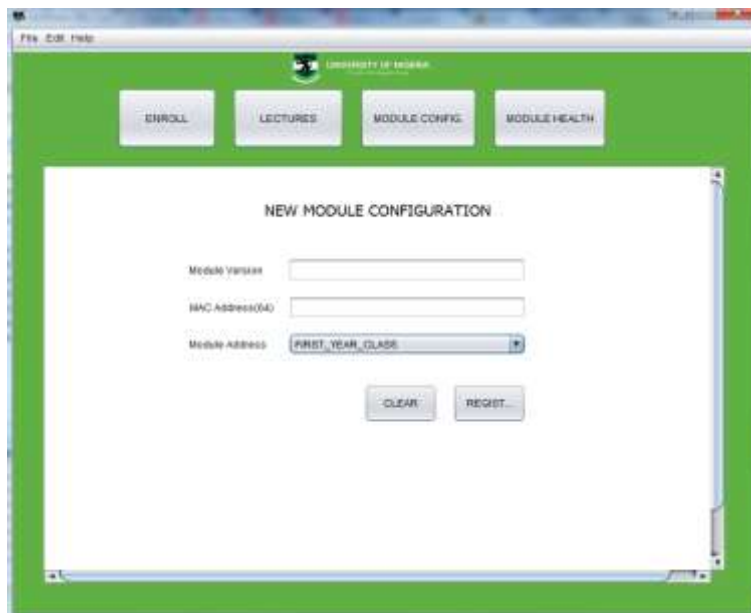

Figure-11: Module Configuration Interface

Module Health

The module health shows the battery level of the module and the location of the module. It also has a column that shows the last time a module communicated successfully.

REFERENCES
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3. Top Universities in Nigeria – 2014 University Ranking, http://campusportal.com.ng/education/top-100-best-university-nigeria-2014-university-ranking/12893/ accessed on 7th July, 2014.

APPENDIX A
RESULTS OF STUDENT REQUIREMENT ANALYSIS

	FEATURES	NOT INTERESTED	NICE TO HAVE	MUST HAVE
1.	Personal Portal Account	4%	36%	60%
2.	View Results Online	6.67%	37.33%	56%
3.	Online Course Registration	1.33%	25.33%	73.33%
4.	Academic Adviser online course form approval	8%	46.67%	45.3%
5.	Updates on Financial Aid(Scholarship)	2.67%	52%	34%
6.	Counselling and Orientation	18.67%	52%	29.33%
7.	Real time messages from lecturer to student(s).	45.33%	45.33%	38.67%
8.	Lecture/Academic Timetable integration	4%	44%	52%
9.	Course (access to info, materials, message boards)	2.67%	37.33%	60%
10.	Group (file sharing, group chat, group rosters)	21.33%	53.33%	25.33%

