Internship Report On System Analysis of ERP Development and Azure Cloud Computing For CLOUD CREATIVE LIMITED

By

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Summer, 2021

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September 11, 2021

Dissertation submitted in partial fulfillment for the degree of Bachelor of Science in Computer Science

Department of Computer Science & Engineering

Independent University, Bangladesh

Attestation

To whom it may concern,

I am writing this letter to attest that the Internship is valid, and this report has been prepared by me, Farhan Khan (1720896). I have submitted this Internship report for fulfilling the requirements to achieve the Degree of Computer Science and Engineering from Independent University, Bangladesh (IUB). This report has been completed under the guidance of my internal supervisor Mohammed Noor Nabi and external supervisor Mr. Nashid Ali.

As everything I learned from my internship period has been implemented in this project and duly acknowledged in this report. Therefore, I hereby certify that all of my work and details laid out in the report are authentic and genuine. In case, if there is need of additional information regarding the report's authenticity, please contact my supervisors.

Signature	Date 9/11/2021
Farhan Khan	
Name	

Acknowledgement

My time in Cloud Creative Limited as an intern from June 12 to September 10 was a memorable period for me. The experiences and opportunities will help me grow and develop more professionally and the contribution of others have to be acknowledged as without their support and help it would have not been possible to achieve this milestone. My sincere gratitude:

First and foremost, I would like to thank Almighty Allah for granting me this internship opportunity in Cloud creative Limited with some of the finest professionals and, for giving me good health to be able to accomplish it, during these hard times. My parents have also played a major role in contributing to my success in the professional environment as they have given me unconditional love, support, and advice for which I was able to handle this challenge.

I also want to thank my External supervisor, Mr. Nashid Ali who is the CEO of Cloud Creative Limited for believing in me and showing his kindness to give me a chance to do my internship at his company. He advised me from time-to-time and provided me with continuous feedback even with his busy schedules. Therefore, I am thankful to have been part of this company. I would also like to express my thanks to Mr. Sumit, Project Manager, and development team for taking part in useful and necessary decisions and guiding me through all the process of work in the office. I am grateful for their helping nature and want to acknowledge it.

I also want to thank my internal advisor and faculty Mr. Mohammad Noor Nabi, Senior Lecturer, Department of Computer Science and Engineering, IUB for his valuable guidance, time, constructive criticism, and useful advice regarding various aspects of my internship report and helping prepare a proper report for submission.

Finally, I want to express my gratitude to all my colleagues for helping me throughout and making this Internship period a positive experience.

This Internship has provided me a huge foundation base for career development as all the learning experiences and implementations helped me develop a good set of skills.

Letter of Transmittal

September 10,2021
Mohammad Noor Nabi
Senior Lecturer
Department of Computer Science and Engineering
Independent University, Bangladesh.

Subject: Internship Report submission Summer, 2021.

Dear Sir,

With due honor and respect, I would like to submit my completed internship report as partial fulfillment of the CSE degree program to you, for your kind consideration. I have given my efforts to study, document and complete my report by due time. This letter is written to inform you that I have completed my internship program in my company Cloud Creative Limited and have prepared a final report for submission. My internship program started on June 12th officially and I have completed it.

This final report is based on my experience and work I came across in Cloud Creative Limited during my internship period. The primary goal for my internship was to gain experience in different technology related fields of the company, starting with research and development, documentation, content writing, ERP software development, cloud server deployment and to get acquainted with cloud infrastructure, services, and best practices. The company contains a team for ERP and Cloud infrastructure who learn, collaborate, and innovate together and it has been a great time working here.

I made sincere efforts for preparation of the report and learned a lot during my internship at Cloud Creative Limited from which I have practically implemented many skills. Finally, I would like to thank you immensely for your guidance and support. I have made this report as comprehensive as possible, and I pray that this report fulfills all the requirements and is up to your expectations and I hope that you will consider my efforts.

Sincerely,

Farhan Khan, 1720896
Department of CSE
Independent University, Bangladesh

Evaluation Committee

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Signature

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Name

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Supervisor

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Internal Examiner

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External Examiner

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Abstract

In today's world there are lots of new changes and covid -19 has shown many weaknesses that haven't been considered before. An educational Institute needs an efficient system to keep track of their records. The more efficiency it has, the better the performance and profit. Education Management System (EMS) is a cloud-based ERP system that is the solution to that, and it delivers various modules of educational institute processes like Admissions, course registration, Class allocation etc.

In this covid - 19 situation, this system has become very necessary for many universities and schools as they operated manually before and lacked infrastructure, technical resources but now with covid their whole setup has been shifted to virtual settings. Given that, recently I received an opportunity of working under a company named Cloud Creative Limited, who have developed this ERP software.

As we know, Enterprise resource planning (ERP) refers to a type of software that organizations use to manage day-to-day business activities such as education management, accounting, procurement, project management, risk management and compliance etc. We are partners with Odoo which is one of the open-source platforms that is a comprehensive open-source enterprise resource planning (ERP) software made up of an integrated suite of business modules, including education, customer relationship management (CRM), e-commerce, accounting, billing, inventory management, project management, financial management, purchasing and others. These modules aim to efficiently and seamlessly communicate with each other to exchange information and provide solutions. Cloud Creative Limited is one of the successful partners of Odoo in Bangladesh. Hence, Odoo has been used in ERP development phase to develop the software.

The task of our team for the project is to research and do requirement analysis, design and develop desired modules and participate in cloud environment deployment. As technology has advanced enormously, we will get to learn more everyday. In this report we will discuss how to implement an ERP system, deploy it in the cloud and how an institute can benefit from this.

As it was under development the company assigned me in the research, design phase of modules, forms and cloud deployment. The web application backend is postgre SQL version 12 and python v3.7 based. So, this provides a responsive user interface and appeals to the users of the system. We have then deployed the web application in Azure Cloud with Microsoft Azure Services.

Working in Cloud Creative Limited as an intern, added huge experience to my career. This report will take us through all the details of ERP development and Azure cloud computing knowledge and experience gathered during this internship period.

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Chapter 1

Introduction

1.1 Overview/Background of the Work

For an educational institute it is hard to manage their database and keep trace of their data if they are not automated. Manually all the process seems to be lengthy, so Education ERP System (EMS) is the solution we provided to some institutes where they use only their preferred modules and migrate all their data in cloud. This eliminates worries about servers, maintenance, physical infrastructure as everything is running in cloud infrastructure and, since you get readymade modules from which you can use the modules you prefer and pay for those modules only, everything is much more convenient and flexible.

Given, that the software will be deployed in cloud infrastructure, we should know that cloud computing is the on-demand delivery of IT resources over the Internet with pay-as-you-go pricing service. Instead of buying, owning, and maintaining physical data centers and servers, you can access technology services, such as computing power, storage, and databases, on an as-per-need basis from a cloud provider like Microsoft Azure for a certain amount of priced subscription. Organizations of every type, size, and industry use the cloud for a wide variety of use cases, such as auto-scalability, Load balancers, data backup, disaster recovery, virtual machines, virtual servers, and software development. As we know, cloud provides many services like SaaS, PaaS, IaaS from which the proposed work will focus mainly on IaaS and then, later PaaS and uses public model.

For example, Cloud is used in many purposes like Game developers are using cloud to deliver online games to millions of players around the world. Mid ranged companies are using cloud to launch their servers. All these are just a glimpse of what cloud computing is useful for.

1.2 Objectives

The objective of ERP development of EMS is to serve the educational institutes purposes hence, the modules are developed accordingly. The EMS system keeps track of all the information about the entire website. Also, the system contains a database where all the information will be stored safely. The front end is based on Javascript and XML, while the backend is based on python v3.7 and PostgreSQL v13.

This ERP website will allow users to get all the relevant information without the hassle of server, system maintenance and software development. They will be able to carry their operations in a secured manner through encrypted SSL/TLS channel. The most beneficial factor of the website is that because it is an online-based system, people can access it from their computers and phones, at any time anywhere. As, cloud computing gives on-demand delivery of IT resources with Agility, Scalability, Cost savings and allows deployment globally in minute's facilities, this makes Microsoft Azure a feasible choice for infrastructure of the software.

