UNIVERSITY OF GHANA
COLLEGE OF BASIC AND APPLIED SCIENCES
FACULTY OF PHYSICAL AND MATHEMATICAL SCIENCES

DESIGN AND IMPLEMENTATION OF AN EXAMINATION MANAGEMENT SYSTEM (EMS)

BY

KOFI AMOAKO YEBOAH – 10835555

KELVIN NII AJETEY ABADANG - 10830633

KELVIN NKETIA-ACHEAMPONG - 10812356

A PROJECT SUBMITTED TO THE DEPARTMENT OF COMPUTER SCIENCE, UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE AWARD OF BACHELOR OF SCIENCE DEGREE IN COMPUTER SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

SEPTEMBER 2023

DECLARATION

I hereby declare that except where specific references are made to the work of others, the contents of this project are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other University.

KOFI AMOAKO YEBOAH: ……..... Date: .....

(Student)

KELVIN NII AJETEY ABADANG: …….. Date: .....

(Student)

KELVIN NKETIA-ACHEAMPONG: ……..... Date: .....

(Student)

This dissertation was under the supervision of:

DR. JUSTICE KWAME APPATI: ……..... Date: .....

DEDICATION

This project report is primarily dedicated to the Almighty God, who has who has been with us every step of the way. Special dedication goes to our parents who have supported us financially and morally in all our endeavours during this academic period. In addition, we would like to express our gratitude to all our lecturers for their invaluable contributions to our academic growth throughout this period.

ACKNOWLEDGMENTS

We would want to express our heartfelt gratitude to our supervisor Dr. Justice Appati for his extraordinary support during this project process. We think the completion of this project would not have been possible without his guidance and support.

We would also like to sincerely thank our family and friends for their endless support and encouragement throughout the project.

ABSTRACT

The Examination Management System (EMS) is an overhaul to the current system that is being used in the school. We created it in an effort to improve the efficiency of the examination process including but not limited to a ticketing system that allows students to report missing grades, a reminder system that sends notifications to the faculty in intervals to remind them to submit exam questions on time, a timetable that shows each day and its course and faculty allocation, a directory or database of information about the courses and faculty in the department, and an attendance system that keeps track of the student IDs and the overall number of students who were present to write a paper. The implementation of this overhauled examination system will streamline the examination process and also assist in solving some challenges that the various departments go through concerning student results not showing.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

API	Application Programming Interface
DFD	Data Flow Diagrams
DSDM	Dynamic Systems Development Method
EMS	Examination Management System
FDD	Feature-Driven Development
IA	Interim Assessment
MIS	Management Information System
N/A	Not Available
SRS	System Requirements Specification
TDD	Test-Driven Development
UG	University of Ghana
XP	Extreme Programming

Chapter 1 - Introduction

1.1. Executive Summary

The Examination Management System (EMS) is designed as an innovative and comprehensive solution with the aim of overhauling and optimizing the current examination system that is being utilized within the University of Ghana (UG). The system introduces a range of features and functionalities that will help in streamlining the whole examination management workflow.

One of the key features within the EMS is the ticketing system which is a dedicated platform that enables students to submit a ticket to report missing grades easily and quickly without having to keep pursuing the lecturers or keep sending multiple emails which could be ignored. When a student's grade is missing, they can easily submit a ticket through the system by going to the webpage containing the form and filling in the required details of the specific course such as student identification number (ID), course code and year. This information is used to assign a unique identifier to each submitted ticket for easy management and tracking and to prevent multiple submissions of a single ticket. This ticket is then forwarded to the assigned faculty for review and resolution.

The EMS also addresses the challenge of delayed exam question submissions which can cause unnecessary stress to the active examination officer and other faculty involved and delay to the exam process as a whole. This is resolved with the use of the reminder system that has been incorporated in the EMS which has been designed to send notifications to faculty to ensure that their exam questions are submitted on time to eliminate the risk of oversight or procrastination.

A directory of information about the courses and faculty within the department is included in the EMS. This serves as a valuable resource for the examination process due to the fact that it offers detailed and up-to-date information about the courses and faculty such as course codes and descriptions, study period, academic credits, and faculty names, staff IDs, emails and phone numbers.

The EMS contains a comprehensive and up-to-date timetable that shows a clear overview of each day's exam and faculty allocations. This includes the course codes and staff IDs of the exams and faculty in charge respectively, as well as the number of students, mode of examination and semester in which the exam is written. As changes in allocations are made, the timetable is updated accordingly.

To keep track of the students who participated in each examination, an attendance system is to be integrated in the EMS. It stores the student IDs of the students as well as the overall expected number of students that are to write the exam so that when a student submits a ticket for a course grade not showing, the first step in resolution is to check if the student's ID is present in the attendance taken on the day of the exam. This is useful in preventing wastage of time of the faculty such as in the case where a student who was not present for an exam submits a ticket.

The EMS aims to improve examination experiences for both the students and faculty as a whole by providing an optimized and efficient system.

1.2. Project Background

The existing UG examination system has been plagued by inefficiencies and challenges, such as missing grades, delayed exam question submissions, and inaccuracies in displaying student results.

Across the academic years, students have been required to write IAs and exams on what they have learnt to better access their knowledge and understanding of the courses they took. Looking at the sheer numbers of students in some departments, it is understandable that more often than not, mistakes and oversights are made where some students may not have their papers either graded or the grades uploaded on the MIS system. The students are therefore required to contact their lecturers either by going to their offices during their assigned office hours, or by reaching out to them through an email or other form of message to bring this mistake to the notice of the lecturers who are then required to make all the necessary corrections. Some issues that plague this system include the case where the student does not get a response from the lecturer by email and also does not meet the lecturer in his or her office during their assigned office times, and the case where the student did not partake in the examination but refuses to divulge this information to the lecturer leading to the lecturer wasting his or her time to search for the student's script. To address these issues and improve the overall examination process, we have developed the EMS as a solution.

The EMS also utilizes a robust reminder system to notify faculty about deadlines to prevent any form of delay. One of the primary goals of the EMS are to mitigate these issues by providing a streamlined and efficient system to make the process of resolution of grades easier for both the students and lecturers by making sure that the tickets submitted by students are noticed by the lecturers in charge and by making it easier for the lecturers to check if the students were present during the exam. The other primary goal of the system is to minimize any issues brought about by any lecturer or staff not submitting exam papers on time.

1.3. Problem Statement

The current examination system in UG suffers from numerous challenges and inefficiencies due to the use of outdated ways of doing some things such as missing grade reporting. Faculty and students alike face some difficulties which are most of the time very time consuming such as reporting of outstanding grades, delayed exam questions submissions and unreliable attendance tracking. These issues can lead to frustration and errors which in turn hinder the examination process as a whole and impede the timely and accurate display of student results.

1.4. Objectives

- To design and implement a better examination system for UG.
- To incorporate a timetable that enables viewing of allocations for each day.
- To incorporate a directory of all department courses and faculty.
- To enable students to submit a ticket for missing grades.
- To incorporate a reminder system to notify faculty of incoming deadlines.

1.5. Scope and Limitations

1.5.1 Scope

The scope of the project report for the Examination Management System (EMS) includes an in-depth analysis and description of the system's design, development, and implementation. It encompasses the features and functionalities of the EMS, such as the ticketing system for reporting missing grades, reminder system for faculty notifications, timetable management, and course and faculty database. The report will detail the integration of these components, their impact on

streamlining the examination process, and the benefits they provide to students, faculty, and administrative staff. The scope will not include detailed technical specifications or implementation details of the underlying software infrastructure.

1.5.2 Limitations

- We did not have adequate information because we were not given access to the school's API.
- Some related works online had paywalls which prevented us from accessing them.

1.6. Significance of Project

The implementation of the EMS will impact everyone involved in the process positively including the examination officer, faculty, students and the examination process as a whole.

- For students, the ticketing system will present an easier and more streamlined way of reporting missing grades since when a grade is presented as N/A, the new graduation system implemented by UG will flag the student as not being able to graduate due to a missing course. It will prevent wastage of time on the part of the student since they will not have to physically go to the lecturer's office and will also serve as an assurance that the lecturers will be notified of their ticket unlike email in which the lecturer might not see or respond.
- For the examination officer, the EMS will help streamline the examination process through the use of the reminder system which will serve as a method of notifying all faculty involved about deadlines. This will help to reduce some delays to the examination process

caused by oversights or procrastination since the lecturers will be sent notifications in intervals to ensure that they are notified in time.

- For the faculty, the attendance system will help to speed up the process of finding out if the student was present to write the exam to prevent waste of time looking for an exam script which does not exist and the ticketing system will help prevent the lecturers from being bombarded with emails from students.
- Concerning the examination and grading process as a whole, the EMS will help in mitigating delays and obstructions caused by delays in the submission of exam papers and would help in resolving challenges faced by students and faculty during this period.

1.7. Outline of Methodology

The Examining Management System (EMS) was created using an Agile methodology to ensure flexibility, cooperation, and iterative improvement throughout the project lifecycle. The Agile methodology enabled gradual development and continuous feedback from stakeholders such as students and faculty. The process entailed breaking down the project into smaller deliverables known as "sprints" and ranking them in order of importance and impact. Each sprint concentrated on a different aspect of the EMS, allowing for frequent testing, feedback, and adjustments. Weekly sprint reviews, for example, encouraged good communication and guaranteed alignment across development teams. This iterative process enabled rapid adaption to changing requirements, ensuring that the EMS addressed the consumers' evolving needs. The development team was able to deliver an EMS that closely coincided with the expectations and requirements of all stakeholders by utilizing the Agile process.