APPENDIX B
MODEL DIAGRAMS

Figure I: Result Sheet Entity

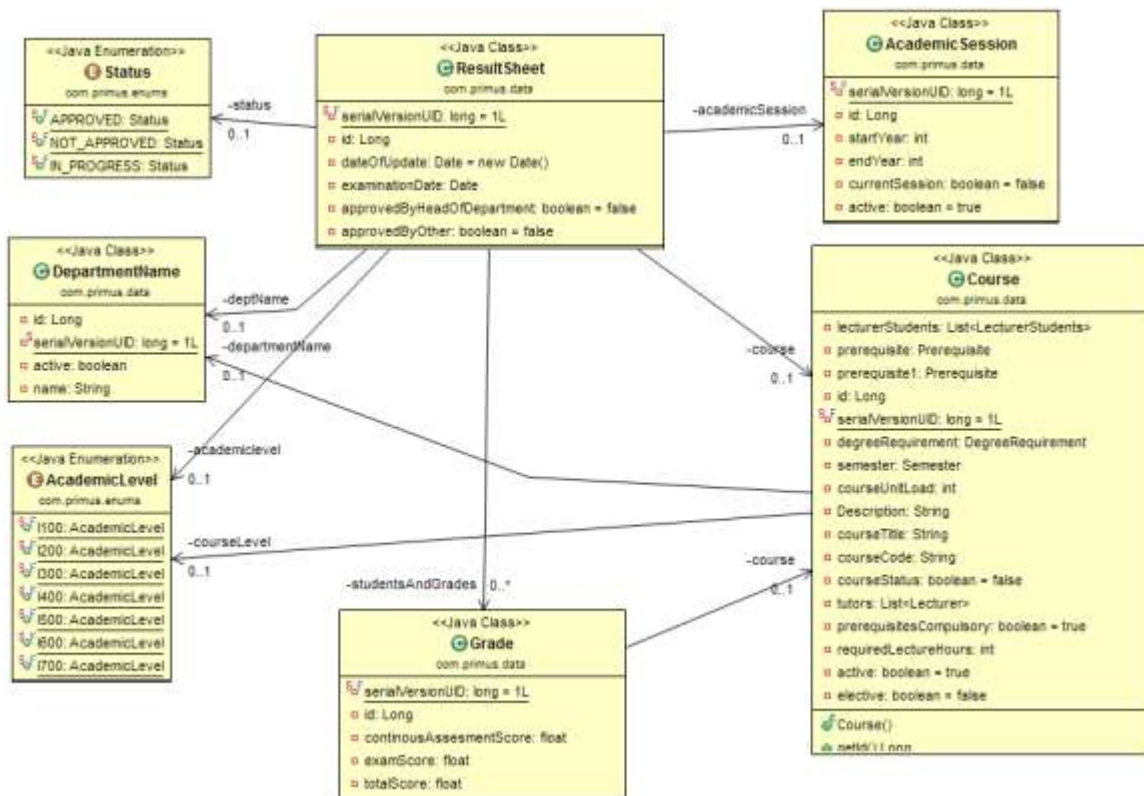