The internship objectives are:

- Learn how to implement theories into practice.
- Learn the role of analysis and design patterns in software development and use the basic design principles in solving real life problems.
- Develop skills in analyzing the usability by different reports.
- Make architectural decisions based on Azure architectural principles and best practices.
- Leverage Azure services to make your infrastructure scalable, reliable, and highly available.
- Leverage Azure Managed Services to enable greater flexibility and resiliency in an infrastructure.
- Make an Azure-based infrastructure more efficient to increase performance and reduce costs.
- Use the Well-Architected Framework to improve architectures with Azure solutions.

1.3 Problem Statement

Many educational institutes lack infrastructure, resources to implement their own software and servers. This is a problem since most of the institute's work are done traditionally causing to be costly and time consuming where vital data are lost, due to loss of tracking records. Also, there are many cases where the institutes who own their own developed system face issues like server crash due to too many server requests during course registration, Data loss due to hard drive corruption, hacking and etc. they also are limited to certain boundaries since they use physical infrastructure.

1.4 Scopes

Our scope is to make an ERP based education system, that will contribute to the society, economics and automation of process flow of educational institutes. My aim of work is to do system analysis and design of the possible modules and then contribute to cloud deployment phase.

Following all the complication mentioned above in problem statement, this internship project gives two types of solutions to solve the ongoing issues of educational institutes regarding software. ERP software and Cloud combination are a perfect solution as they provide wide range of resources, flexibility, and availability. ERP allows automation of process and use of preferred modules whereas, cloud eliminates issues of server crash, data storage concern, need of physical infrastructure through features like clustering, VMs, virtualization, Vnet that address many problems and provide solutions. Hence, the main objective of the project is to provide an inexpensive, scalable solution to such problem scenarios in comparison to current traditional practices.

The Education ERP system we will be designing will have certain modules that we aspire to complete development of and will hopefully be deployed in cloud infrastructure to allow global reach and accessibility. We also intend to incorporate more feature in the future such as faculty evaluation, CGPA analyzer and etc.

The project covers certain modules that are such:

- Dashboard: Admin panel is accessible only to administrator who can view modules and perform all CRUD operations as they prefer. Then, we have student dashboard where the student can register for courses, view assignments, print bill. Lastly, faculty dashboard is where faculty will be able to view assigned subjects, take attendance, view sessions.

- Admin (User management): It allows admin to add / edit / delete unlimited users as per wish. Given that admin can view user profiles and implement role-wise user authentication (Student, Teacher, Department Admin). Also, as admin can operate all CRUD operations, they can manage the user role capabilities.
- Manage student admission: Here student can apply and register for admission.
- Course Management: It allows specified user to add /delete course, Allocate course, Schedule timing and sessions and subject registration. Allows department admin to assign student teachers to classes, section and classrooms.
- Manage Degree program: In here admin can allocate faculty, Create Batch id and allocate department courses.
- Classroom management: It allows to assign facilities, allocate Classroom number, and assign classroom to courses.
- Faculty profile: Here faculty can view information, assigned subjects, view sessions, and assign assignments to students and take attendance.
- Student profile: Here, student can view information, assignments, attendance record and register for course.
- Timetable: It allows to configure timings and generate session for classes and faculty.
- Result management: In this module we will be able to set grade and percentage accordingly and define the pass mark and generate class wise exam result that marksheet can be printed class wise or even for individual student.
- Attendance Management: Take attendance of students for regular classes and exams too.
- Financial Management: In this module we will be able to manage student payments, print invoices, mange overdue list and configure fee terms of courses, semesters accordingly.
- Architecting Cloud Infrastructure: In deployment phase, we will design cloud architecture, ensure workload compatibility with Microsoft azure cloud environment. Then we also have to analyze and architect the required environment the system will be placed in, following use of Azure resources such as Azure VMs, Data storage, Database, Load Balancer and finally deploying the system in cloud.

Chapter 2

Literature Review

2.1 Relationship with Undergraduate Studies

The internship is IT based and requires a CSE background student as its employee. The work involves a huge portion of my academic knowledge from my undergraduate studies.

These are the courses related to my work:

- Cloud Computing (CSE 472): This is an introduction course based on cloud computing which covers the fundamentals of what cloud infrastructure is and this helped me to understand all the terms and processes that were being use during implementation of cloud infrastructure deployment during my internship. This is a vital part of my learnings.
- Database Management (CSE 303): This course taught me how to design and plan a project. It covers popular planning and strategy practices such as Six Element Analysis, Problem Analysis, System Development Life Cycle, Rich Picture, Requirement Analysis, Entity Relationship Diagram, Business Process Model, many more which were useful in this report.
- System Analysis and Design (CSE 307): This course gives an in-depth overview of Use Case Diagram, SDLCs and how to adopt each one of these to the project for implementation. It is a vital part of my project work.
- Web Application and Internet (CSE 309): This is the course where the development of web applications is taught. It covers very important technologies that are highly in demand in the industry, such as HTML, CSS, JavaScript, jQuery, View Engines (Handlebars and embedded JavaScript) that were used for front end development.

- Network Management (CSE 403): This course gives an overview of networks. This gave an idea about servers and communication patterns, policies, security which was useful for Microsoft azure services.
- Data Communication and Networking (CSE316): This course gives fundamental understanding of Networks, traffic routing and management which helped in understanding certain factors in the cloud deployment phase.

2.2 Related works

1. Syntech – Education ERP: They serve many known universities such as Bangladesh Agriculture University, Sonargaon University Dhaka, Sher e Bangla Agricultural University, Sylhet Agricultural University, Prime University, Islamic University, Kushtia

2. Educlerk – Education ERP: They serve many schools like LORDS, Grace International School

All these institutes use Education management ERP system to manage their business system which minimizes the amount of employee and maintenance cost making process much smoother and easier for the institutes. The system provides benefits since the software, server, database all are responsibilities of the cloud service providers (vendor) and since institutes only use modules that they need, it is much more convenient for them. The whole system is sitting on a cloud infrastructure, making it accessible to all users through internet. Also, all the data records are stored in the cloud, which ensures data safety to a much reliable extent and prevents data loss from occurring due to disaster as the data are kept in a cluster and backup datacenters unlike traditional on- premises database infrastructure. As it is in the cloud, it is the responsibility of the vendor to maintain and manage it. Hence, the maintenance cost is also reduced.

Chapter 3

Project Management & Financing

3.1 Work Breakdown Structure

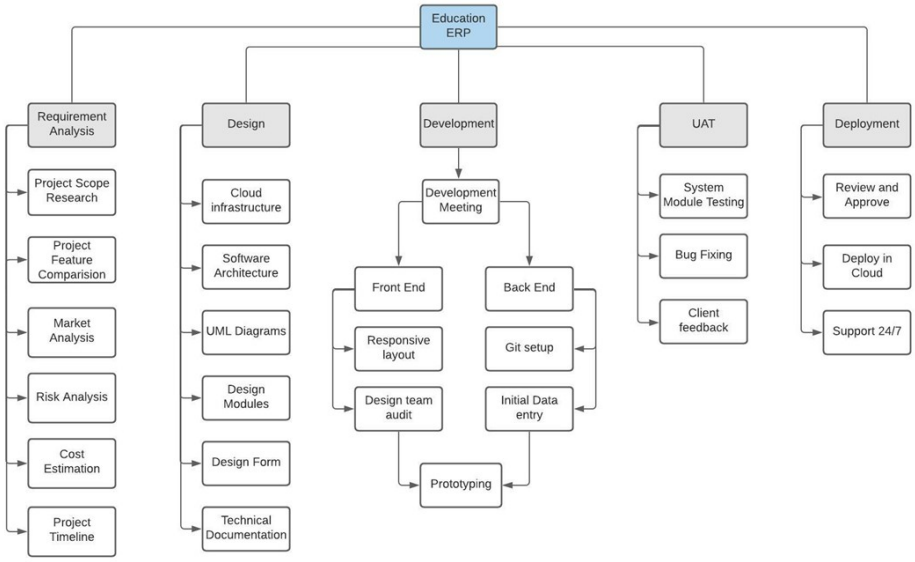


Figure 3.1: WBS of ERP

WBS is used to breakdown these basic phases into much more detailed portions. We have used the top-down approach. This is an ideal tool for brainstorming and having a clear vision of scopes listed out. As you can see from the diagram, we have 5 phases of the SDLC life cycle. As you can understand, we have a planning and research work in the first phase in which project scope, analysis and required factors are completed. Then we move on to the design phase where we implement our planning into real picture and design it, this is the foundation of building the system. After that we have the development phase where we design the UI, the front and back-end work are done by the development team, following which system module testing is implemented and clients are shown a demo of the prototype through which last minute faults are identified, and bugs

are fixed. After all that is implemented and done, we move on to the deployment phase where we architect the cloud environment and deploy the ERP system in the cloud. [1]