1.8. Organization of Study

The EMS project would include five (5) chapters.

Chapter One talks about the proposed project and its problem statement, objectives, scope and limitations, project significance, and outline of methodology of the study.

Chapter Two is a literature review of the project and gives a review on similar projects by other students and how they were implemented.

Chapter Three talks about the methodologies used and provides a comprehensive analysis of the system's design and construction using use-case diagrams, data flow diagrams and ER diagrams.

Chapter Four talks about the testing of the system including the alpha test phase, beta test phase, unit testing and the system implementation.

Chapter Five summarizes and concludes the whole project and talks about the future works planned for the system.

Chapter 2 - Literature Review

2.1. Introduction

Examination Management System (EMS) is a comprehensive software solution designed to expedite and improve the examination process in educational institutions. It plays a crucial role in enhancing the effectiveness, precision, and overall administration of exams, which ultimately benefits students, faculty, and administrative personnel. In this review of the literature, we investigate the existing knowledge and research on EMS in order to obtain a comprehensive understanding of its significance and impact on the examination process.

2.1.1 Examination Process Challenges

The traditional manual examination processes in educational institutions are associated with several challenges that hinder efficiency and effectiveness. Numerous studies have shed light on the limitations and drawbacks of paper-based systems, providing insights into the problems that need to be addressed.

One significant challenge is the delay in result processing, which often leads to prolonged waiting periods for students to receive their grades. This delay not only affects students' academic progress but also hampers the timely feedback necessary for improvement. A study examining the impact of result processing delays on student satisfaction was conducted and it was found that extended waiting periods led to increased frustration and dissatisfaction among students (Smith, 2018).

Another challenge is the potential for errors in data management. The manual handling of examination-related data, including student information, course details, and grading records, increases the likelihood of data entry mistakes, data loss, and inconsistencies. These errors can

have serious implications for students' academic records and the overall integrity of the examination process. Research was conducted on data accuracy in manual examination systems, and it was found that a significant number of discrepancies and errors were present in the recorded data (Johnson, 2019).

Difficulties in tracking and managing student records also pose challenges. With paper-based systems, retrieving and organizing student information can be time-consuming and error-prone. The lack of a centralized database makes it challenging to maintain accurate and up-to-date records, leading to inefficiencies in student registration, grade tracking, and overall administrative tasks. A study highlighted the struggles faced by administrative staff in managing paper-based student records, including misplaced documents, difficulties in locating specific information, and the need for extensive manual effort (Anderson, Simmons, & Roberts, 2020).

Furthermore, the communication channels within traditional examination processes often prove to be inefficient. Students, faculty, and administrators may face challenges in exchanging information, submitting inquiries or complaints, and receiving timely updates. This lack of effective communication can lead to confusion, delays in resolving issues, and a general sense of frustration among stakeholders. A study was conducted that explored the communication challenges in manual examination systems and emphasized the need for improved channels that facilitate seamless information exchange and prompt response (Thompson, 2017).

To overcome these challenges, researchers and practitioners have recognized the necessity for a more streamlined and automated approach to the examination process. By implementing an Examination Management System (EMS), educational institutions can mitigate the issues associated with traditional manual processes and improve overall efficiency and effectiveness.

2.2.Relevant Works

2.2.1 Overview

This chapter provides a thorough survey of relevant works in the field of Examination Management Systems (EMS). Existing literature, research studies, and case studies pertinent to the development and implementation of EMS in educational institutions are examined. The purpose of this chapter is to establish a foundation of knowledge and comprehension regarding EMS and its impact on the examination process by analysing the works of previous researchers and practitioners. The review incorporates numerous facets, such as the difficulties and limitations of traditional examination processes, the benefits of EMS implementation, the functionalities and features of EMS, user participation, and effective EMS implementation strategies.

2.2.2 Examination Management System by A. Goel, A. Singh and D. Panwar

The Examination Management System project by A. Goel, A. Singh and D. Panwar of the Vyas Institute of Engineering and Technology is a project which is similarly concerned about making the whole examination process of the university more streamlined and optimized whiles reducing the amount of paperwork needed. According to their report, the Examination Management System makes it easier to retrieve exam information for a specific student in a certain class. The operators, which the teacher will supply for a specific class, sort the information. This system will be useful in determining whether a student meets the requirements for an exam. The main purpose of their Examination Management System is to transition the traditional way of taking exams into a computerized way. The system also automatically generates reports on the seating arrangement during exams at the conclusion of the session or in between sessions.

The system consists of two modules which are:

- Admin module: It has the authority to designate a new examination cell for a fresh batch of students and to modify student results.
- User module: The second module is managed by the user, who may be an operator or a flaw. The user is entitled to view the outcomes.

The problem the system is trying to solve is the inefficiency and sluggishness of the old current system. The manual method of undergoing some processes leads to error and miscalculations which leads to more work on the parts of the actors involved. The disadvantages of the traditional system are

- Due to delayed data retrieval and ineffective data maintenance, the current system is not user friendly.
- The report is generated at the end of the session because it requires more calculations to produce. Additionally, the student is unable to predict which class they will take their exam in.
- Since all computations are done by hand, there is a chance for error.
- The current system necessitates a lot of paperwork. Because all the papers are required to produce the reports, even the loss of one register or record might create a challenging situation.
- Since all work is done manually, we are unable to produce reports in the middle of a session or as needed because doing so takes a lot of time. (Aakash Goel, 2023)

The reason this paper has been chosen and is being reviewed is due to the similarities between the project visions. Just like our Examination Management System, their system aims to modernize and get rid of traditional methods of doing some tasks which are tedious and often lead to errors.

A difference between the two projects is the ability of their system to determine whether a student meets the requirements for an exam while our project allows students to send tickets for any discrepancies in their final grades.

2.2.3 Senior Capstone Project - Examination System by S. Vasupongayya, W. Noodam, and P. Kongyong

This project focuses on building and improving an Examination Management System which focuses on allocating examination rooms to subjects based on the factors such as type of examination, number of students partaking in the exam and the capacity of the room and allows examination proctors to be assigned to an examination room. Due to this, the Examination Management System has been classified into two modules called:

- Examination Room Assignment and Seating Layout: The major objective of this module is to select the appropriate room for each subject based on the type of examination (open or close book exam), the room's capacity, the relationship between subjects in the same room, and the room's availability. In other words, the open book exam shouldn't be in the same room as the closed book exam. The greatest number of students per subject that can be accommodated in the room while preventing students from the same subject from sitting close to one another is known as the room capacity.

- Examination Proctor Assignment: The interactive proctor assignment module for exams is what the examination proctor assignment module aims to build and develop as a web-based application. This module's major objective is to give proctors the ability to connect into the system and choose their assignments from a list of available exam rooms that is generated by the examination room and seating layout module. Additionally, the module must include a random proctor assignment so that the administrator can choose at random which proctors will be placed in which exam rooms (Vasupongayya, Noodam, & Kongyong, 2007).

This project paper was also reviewed due to its similar vision of improving the current examination system using technology using different methods from ours.

Chapter 3 – Methodology

3.1. Overview

The purpose of this chapter is to determine the requirements, both functional and non-functional, that must be met by the Examination Management System (EMS) before it can be created. In addition to providing an in-depth explanation of the system's design and the data that is associated with it, it discusses the performance that was intended for the system. In addition, this chapter provides an explanation of the information that is necessary to establish the structure and functioning of the EMS in an effective manner. It specifies the methodology that will be utilized to construct the system, as well as the manner in which the system will be constructed making use of the selected methodology, which in this case is the Agile Development Methodology. This chapter focuses on the many technologies, stages, and approaches that were utilized to accomplish the project's objectives and bring about the EMS that was envisioned.

3.2. Study Methodology

The study methodology refers to the strategy or collection of methodologies that was utilized to carry out the investigation or research. It describes the methodical procedure that was followed to gather, analyse, and interpret data in order to answer research questions or accomplish research goals. The methodology of the study offers a structure for organizing the process of doing research, which helps to ensure the consistency, dependability, and validity of the findings (Bouchrika, 2023).

3.2.1 The Agile Development Methodology

Agile project management is a method for administering a project that requires continuous collaboration and iterative work. It is predicated on the notion that a project can be continuously enhanced throughout its life cycle and rapidly adapt to changes (What Is Agile Methodology in Project Management?, 2023).

Agile requires collaborative cross-functional teams, whereas the traditional "waterfall" approach has one discipline contribute to the project, then "throw it over the wall" to the next contributor. Agile is based on open communication, collaboration, adaptation, and trust among team members. Although the project manager or product owner typically prioritizes the work to be delivered, the team self-organizes around granular tasks and assignments to determine how the work will be completed.