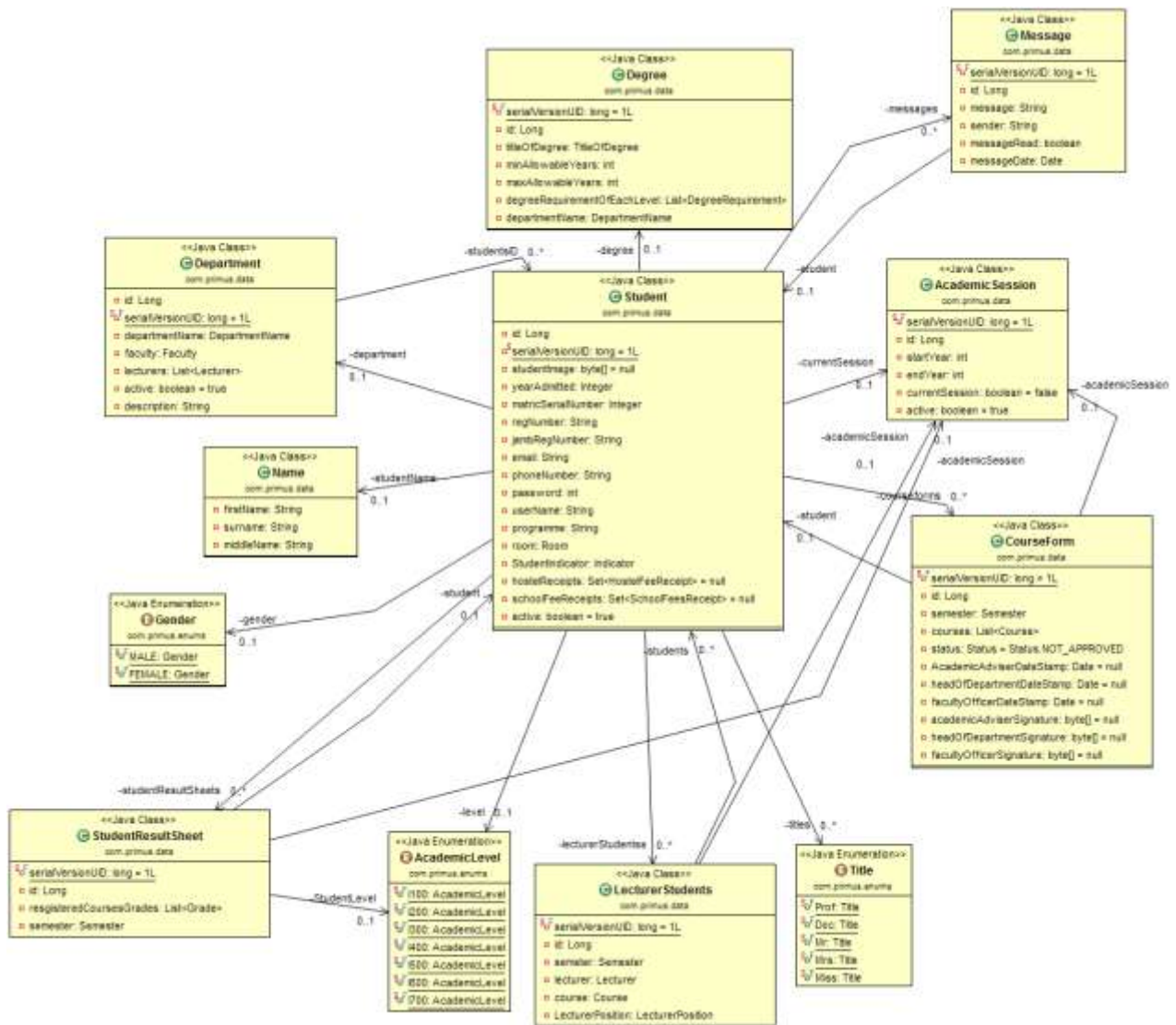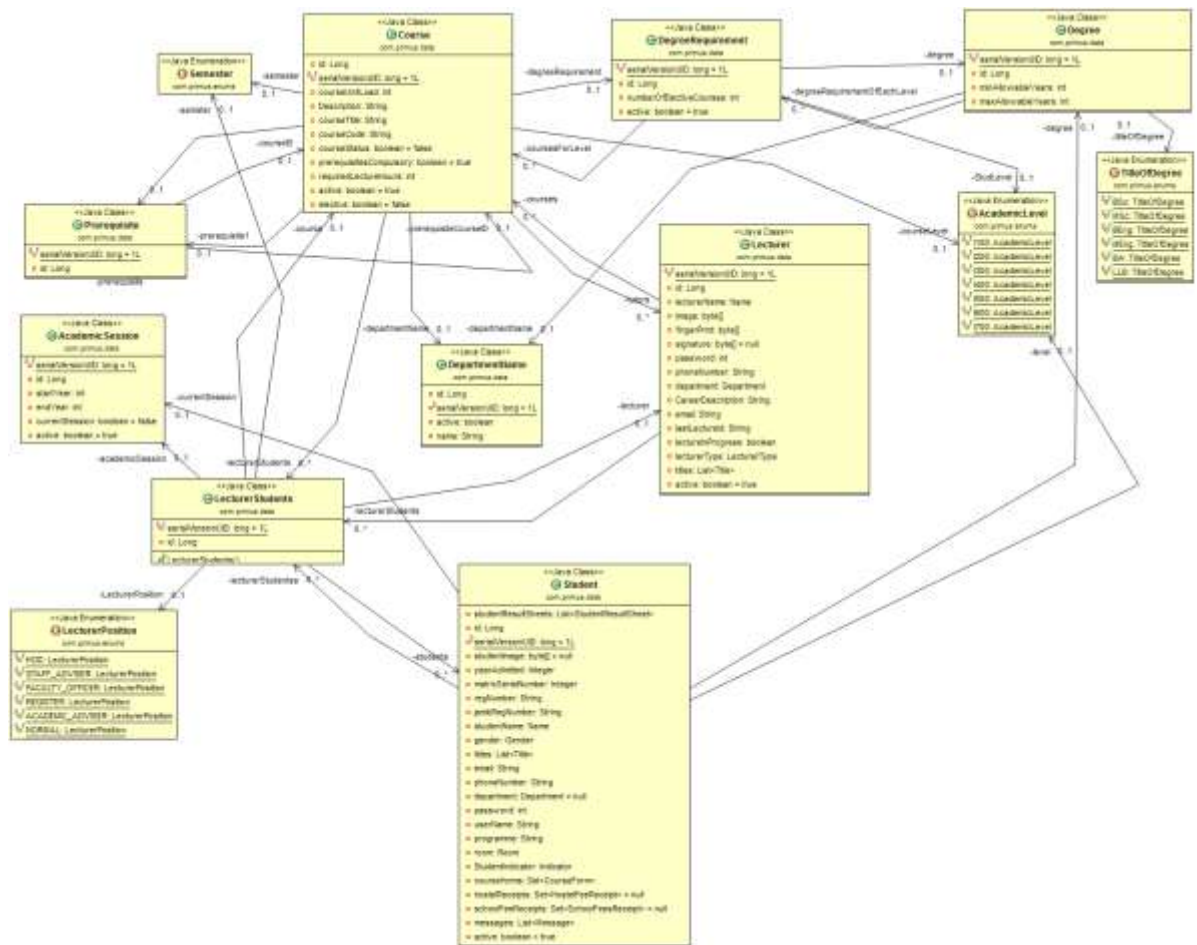**Figure II: Student Entity**

Figure III: Course Entity