3.2 Process/Activity wise Time Distribution

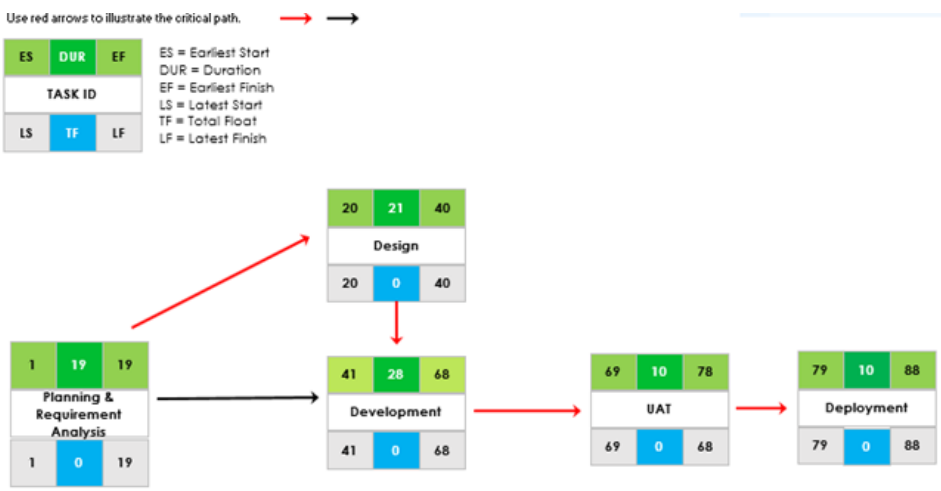


Figure 3.2: Critical Path Method of Project timeline

Task	Predecessor	Days	Work Percentage %
Planning & Requirement Analysis	-	19	15
Design	Planning & Requirement Analysis	21	25
Development	P&R and Design	28	30
User Acceptance Testing (UAT)	Development	10	10
Deployment	UAT	10	20
Total	-	88	100

Figure 3.3: Task wise time distribution

3.3 Gantt Chart

We have made Gantt charts by using excel to schedule all our planning and tasks accordingly, to achieve a successful deployment of ERP software before the estimated

deadline. Gantt chart is a representation of the activities and days it takes to complete them. As you can see, we have a compiled overview of the total days each event needs to be completed in sequential manner.

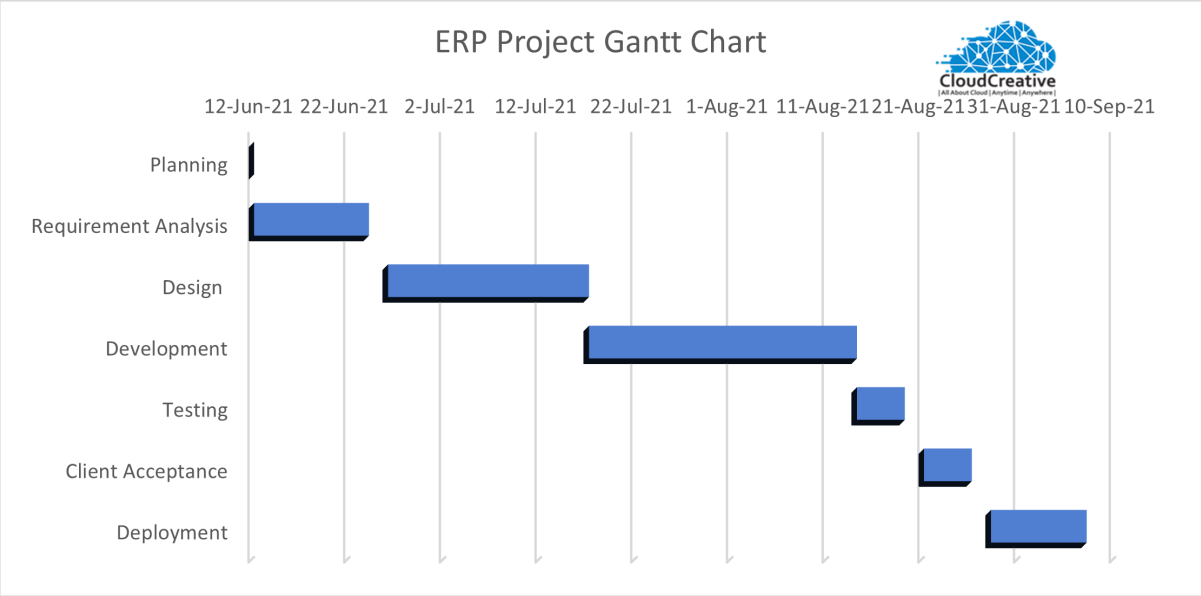
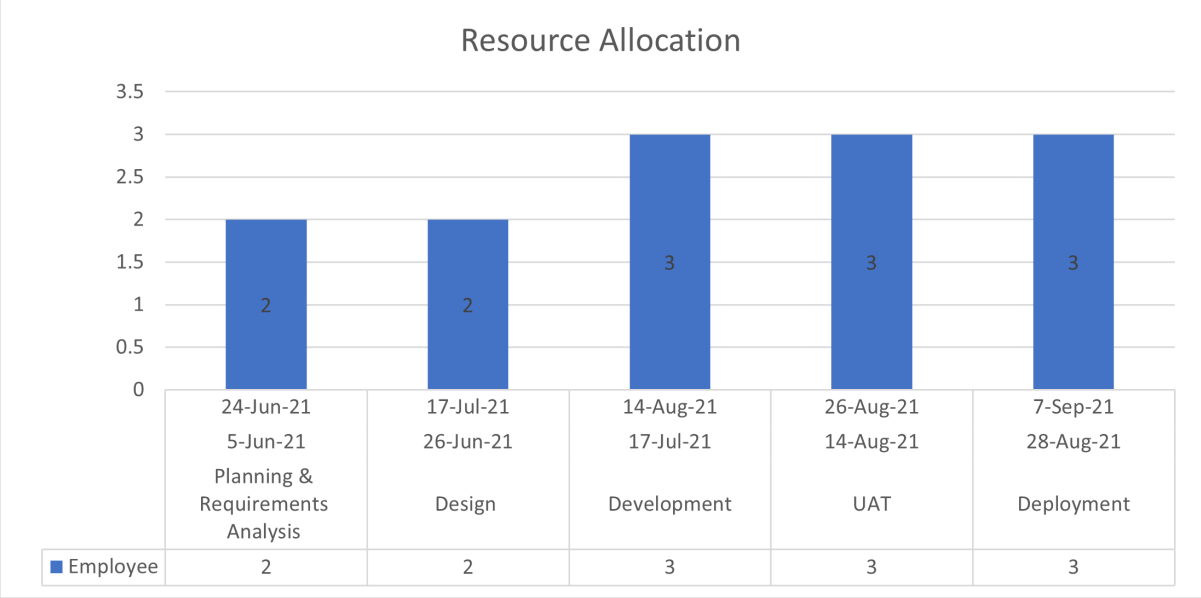