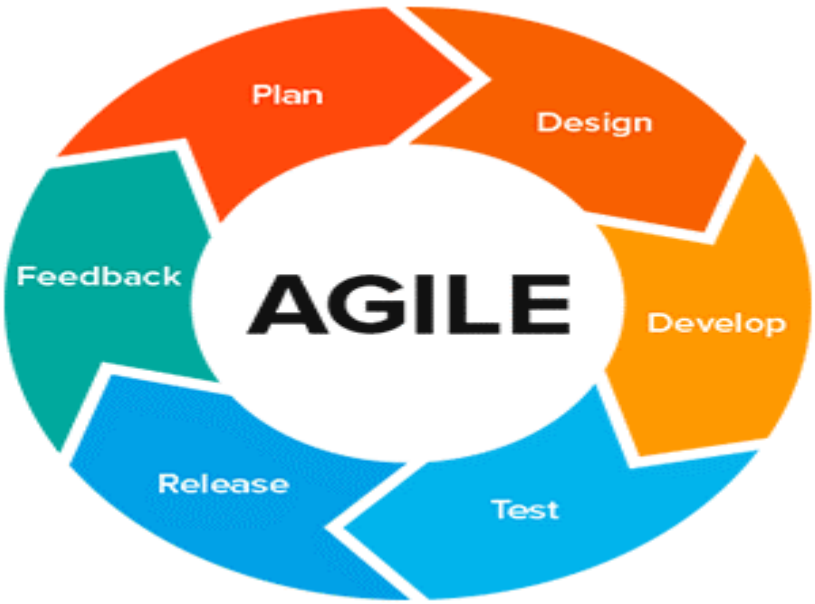

Figure 3.1 - The Agile Method Module

The figure above shows the processes involved in the agile method. Agile is not defined by a specific set of ceremonies or development methods. Instead, agile is a collection of methodologies that emphasize rapid feedback cycles and continuous improvement (The Agile Coach, 2023). The following are some examples of Agile methodologies.

- Scrum is one of the most popular Agile methodologies. The approach is iterative and incremental, with work divided into time-boxed iterations known as sprints. Scrum prioritizes self-organizing teams, daily stand-up meetings, and frequent stakeholder collaboration.
- Kanban is a visual Agile methodology that emphasizes workflow visualization and the limitation of work in progress. It utilizes a Kanban board to visualize tasks and their progress, allowing teams to optimize flow and increase productivity. Kanban focuses on continuous delivery and encourages teams to extract work as capacity permits.
- Extreme Programming (XP): Extreme Programming is an Agile methodology that emphasizes engineering practices to assure the development of high-quality software. It incorporates TDD, pair programming, continuous integration, and frequent releases. XP encourages direct cooperation between developers and clients.
- Lean Software Development is an application of Lean Manufacturing concepts to software development. It focuses on minimizing waste, maximizing customer value, and optimizing flow. Lean Software Development promotes continuous improvement, value stream mapping, and maximizing value while minimizing resources.
- DSDM is an Agile methodology that provides a framework for rapid and iterative software development. Throughout the project, it emphasizes frequent delivery, close collaboration,

and active user participation. DSDM incorporates timeboxing, prioritization, and prototyping principles.

- FDD: Feature-Driven Development is an Agile methodology focused on the incremental development of features. It focuses on domain object modelling, iterative feature development, and routine progress reporting. FDD requires establishing a list of features, planning by feature, and concentrating on feature delivery.
- Crystal: Crystal is a family of Agile methodologies that adapts to the characteristics and team size of a specific project. It provides guidelines and principles that are adaptable to guide the development process. Depending on the scale and complexity of the project, Crystal methodologies prioritize communication, teamwork, and rapid delivery (Laoyan, 2022).

Agile methodology was selected due to its essential characteristics such as:

- Iterative Method: Projects are divided into iterations or sprints, with each iteration producing a product increment that is functional.
- Continuous Collaboration: Close collaboration between team members, stakeholders, and clients throughout the duration of the project, promoting openness and communication.
- Capability to respond to changing requirements, feedback, and market conditions throughout the duration of the undertaking.
- Cross-functional teams are self-organized and have autonomy in decision-making and task allocation.
- Focus on delivering value to the customer through frequent releases and incorporating consumer feedback.

- Review and reflection on processes and outcomes on a regular basis, allowing for continuous improvement (Laoyan, 2022).

3.3. Proposed System’s Requirements

System requirements are the minimum or maximum hardware and software specifications that a system or application must satisfy to function correctly. For determining the system requirements for a specific system or application, it is essential to analyse both the functional and the non-functional requirements of the system or application, as well as to identify any constraints or other factors that may impact its performance. SRS is the result of adapting this to software development. System Requirements Specification (SRS), also referred to as Software Requirements Specification, is a document or collection of documents that defines the features and behaviour of a software application (What Are System Requirements Specifications?, 2022). Proposed system's requirements for a project report typically include both functional and non-functional requirements.

3.3.1 Functional Requirements

These requirements outline the specific capabilities and features that the proposed system must possess. They describe the expected behaviours, actions, and duties of the system. The functional requirements for the EMS are:

- User Authentication: To ensure that only authorized users have secure access to the system, the EMS should provide authentication mechanisms.
- The system should be able to keep track of the attendance of students during the examination.

- The system should allow students to fill and submit tickets concerning missing grades.
- The system should allow the admin to view the directory of faculty and courses.
- The system should allow the admin to edit the details of courses and faculty in the directory.
- The system should allow the admin to add a new entry to both the courses and lecturer directories.
- The system should allow the admin to send notifications to the faculty.
- The system should allow the user to see the allocations for any particular day.
- The system should allow the user to search and filter through the directory.

3.3.2 Non-functional Requirements

Non-functional requirements emphasize on the characteristics and qualities of the proposed system. They describe the constraints, expected performance, and usability factors. The non-functional requirements for the EMS are:

- Reliability: This refers to the system's ability to consistently perform its intended functions without errors or failures. This includes factors such as system uptime, data backup and recovery mechanisms, and fault tolerance.
- Usability: The Examination Management System (EMS) should prioritize a user-friendly interface design that caters to the needs of both students and faculty. The system should be intuitive, allowing users to easily navigate through its features and functionalities.
- Robustness: A robust system can handle error conditions effectively and without a delay. Tolerating inaccurate data, software defects, and unpredictable operational situations is an element of robustness.

- Performance: The system should be able to manage a large number of concurrent users and efficiently process data. The response times for generating reports, displaying examination schedules, and carrying out other system operations should fall within acceptable parameters.
- Security: The EMS should have adequate safeguards in place to safeguard sensitive student data, guaranteeing their confidentiality, availability, and integrity. It should include authentication mechanisms, access controls, and encryption techniques to prevent data breaches and unauthorized access.
- Scalability: The EMS should be scalable to accommodate a growing number of students, courses, and faculty. It should be able to accommodate expanding data volumes and user loads without sacrificing functionality or performance.
- Compatibility: The system must be compatible with multiple devices and operating systems, allowing users to access it from a variety of platforms, including desktop computers, laptops, iPads, and mobile devices. It should support multiple web browsers to assure universal accessibility.
- Data Integrity: The EMS should uphold data integrity, ensuring that student records, exam results, and other essential data are accurate and consistent. It should contain data validation mechanisms and error-checking procedures to prevent data inconsistencies and errors.
- Compliance: The system must comply with applicable regulatory and legal requirements, such as data protection and privacy legislation. It should assure the proper handling of personal data and provide mechanisms for data deletion and consent to data privacy, if necessary.

- Maintainability: The system should be simple to maintain, permitting future enhancements, problem fixes, and system updates. To facilitate system maintenance and future development, it must have explicit documentation, well-structured code, and a modular design.

3.4. Diagrams

3.4.1 Use-case diagram

Use-case diagrams depict the interactions between consumers (actors) and a system. They are frequently employed in software development to convey the functionality of a system from the user's perspective. Use-case diagrams illustrate the various use cases or scenarios in which users interact with the system to accomplish particular objectives. The diagram depicts actors, use cases, and their respective relationships. Use cases represent the specific actions or tasks conducted by actors. The relationships, such as associations and dependencies, demonstrate the connection between actors and use cases. Use-case diagrams assist in requirements analysis, system design, and stakeholder communication by providing a high-level overview of the system's functionality. They assist stakeholders in visualizing the system's behaviour and comprehending its primary features and interactions (UML Use Case Diagram, 2021).

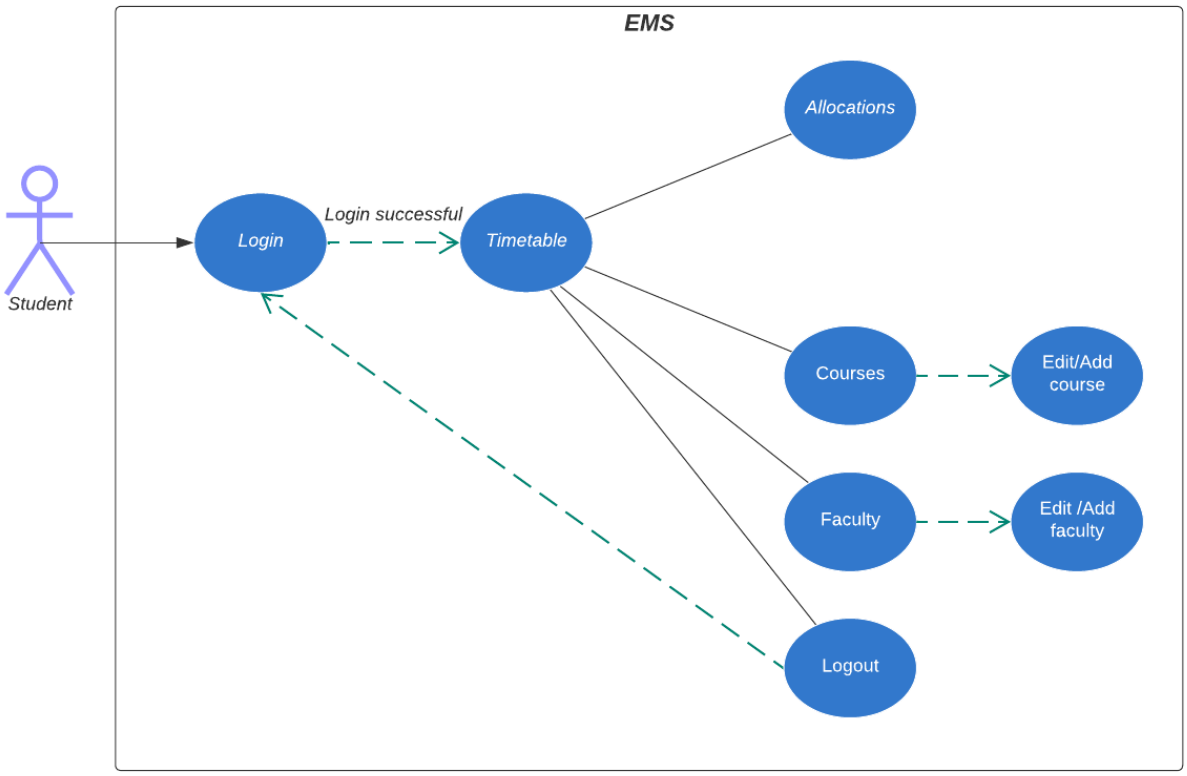

Figure 3.2 - Use-case Diagram for Admin

The following are the use-case descriptions for the student ticketing website.