Figure 3.4: Gantt Chart Project Planner

	Planning	Requirement Analysis	Design	Development	Testing	Client Acceptance	Deployment
Start	5 -Jun -21	12-Jun- 21	26-Jun-21	17-Jul-21	14-Aug-21	21-Aug-21	28-Aug-21
Days to Complete	7	12	21	28	5	5	10

Figure 3.5: Gantt Chart Timeline

3.4 Process wise Resource Allocation



Task	Start	End	Resources	Employee
Planning & Requirements Analysis	5-Jun-21	24-Jun-21	Google, Similar projects, Articles, Client requirement	2
Design	26-Jun-21	17-Jul-21	Lucid chart, Excel, Draw.io, Visual Paradigm, XML	2
Development	17-Jul-21	14-Aug-21	Python, Postgres, XML, JavaScript	3
UAT	14-Aug-21	26-Aug-21	Testing tools, Test Server, Bug fixing	3
Deployment	28-Aug-21	7-Sep-21	Filezilla, Microsoft Azure - Portal, VM, DB, Load Balancer with auto scaling, Backup Solution, NSGs, Virtualization.	3

Figure 3.6: Resource Allocation of Project

Here, we allocate resources and manpower that the software needs to complete each event smoothly and the maximum budget set for them. The company has a team who work and innovate together, given that including me, we had a team of 6 who contributed to the project phase activities.

3.5 Estimated Costing

The cost was calculated based on modules the market demanded for the Education ERP software. The key factors were the requirements, features, functionalities and design

of the software. The software has technical documentation included making it flexible for future modifications by the institute themselves. Many tools were used in the process, following that the expense of team and resources used were also considered. Therefore, the approximate cost was estimated around Tk. 2, 71,500/=.

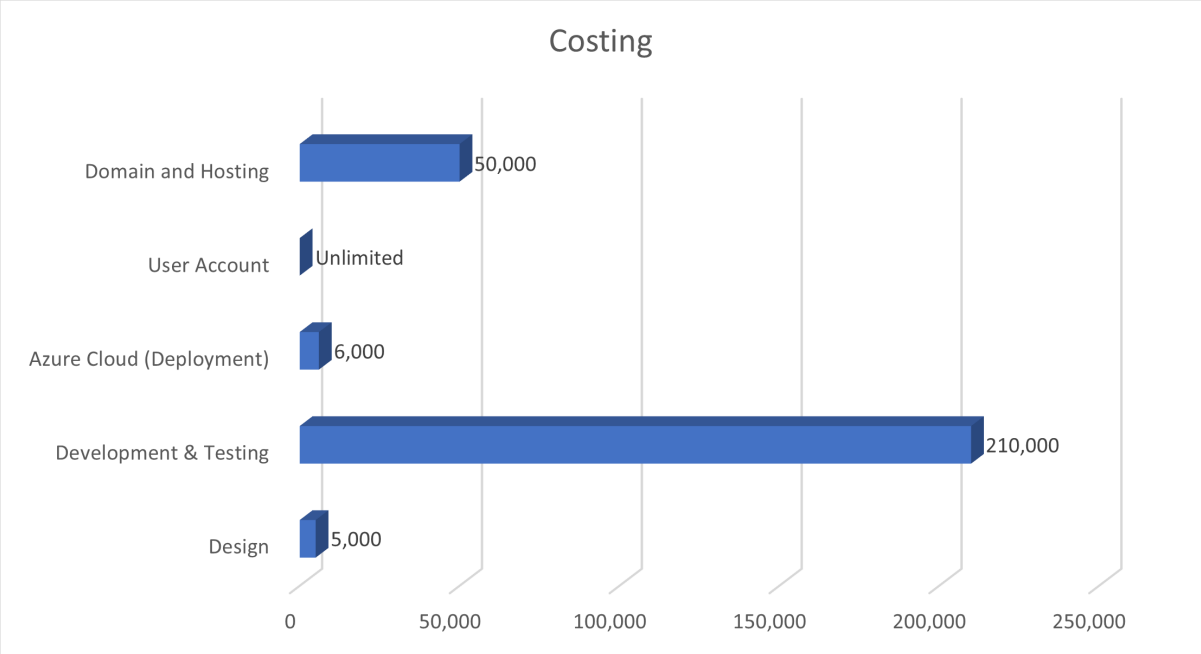


Figure 3.7: Estimated Costing of the Project

Work Distribution	Costing
Design (Modules)	5,000
Development & Testing	2,10,000
Azure Cloud (Deployment)	6,500
User Account	Unlimited
Domain and Hosting	50,000

Table 3.1: Estimated Costing

Chapter 4

Methodology

For a company it is very important to understand the importance of analyzing the implementation of ERP, as if there is a high chance of failure for the implementation process which can be later very costly for the company to bare. Usually, to deploy the ERP system the company must follow a specific framework and methodology.

Therefore, we use and follow certain methodology to set a structure and plan to process the implementation of the ERP system. The vital portion of the ERP project is conducted by a team, they develop different designs, templates, structures, entity relationship schema and flow charts and use different tools to achieve them which are involved in the methodology. It is considered as the roadmap for a successful implementation of the project, and we must say it is where the workings for the implementation begins. The most used methodology is Agile, which follows Planning requirement analysis, design, development, testing, deployment, review and then process is repeated like an ongoing circle. [2]

For this Project we had to do planning and requirement analysis of the system from these discussions we finalized our design and the development team started modifying modules accordingly. Following these implementations, we set meetings with our client and had continuous feedback sessions. After that we will follow through testing, where we will use test sites accessed by user to test different modules before using in real life data. After all the testing will be done, the designed document will be signed out and this will certify the user acceptance certificate and the system will be declared to go live for the company. From this point we architect cloud environment accordingly and deploy the software into cloud infrastructure.

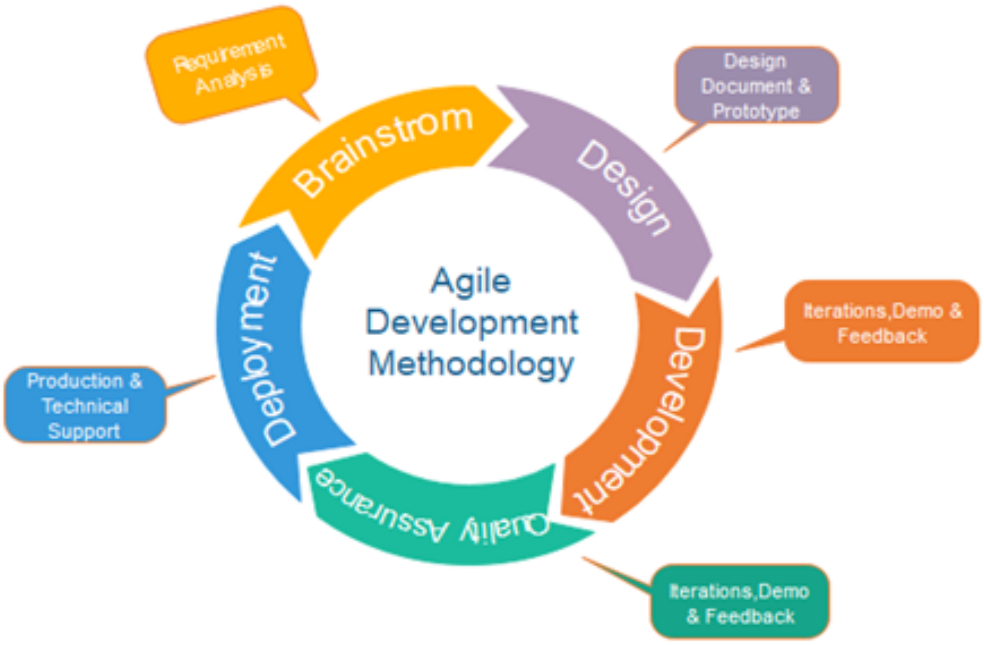


Figure 4.1: Agile Development Methodology

Cloud Implementation Methodology

At first, we strategize business outcomes and align possible plans for adoptions and actions to be taken. Also, then we train and prepare the people for new changes in ready phase. Later, we proceed to deployment phase where we release the workloads accordingly following the agile methodology over here too. [3]

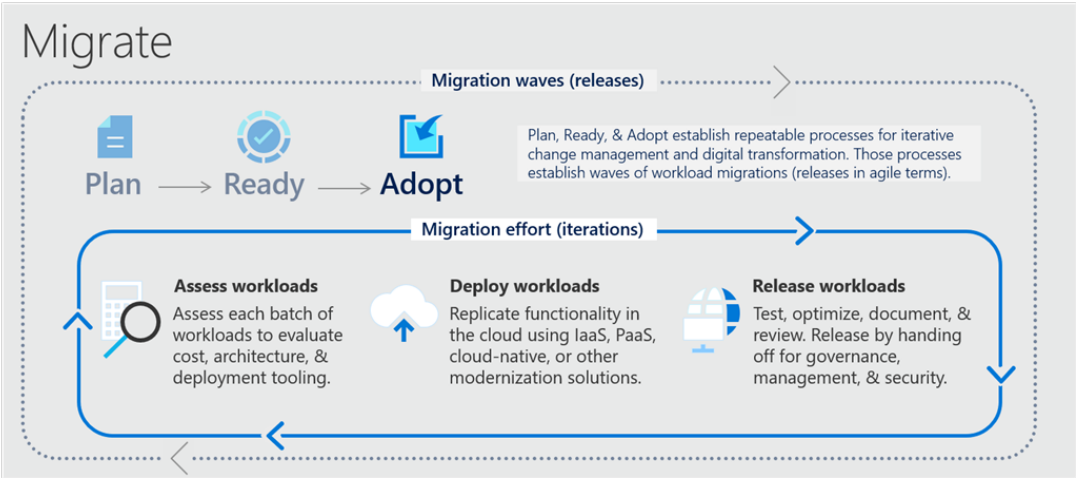


Figure 4.2: Cloud Implementation Methodology

Chapter 5

Body of the Project

5.1 Work Description

Education ERP is a software that has been developed by Cloud creative limited to manage educational institute processes in a single simplified platform rather than in different segments. ERP is a service that allows clients to use modules as per need. The core ERP and cloud infrastructure team was formed by the higher authorities. The company consists of different divisions of teams working together such as research, design, development and deployment teams who are overseen by a project manager. The project manager divides the work and acts as a medium of collaboration between teams. All of the teams work together to modify modules, normalize the system to users and make things more appealing. Hence, the system being deployed in the cloud and being an ERP system allows many flexibilities and opportunities to consumers.

Furthermore, the tasks I was assigned to, was mainly related to research, design and deployment phase of certain modules. At first, I was assigned to do requirements analysis and market analysis where I researched other software's of universities, their functionalities and their market demand. Following which I did technical documentation of system analysis and design process of the system which contained use case etc. Later, my job was to deploy the system into Microsoft Azure cloud infrastructure which provides backup by replication strategy, load balancing, IaaS and other services/tools which complement the software very efficiently. This cloud environment and virtualization also offers many more flexibilities which keeps on improvising through new additions of functions and hence, it is a never-ending learning process. Other than that, I also monitored the client servers to troubleshoot errors if any and analyses their consumption factors/ metrics.

The resources that I used for requirement analysis are articles, monitoring other university systems, viewing similar projects while for designing I used excel, lucid chart and

visual paradigm. Also, for software deployment in Microsoft Azure services were used for VM configurations, I have used Linux, webserver (NginX), Odoo (for education ERP) and Github for code management in the process.

5.2 Requirement Analysis

5.2.1 Rich Picture

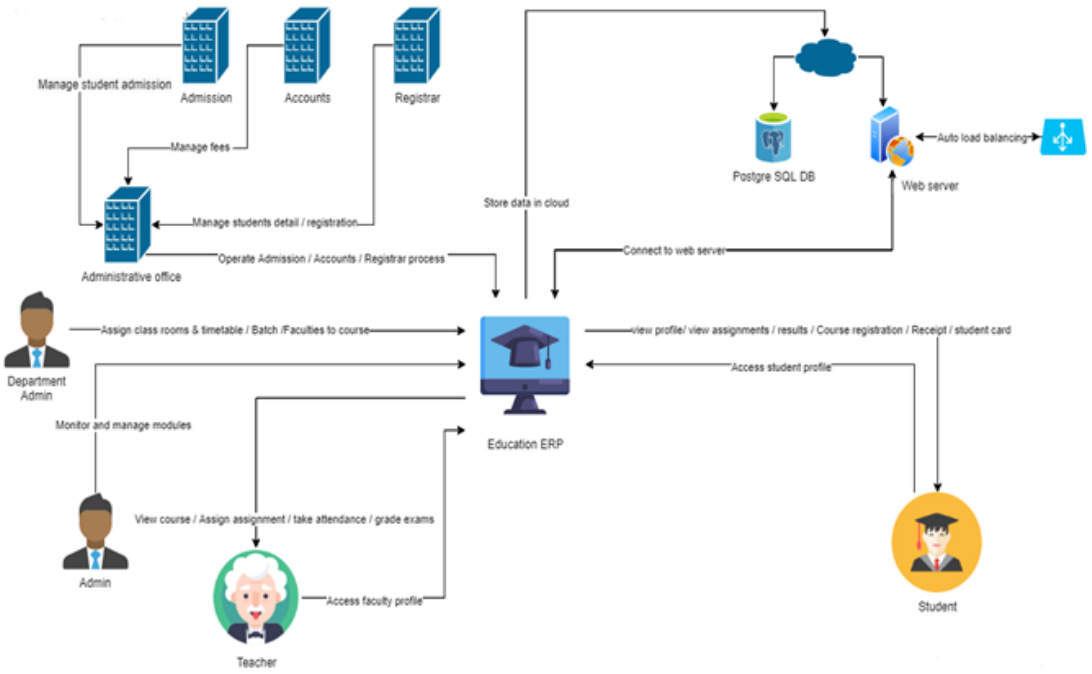


Figure 5.1: Rich Picture

5.2.2 Functional / Non-functional Requirement

Functional Requirement:

A functional requirement document helps an individual to define the functionality of the system or one of its subsystems. Functional requirements along with requirement analysis help to identify the missing requirements. They help clearly define the expected system service and behavior.

Functional Requirement No.	Functional Requirement Description
FR 1	System shall verify and record all details of the new user when creating an account.
FR 2	System shall send a verification email to a new user who creates a new account.
FR 3	System shall generate a unique user id for all users.
FR 4	System shall allow the user to set-up a password when above 8 characters and it can contain alphabets, numbers, and characters.
FR 5	The system shall keep track of user sign in in a log file with proper credential of user.
FR 6	System shall check if a new user's email address is unique or not. And the system will only accept unique email for new users.
FR 7	System shall check the details inputted in the login form are valid or not and identify the user by their verified id and password.
FR 8	System shall allow users of category to access their own dashboard only if the credentials are verified like faculty will only see the faculty profile whereas students will see students profile.
FR 9	System shall allow the user to reset the password when they forget it.
FR 10	System shall send a recovery password email to users who asked for it.
FR 11	System shall update the new reset password in its database.
FR 12	System should keep a track of recovery of password cases in the log file.
FR 13	System shall check if the user's account is set up completely or not.
FR 14	System shall have a strong and secure channel for data collection.