- Login: Faculty need to login to access the system.
- Timetable: Faculty can view the courses and faculty allocated to any examination day on the timetable.
- Allocations: Admin can see the allocations of all faculty and the courses they have been assigned to, and other information such as the mode of the exam.
- Courses: Admin can view, edit and add a course to the directory of courses.
- Faculty: Admin can view, edit and add a new faculty member to the directory of faculty.

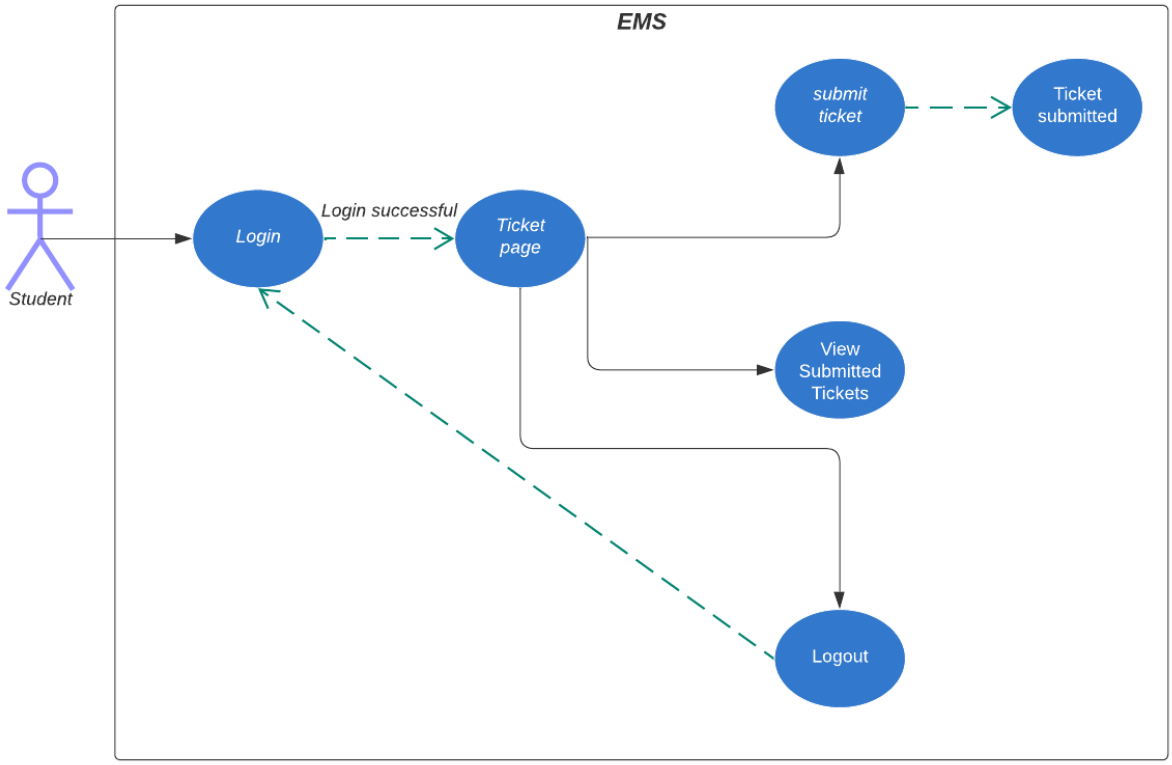

Figure 3.3 - Use-case Diagram for Students

The following are the use-case descriptions for the student ticketing website.

- Login: Students need to login to access the system.
- Submit ticket: Students can submit a ticket for a missing grade.
- View submitted ticket: Students can view the status of the tickets they have submitted.
- Logout: Students can logout of the system.

3.4.2 Data Flow diagram

Data flow diagrams (DFDs) are graphical illustrations of the data transfer within a system. They illustrate how data flows from input sources, through multiple processes, and to output

destinations. DFDs depict data flows, processes, data centres, and external entities using symbols and arrows. These diagrams provide a clear and visual representation of how data is processed and transformed within a system, enabling stakeholders to comprehend the functionality and data interactions of the system. DFDs are useful for analysing, designing, and documenting systems because they help identify data dependencies, potential bottlenecks, and development opportunities. DFDs facilitate effective communication and collaboration between project stakeholders by documenting the data flow within a system, allowing them to gain insights into the system's inner workings and make informed decisions.

The flow diagram below shows a basic flow of the different parts of the EMS working together to resolve a missing grade issue.

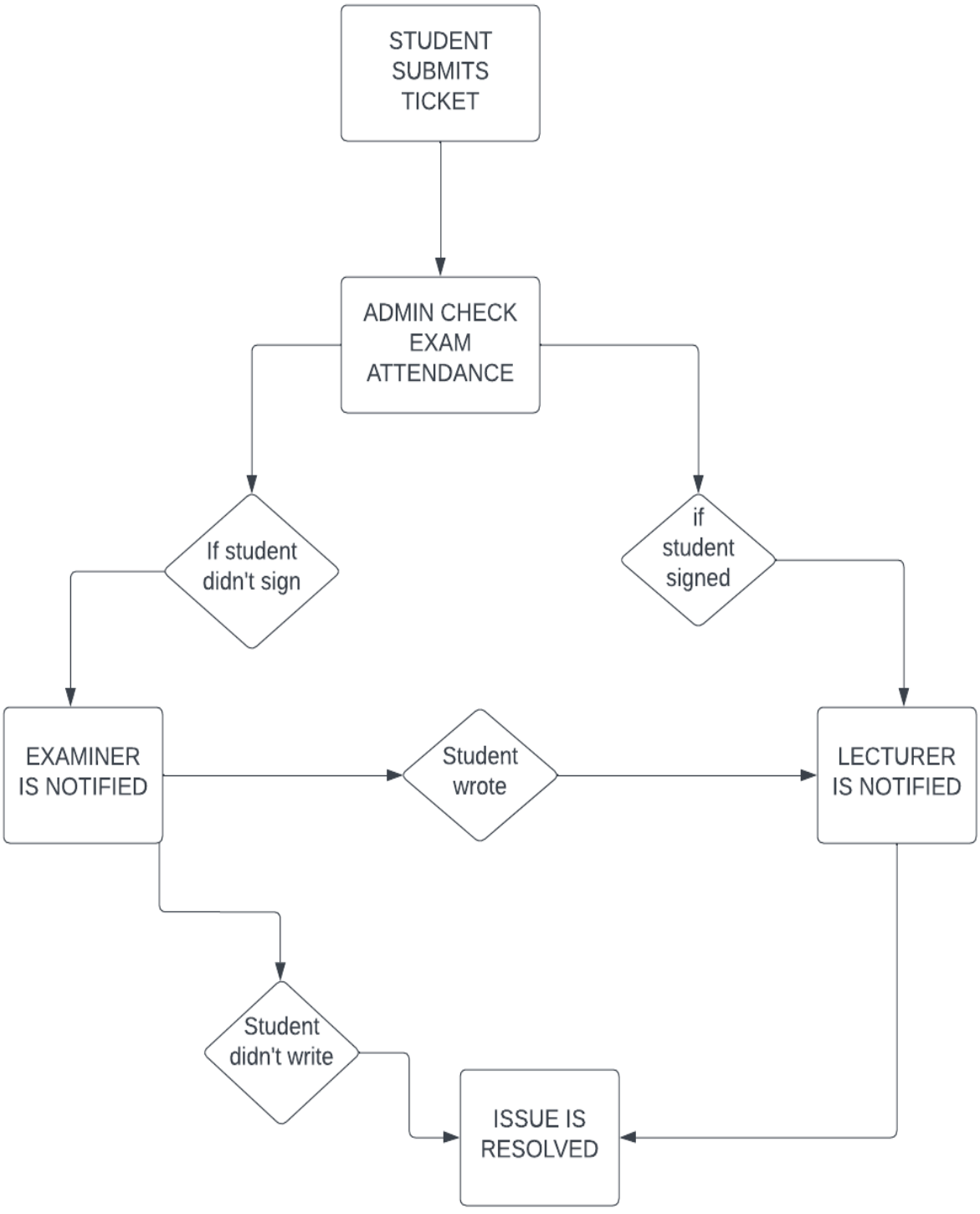

Figure 3.4 - Data Flow Diagram

3.4.3 ER diagram

Entity-Relationship (ER) diagrams are used to depict the relationships between database entities. ER diagrams illustrate the structure and organization of data by depicting the entities (objects or concepts) and their attributes, as well as the relationships between entities. The diagram is composed of entity cells, which represent the entities, and lines, which represent their relationships. In the entity boxes, each entity's attributes are enumerated. ER diagrams provide a visual representation of the database schema, enabling stakeholders to comprehend the system's data structure and relationships. They aid in the design, development, and maintenance of databases by facilitating effective communication between developers, designers, and stakeholders. ER diagrams are an essential component of the database design process, allowing for the documentation of data models in a clear and concise manner and facilitating efficient database management.

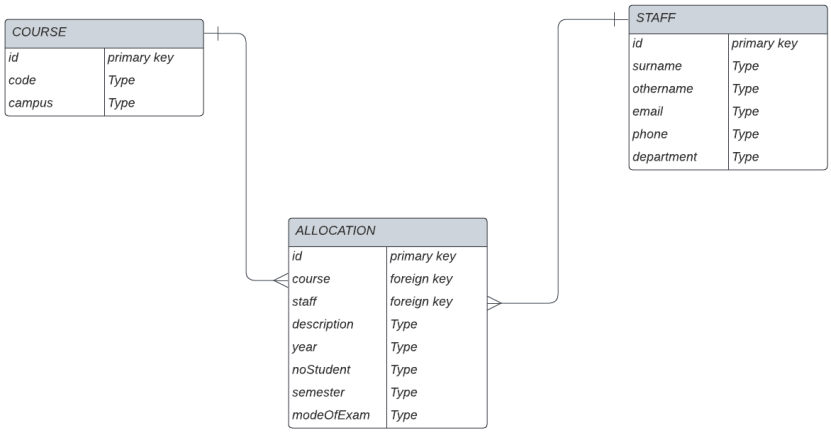

Figure 3.5 - ER Diagram

3.5. Development Tools Used

The development tools used in the project include the following:

- Vue.js for Frontend: Vue.js is a popular JavaScript framework for building user interfaces. It provides a flexible and scalable approach to developing interactive and dynamic web applications. Vue.js enables efficient rendering of components and seamless integration with other libraries or existing projects.
- Typescript for Backend: Typescript is a programming language that is a superset of JavaScript. It adds static typing and additional features to JavaScript, enhancing code maintainability, scalability, and error detection. Typescript is commonly used for building server-side applications, providing a robust and structured approach to backend development.
- PL/SQL for Database: PL/SQL (Procedural Language/Structured Query Language) is a programming language designed for managing and manipulating data in Oracle databases. It allows developers to write stored procedures, functions, and triggers, enabling efficient data processing, querying, and database operations.

By leveraging Vue.js for the frontend, Typescript for the backend, and PL/SQL for the database, the development team can create a comprehensive and integrated solution for the project. These tools provide a combination of frontend interactivity, backend logic, and efficient data management to support the development and implementation of the system.

Chapter 4 – Testing

4.1. Introduction

This chapter focuses on testing the different components to make sure they work with other system components. Here, the system is used, and its operation is assessed to determine whether it complies with the requirements.

4.2. Software Testing

Software testing is the act of checking and verifying that a system, piece of software, or application is free of bugs, complies with all technical specifications established during its design and development, and effectively and efficiently satisfies user requirements while handling all exceptional and boundary cases.

In addition to identifying flaws in the software that is already in use, the process of software testing looks for ways to increase the product's effectiveness, accuracy, and usability. It primarily seeks to gauge a software program or application's specification, functionality, and performance.

4.3. Alpha Test Phase

The initial end-to-end testing of a product to make sure it adheres to specifications and performs as intended is known as alpha testing. The Examination Management System (EMS) received extensive testing during the alpha test phase to verify its performance, functionality, and usability. Unit testing, functional testing, and usability testing were the three main parts of the testing process.

4.3.1 Unit Test

During this phase, the EMS's individual components were tested separately to ensure their accuracy and performance. Thorough unit tests were run on the login method, attendance tracking, ticket submission, and notification systems. This procedure was designed to find and fix any mistakes or faults in the system's coding, ensuring that each component worked as it was meant to.

The login page allows users with the right credentials to access the system. This system has separate log in pages for students and admin. The students, as well as the admin, will have to login with their credentials given to them by the system.