FR 15	System shall allow users to write or edit their user bio, upload user profile pictures, and complete their account settings.
FR 16	System shall allow specific users like admin to have access control to modules.
FR 17	System shall allow admin to configure changes and have create credentials
FR 18	System shall identify the users accordingly and give them access to their preferred dashboard.
FR 19	System shall allow department admin to assign courses and generate timetables to faculties.
FR 20	System shall display courses of batches sessions.
FR 21	System shall allow students to apply for admission.
FR 22	System shall allow students to view and register for their course and view their faculty and session.
FR 23	System shall create a bill for the registration and provide it to the student.
FR 24	System shall track the payment dues and payment cleared by students.
FR 25	System shall keep the track of the transaction in a log file when payment is done.
FR 26	System shall allow students to download payment receipt once registration is done.
FR 27	System shall show the assigned courses and timetable the department admin has designed for faculty.
FR 28	System shall let faculty take attendance and save the data.
FR 29	System shall allow faculty to assign exams and assignments to students.
FR 30	System shall allow faculty to track submissions of assignments and exams.
FR 31	System shall allow faculty to grade assignments & exams and later, publish results.
FR 32	System shall allow students to submit their assignments and exam scripts and view grade.
FR 33	System shall allow students to view their attendance status.
FR 34	System shall keep track of records and backup data in the cloud using replication strategy.
FR 35	System shall be compatible with cloud environment and use auto-load balancing in case of resource expansion.

Figure 5.2: Functional requirement

Non- Functional Requirement:

A non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. It ensures the effectiveness of the system and are developed for the betterment of the users and system. They are contrasted with functional requirements that define specific behavior or functions.

Category	Nonfunctional Requirement
Usability	• This system's user interface (UI) must be clean and fast. Meaning that current consumers will quickly learn how to use the system. • The infrastructure will be on cloud providing more compatibility and flexibility. • On the website, a complete user guide, rules, and regulations must be submitted for the user. It is available for users to read at any time
Performance	• System will be responsive with mobile and any type of device. • System will be capable enough to handle millions of users without affecting its performance. • System will respond to user requests in a few milliseconds.
Information	• Users can download all relevant information if needed. • All inputted information will be stored in the database.
Economy	• This system will be deployed in a cloud hosted infrastructure by service provider, so that we do not need any data center or server making it cost efficient. • It will give a broader market reach allowing more exposure. • This system can be developed in a short time such as 3- 6 months.
Control	• The user's privacy would be protected by this system. • The system would be safe to use as there will be security policies set like SSL /TLS, DDOS. • User files would be backed up every 2 days through replication strategy to the nearest datacenter to avoid high latency and retention will occur in order to utilize storage, also in an event of a disaster recovery the image of the VM stored in backup datacenter will be fetched through bridgehead servers and synchronize. • If our server faces any anonymous attack, then our security team will respond immediately, and data backups will be strictly monitored.
Service	• System will be deployed on cloud and regularly maintained by system admin and other employees hence, there is no maintenance cost involved. • There will be 4 types of users. Admin, Students, Faculty, Parents. • Users can use the system from anywhere in the world. • Necessary system updates will come from time to time.
Reliability	• System will be reliable and available for any kind of OS (Linux preferable) or device such as computer, mobile. • System will have cloud backup storage; hence, no data will be lost, making it more reliable.

Figure 5.3: Non-Functional requirement

5.3 System Analysis

5.3.1 Six element Analysis

Process	Human	Non-Computing	Computing hardware	Software	Database	Communication and network
Course Management	Department admin – Registrar	Paper	Computer	ERP, web browser	PostgreSQL	Internet connection
Classroom management	Department Admin	Paper	Computer	ERP, web browser	PostgreSQL	Internet connection
Enrollment	Student, Admissions office	Paper	Computer	ERP, browser	PostgreSQL	Internet connection
Student Profile	Student	Paper	Computer	ERP, browser	PostgreSQL	Internet connection
Faculty management	Faculty, Department Admin	Paper	Computer	ERP, web browser	PostgreSQL	Internet connection
Attendance	Faculty, Student	N/A	Computer	ERP, browser	PostgreSQL	Internet connection
Timetable	Department admin - Registrar, Faculty, Student	Paper	Computer	ERP, web browser	PostgreSQL	Internet connection
Assignments	Faculty, Student	Paper	Computer	ERP, web browser	PostgreSQL	Internet connection
Financial	Accounts manager – Accounts Office	Paper	Computer	ERP, browser	PostgreSQL	Internet connection

Figure 5.4: Six Element Analysis

5.3.2 Feasibility Analysis

A feasibility analysis evaluates the projects potential success. It helps to conclude whether the project is worth the investment and time or not. The factors we need to consider for feasibility study are:

- **Needs Assessment:**

As the word is self-explanatory, at first, we need to analyze the requirement of the education ERP software in institutes. Then we check if the new software maintains the needs of institutes and are the procedures executable by institutes easily. After that, we extract the faults that the previous system had and understand the goals the institutes have set for migrating to education ERP software. Later, we research on solutions our software provides to the problems and will it allow future flexible changes and hence, as requirements are met and software is capable to support all needs and cloud implementation is efficient, we conclude that there is a need of the software and move ahead to

next step of the procedure.

- **Resources Assessment:**

As we know, implementation of ERP requires both time and money. The educational institutes might lack dedicated professional for maintaining and implementing such a software hence, to fulfil their functional and technical issues it is necessary to have a vendor like us, who provides such cloud server maintenance support and also training can be given to staffs. Therefore, as we can understand implementation and maintenance requires a good amount of investment at first, but later proves to be a wise and cost-efficient decision resulting in a good choice of investment.

- **Technical Assessment:**

This is one of the most important assessment where necessary tools and technical support required for an institute to migrate to the new system is analyzed. At first, we need to understand that the Education ERP will be hosted in the Microsoft Azure cloud. So, as we have the professionals for development phase of project, they need to ensure that the ERP system can perform all functionalities required to solve problems and relief workload. Also, since the team has all the required hardware and software needed to develop this system it is technically feasible.

All these assessments allow us to evaluate that the system is feasible and a good investment considering current scenario and future advancements.

5.3.3 Problem Solution Analysis

PROBLEM	SOLUTION
1. The current education systems are not accessible from everywhere for administrative staffs as they have to go to the campus to access the system which restricts their work to limited boundaries during this pandemic. This is causing irregularities and damaging profits due to resource consumption.	1. Proposed system will be cloud based and be available online for users to access it from anywhere via using the internet. Administrative staffs can easily access their modules, work on it and avail information just by few clicks. This allows the administrative process to carry on.
2. At a certain time, during course registration there occurs a huge amount of pressure on the server as many students access the registration module at once which results in server breakdown. Many campuses that use on premise servers are limited to resources and infrastructure due to space limit, that's why they face this server breakdown issue quite a lot. Example: EWU, BRAC.	2. With the proposed system as everything will be deployed in Microsoft Azure cloud, it has a feature called auto - scaling load balancer which basically based upon server request load extends the server capacity to avoid server breakdown, resulting in smooth operation of registration process to take place and later it can scale down its resources resulting in an efficient solution to this problem that occurs twice in a semester.
3. If there is a need for infrastructure expansion like more servers and more storage space, it will be expensive and time consuming to maintain in a physical environment. Also, there can be compatibility issues during migration.	3. This platform will eliminate the need of physical infrastructure for server, storage space, compatibility issues of data and allow smooth data migration as everything will be in the cloud environment.
4. Expenses are high since all the on - premises maintenance costs are institutes to bear making it costly.	4. Since, the server is on cloud, all the maintenance are service providers to bear and in the long run it is cheap as maintenance and monitoring costs are terminated and the subscription fee is a considerable amount.
5.All the administrative software's were dispersed and were independent from each other causing a gap of information and inefficiency	5. All the modules are brought under one ERP software, eliminating the problem of dispersion and inefficiency
6. Not much market presence available as ERP exposure is limited.	6. This platform will give a boost to the education institutes day-to-day processes as technological advancements will allow more smooth transition and help to gain more exposure.