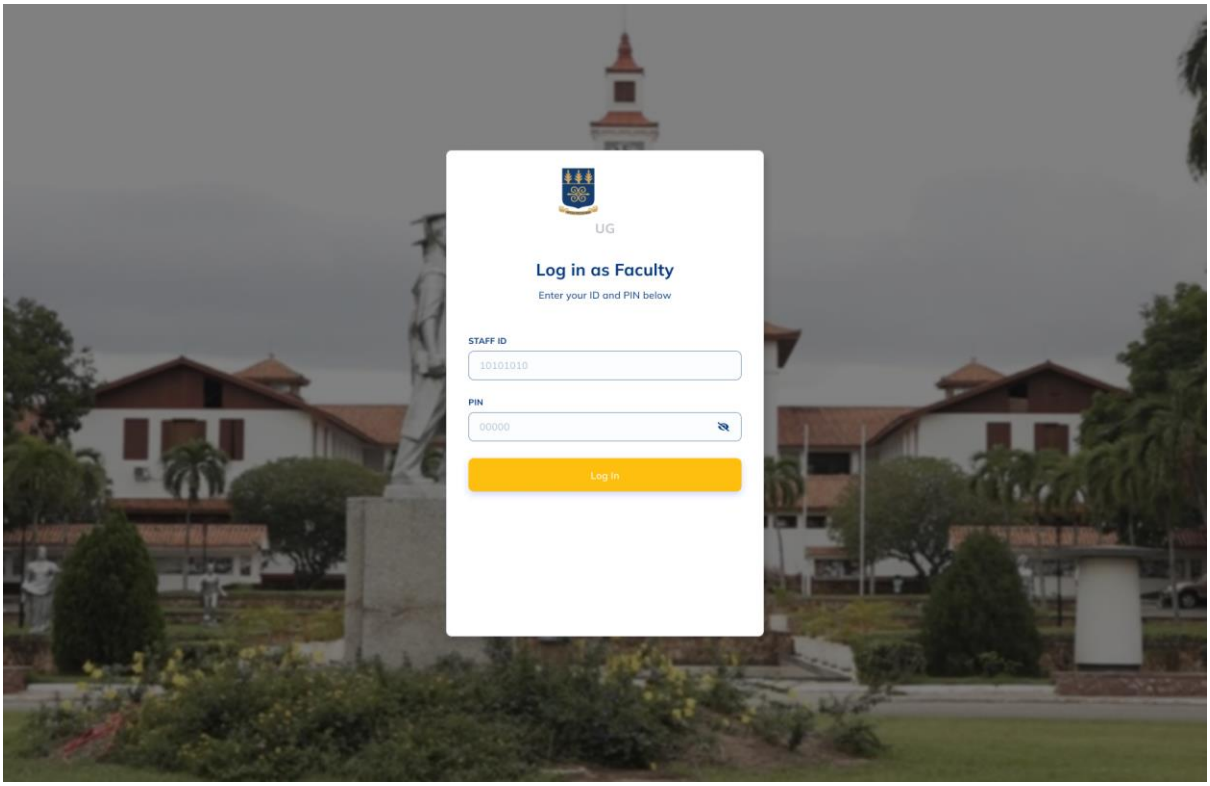

Figure 4.1 - Admin/Staff Login Page

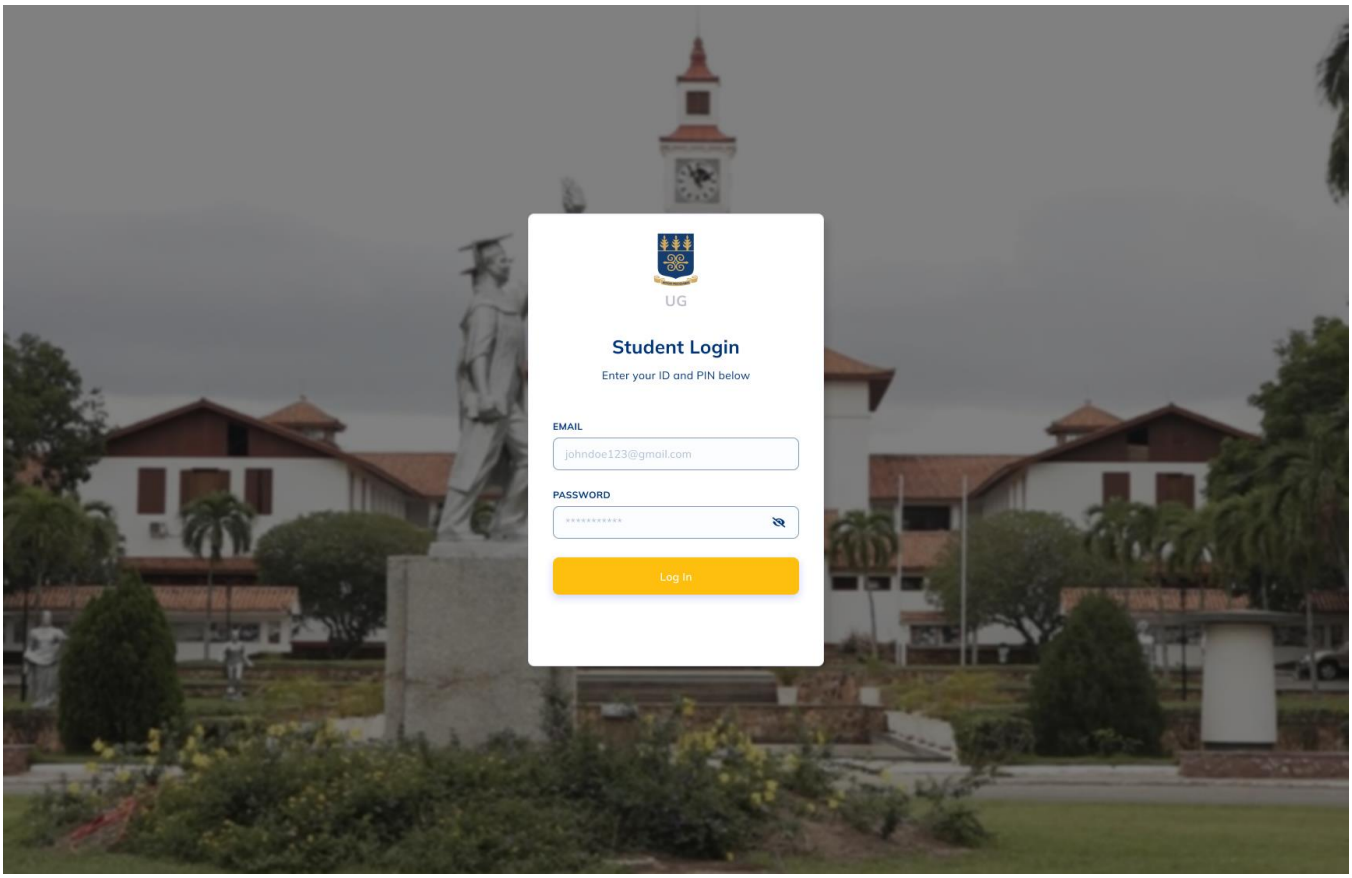

Figure 4.2 - Student Login Page

The login page gives way to the timetable page, where users can check the allocations for a particular day by selecting that day on the calendar and notifications can be sent to all staff who have a role to play on that day.

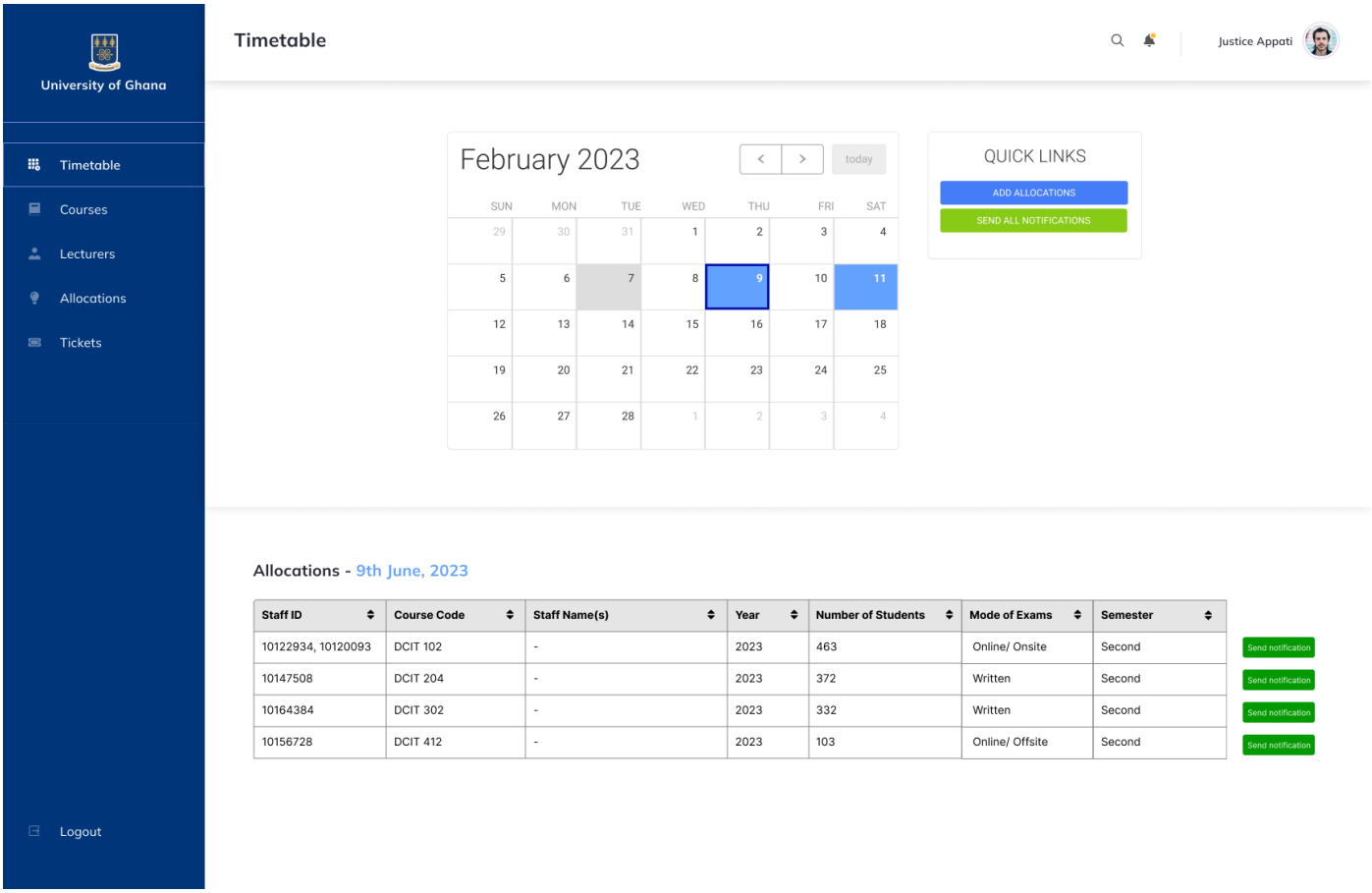

Figure 4.3 - Timetable Page

The course and lecturer directory pages contains the information on the courses available and the staff in the department allowing for edits to be made to the info in case of any errors or mistakes.

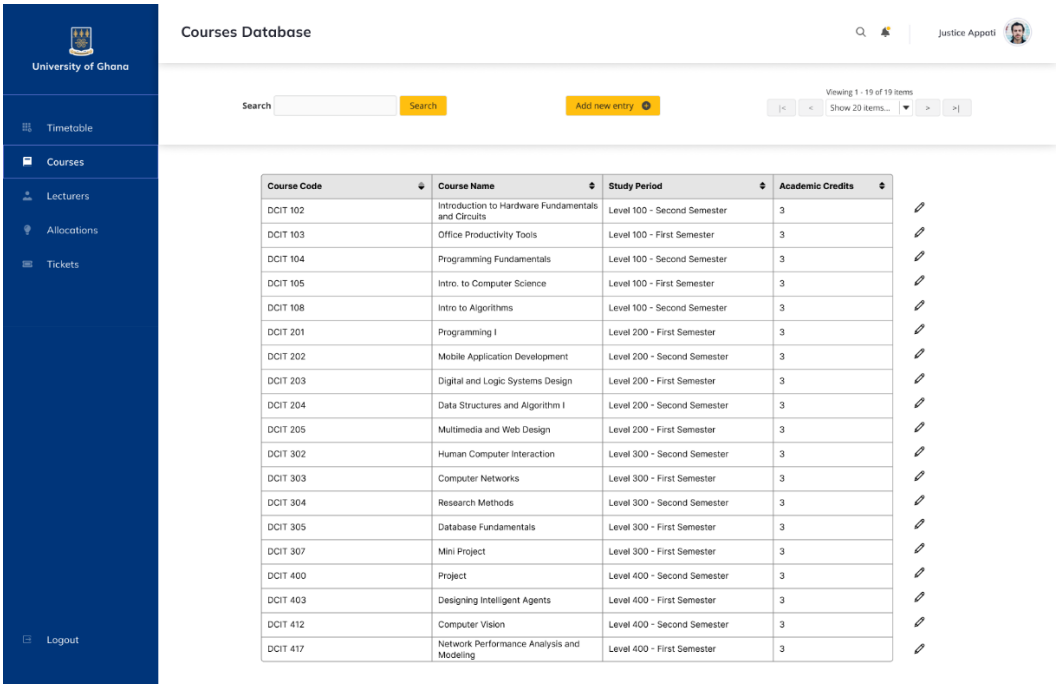

Figure 4.4 - Course Directory Page

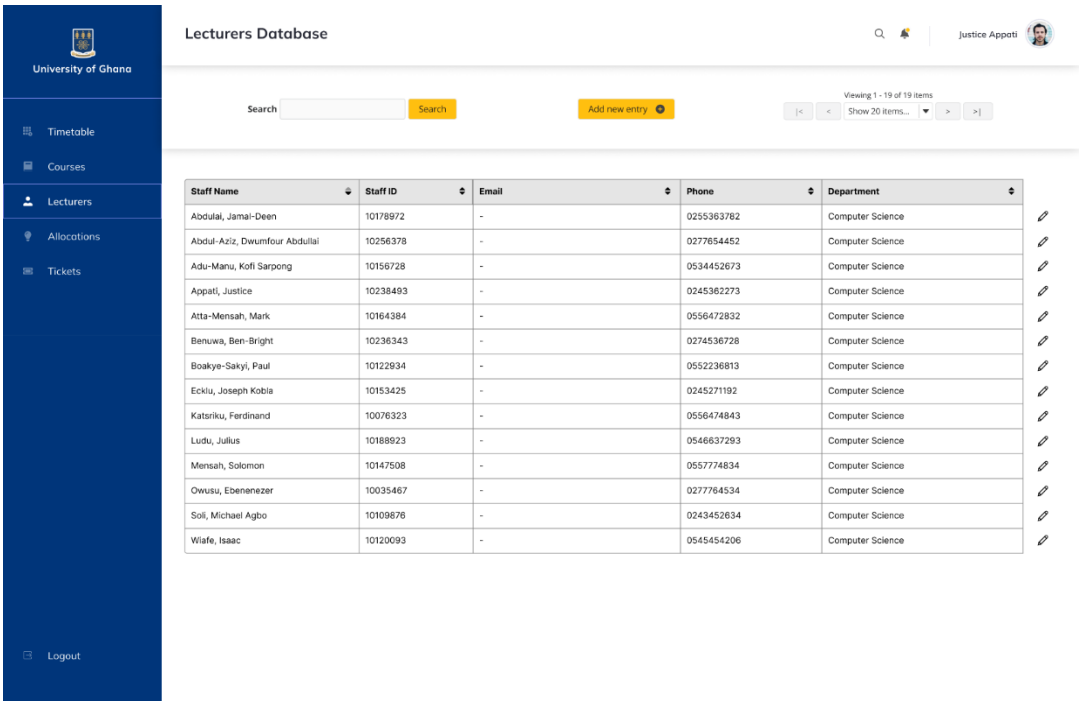

Figure 4.5 - Lecturer Directory Page

The allocation page allows for viewing and editing of allocations for each particular day.