Figure 5.5: Problem and solution Analysis

5.3.4 Effect and Constraints Analysis

The Education ERP system helps educational institutes with the drawbacks that they are facing. It helps to identify the fallbacks and allows digitalization of procedures that were done manually. Due to covid-19 many governmental educational institutes closed down, and many private schools faced difficulty conducting classes, covid-19 has shown us the weakness in our system, and we need to adapt and improvise to changes. This system will provide solutions to many institutes' problems at a cheap affordable price as cloud implementation is done.

As we know, scalability and flexibility is offered at a high availability in cloud allowing many troublesome factors to be dismissed such as course registration is a time when many students access the server at once which results in huge server miss rather than hits, by use of cloud's auto-load balancing feature we can set policies such as if the server requests cross the server request handling limit then scale up the package and open another server for time being which reduces the chances of server breaking down due to overload of requests and allows students to register smoothly.

But also, the system still has limitations which need modifications for further development. There are many modules that are needed but not considered hence, we are still thriving to bring out more changes and add more features/modules to our software that would bring solutions to many issues and, encourage more and more people to start the practice of working from any setting, since modules can be accessed online from anywhere. This will not only make people's lives easier but will also be a big advantage during the ongoing pandemic.

5.4 System Design

5.4.1 UML Diagrams

Use Case Diagram

The use case diagram represents the functional requirements of the system. It shows the actors, cases, communication links, system and relationship.