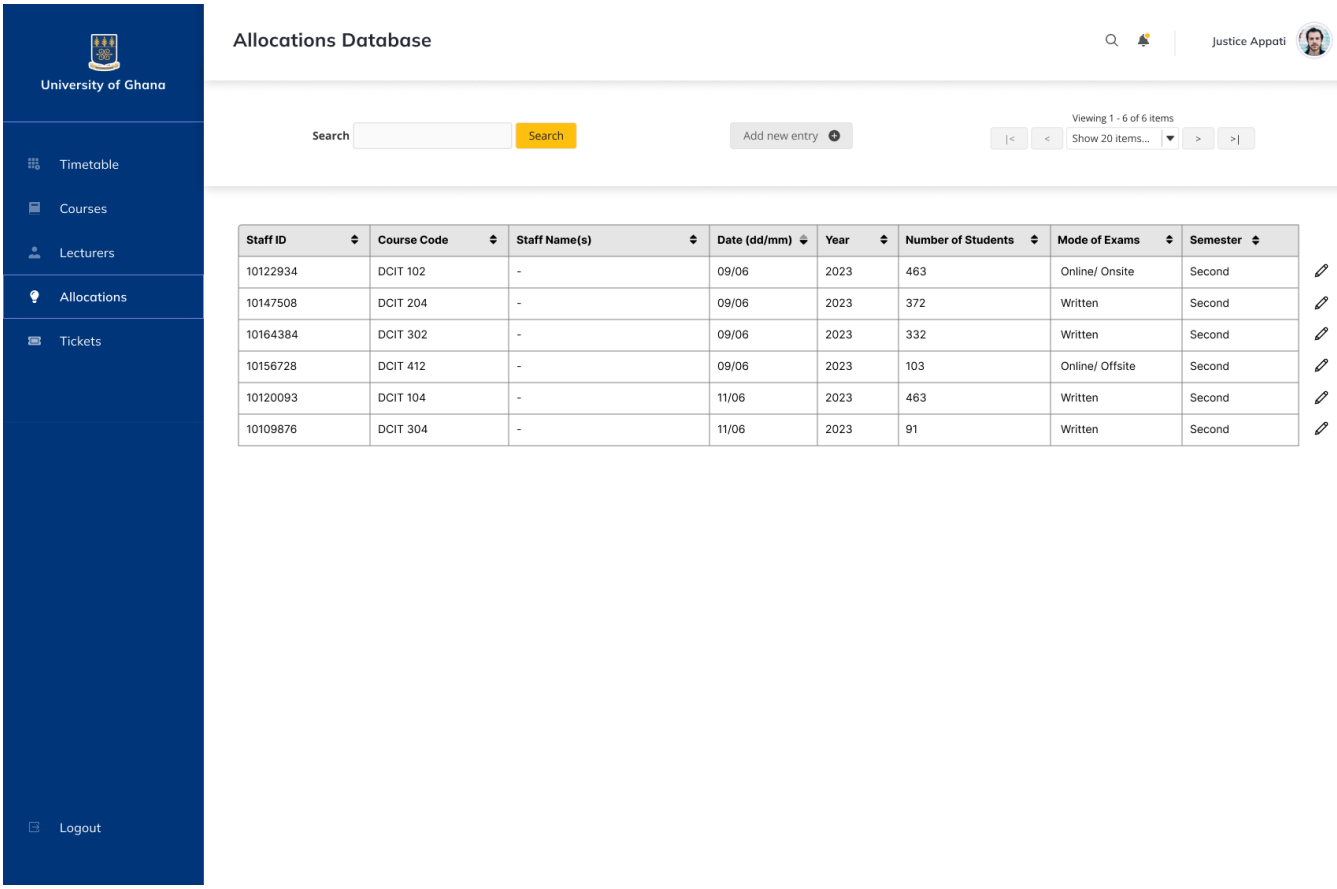

Figure 4.6 - Allocations Page

The tickets page enables the users to see submitted tickets from student and also see the state of the tickets.

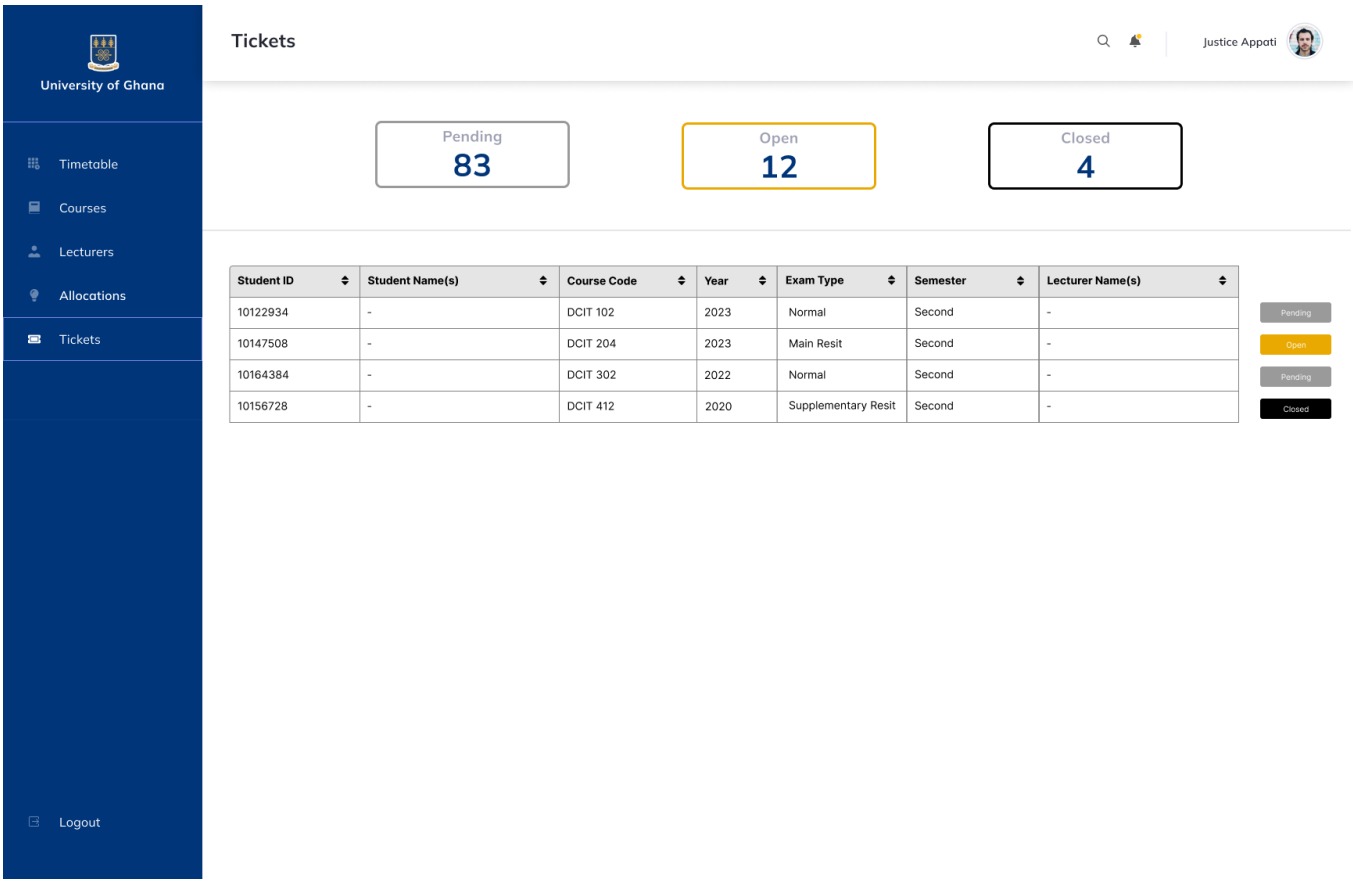

Figure 4.7 - Tickets Page

The ticket form page allows students to submit tickets concerning any discrepancies concerning their grades.

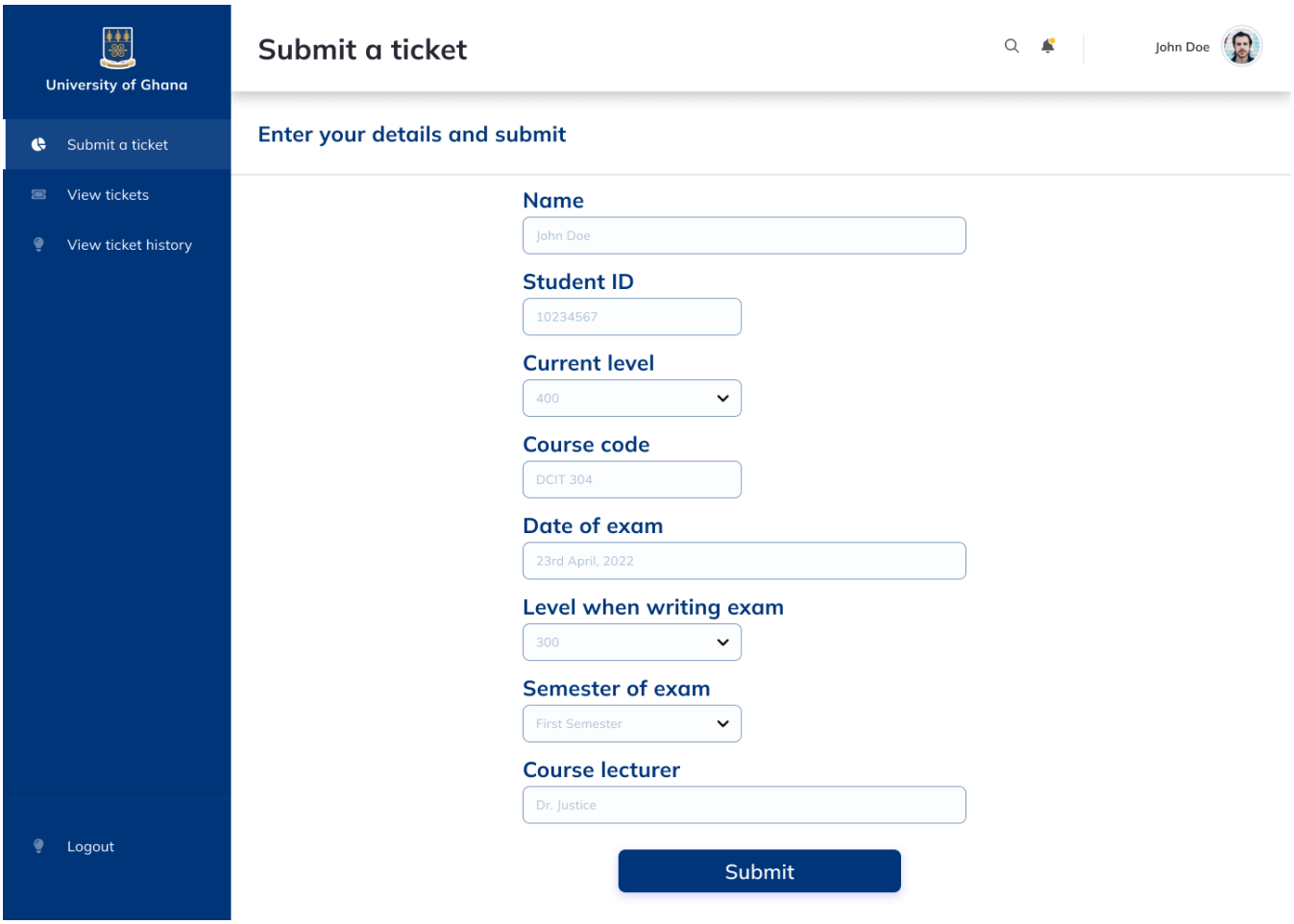

Figure 4.8 - Form Page

4.3.2 Functional Test

The EMS's capacity to carry out its planned functions precisely and successfully was evaluated during the functional testing stage. A variety of situations and inputs were used to test the system's functions, including user authentication, ticket submission, and directory administration. This testing strategy made sure that the system's functionality matched the requirements and that any differences were immediately fixed.

4.3.3 Usability Test

During the usability testing phase, the primary objective was to assess the user-friendliness and overall user experience of the Examination Management System (EMS). To achieve this, a selection of representative users, including both students and faculty members, actively engaged with the system to complete tasks such as submitting tickets for missing grades, browsing directories of courses and faculty, and accessing examination schedules. Throughout these interactions, detailed observations were made, and interactions were recorded to comprehensively evaluate factors like ease of use, navigation efficiency, and overall user satisfaction. The invaluable feedback obtained from this testing phase offered valuable insights into potential areas requiring enhancement. By analysing user input and preferences, the system's interface underwent refinements aimed at optimizing user interactions, thus enriching the overall experience, and improving the system's accessibility for all users.

4.4. Beta Test Phase

During the Beta Test Phase, the focus shifted towards conducting acceptance tests to validate the Examination Management System's (EMS) readiness for deployment. These tests aimed to ensure that the system met the predetermined requirements and fulfilled the stakeholders' expectations. The acceptance tests were performed by engaging end-users, including students, faculty, and administrators, to use the system in a real-world context. This involved executing various scenarios, such as submitting tickets, managing directories, and interacting with examination schedules. The feedback gathered during the Beta Test Phase played a crucial role in identifying any remaining issues, fine-tuning system functionalities, and making final adjustments before the system's official release.

4.5. System Implementation

The System Implementation phase involved the actual development and deployment of the Examination Management System (EMS). This phase consisted of translating the system design into a functional and operational reality. Various technical components were integrated, including the frontend developed using Vue.js, the backend implemented in Typescript, and the database managed using PL/SQL. These technologies were chosen for their capabilities in creating an interactive user interface, handling backend logic, and efficiently managing data. The implementation process required careful coordination among the development team members to ensure seamless integration and functionality across different system layers.

4.5.1 Specific Implementation Used in the Study

For the implementation of the Examination Management System, a specific technology stack was utilized. The frontend was developed using Vue.js, a widely adopted JavaScript framework known for its flexibility in building dynamic and responsive user interfaces. The backend was implemented using Typescript, a programming language that enhances code maintainability and scalability through static typing. To manage the system's data, PL/SQL, a powerful language for Oracle databases, was employed. This choice of technologies facilitated the creation of a comprehensive system that combined interactive frontend features, efficient backend operations, and robust data management.

Chapter 5 – Conclusion and Future Works

5.1. Conclusion

In conclusion, this project report gives a complete overview about the Examination Management System that aims to improve the main aspects of the examination system in the university using many features such as the student ticketing system and lecturer notification system.

5.2.Future Works

As time goes on there will be several avenues for further enhancement and improvement of the Examination Management System. More features will also be added to the system to further enhance the whole functionality of the system. In order to improve the system's functionality and handle any emerging usability issues, constant user feedback will be essential. Iterative changes that adapt the EMS to changing needs can be guided by ongoing cooperation with students, professors, and administrators. The Examination Management System’s scalability could also be expanded to accommodate a larger user base as time goes on.

Integrating a mobile application into the Examination Management System (EMS) holds the potential to greatly enhance user convenience and accessibility. By providing students, faculty, and administrators with on-the-go access to the system's features, tasks such as submitting missing grade reports, accessing schedules, and managing course directories could be seamlessly accomplished from mobile devices. This advancement would not only free users from desktop limitations but also empower faculty to efficiently handle their responsibilities and administrators to oversee operations remotely. While this expansion would necessitate careful design, security

measures, and regular updates, it could ultimately create a more user-centered and adaptable system that aligns with current user needs.

Another planned future update is a WhatsApp bot that sends notifications to users about any updates or changes in the exam schedule or submission deadlines, updates students on the progress of their missing grade tickets submitted and allows users to request details about specific courses, or exam allocations.

References

Aakash Goel, A. S. (2023). *" Examination Management System " (Project Stage 1) Examination Management System.* Retrieved from Academia: https://www.academia.edu/37780084/_Examination_Management_System_Project_Stage_1_Examination_Management_System

Anderson, J., Simmons, M., & Roberts, L. (2020). Challenges in managing paper-based student records. *Journal of Educational Administration*, 120-135.

Bouchrika, I. (2023, May 15). *How to Write Research Methodology: Overview, Tips, and Techniques*. Retrieved from Research.com: https://research.com/research/how-to-write-research-methodology

Johnson, P. (2019). Examining data accuracy in manual examination systems. *International Journal of Educational Management*, 485-502.

Laoyan, S. (2022, October 15). *What is Agile methodology? (A beginner's guide)*. Retrieved from Asana: https://asana.com/resources/agile-methodology

Smith, A. (2018). Impact of result processing delays on student satisfaction. *Journal of Higher Education*, 278-293.

The Agile Coach. (2023). Retrieved from Atlassian: https://www.atlassian.com/agile

Thompson, L. (2017). Communication challenges in manual examination systems. *International Journal of Educational Technology*, 45-60.

UML Use Case Diagram. (2021). Retrieved from Javatpoint: https://www.javatpoint.com/uml-use-case-diagram

Vasupongayya, S., Noodam, W., & Kongyong, P. (2007, January). *Developing Examination Management System: Senior Capstone Project, a Case Study*. Retrieved from World Academy of Science, Engineering and Technology: https://publications.waset.org/16548/developing-examination-management-system-senior-capstone-project-a-case-study

What Are System Requirements Specifications? (2022, December 18). Retrieved from Inflectra: https://www.inflectra.com/Ideas/Topic/Requirements-Definition.aspx

What Is Agile Methodology in Project Management? (2023). Retrieved from Wrike: https://www.wrike.com/project-management-guide/faq/what-is-agile-methodology-in-project-management/