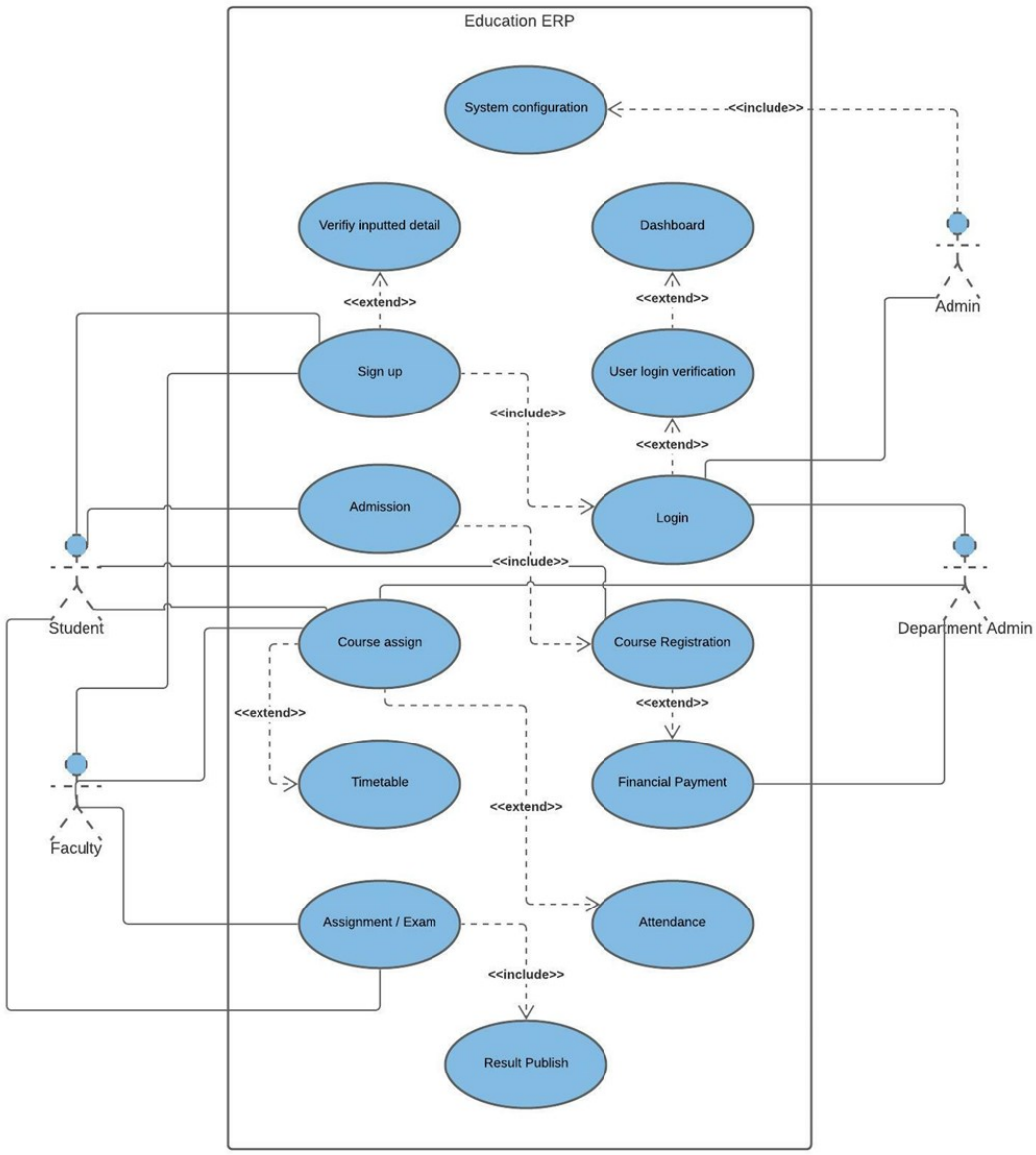


Figure 5.6: Use Case Diagram

Context Level Data Flow Diagram

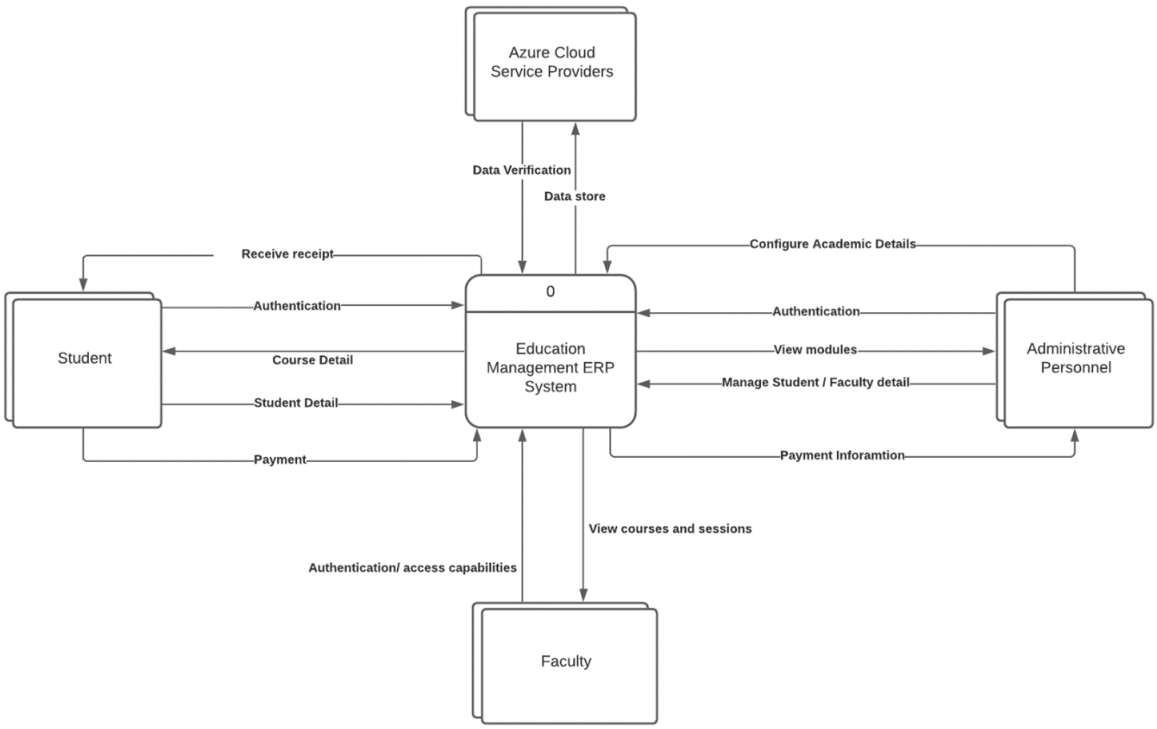


Figure 5.7: CFD

Activity Diagram

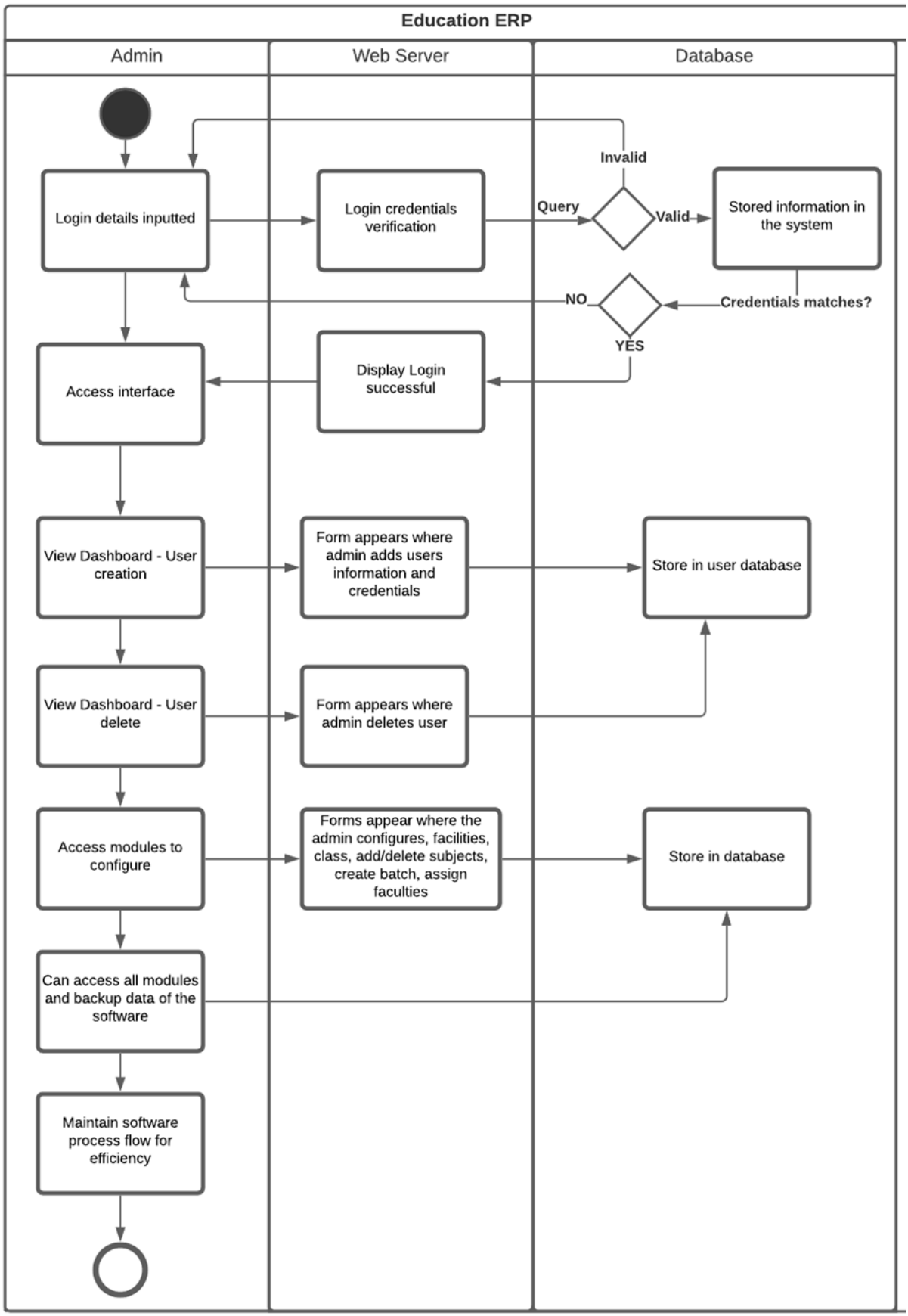


Figure 5.8: Activity Diagram of Admin

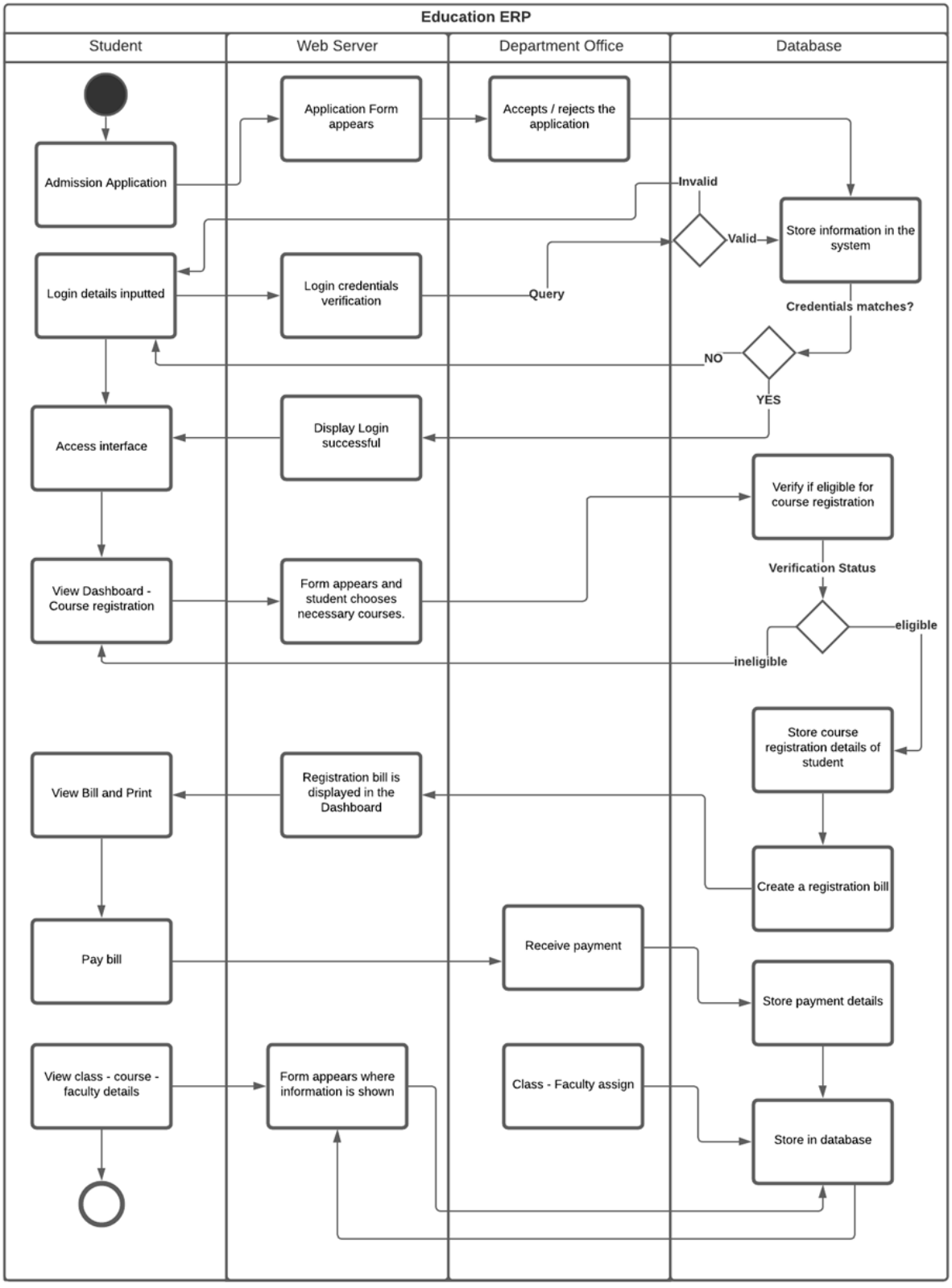


Figure 5.9: Activity diagram of Student

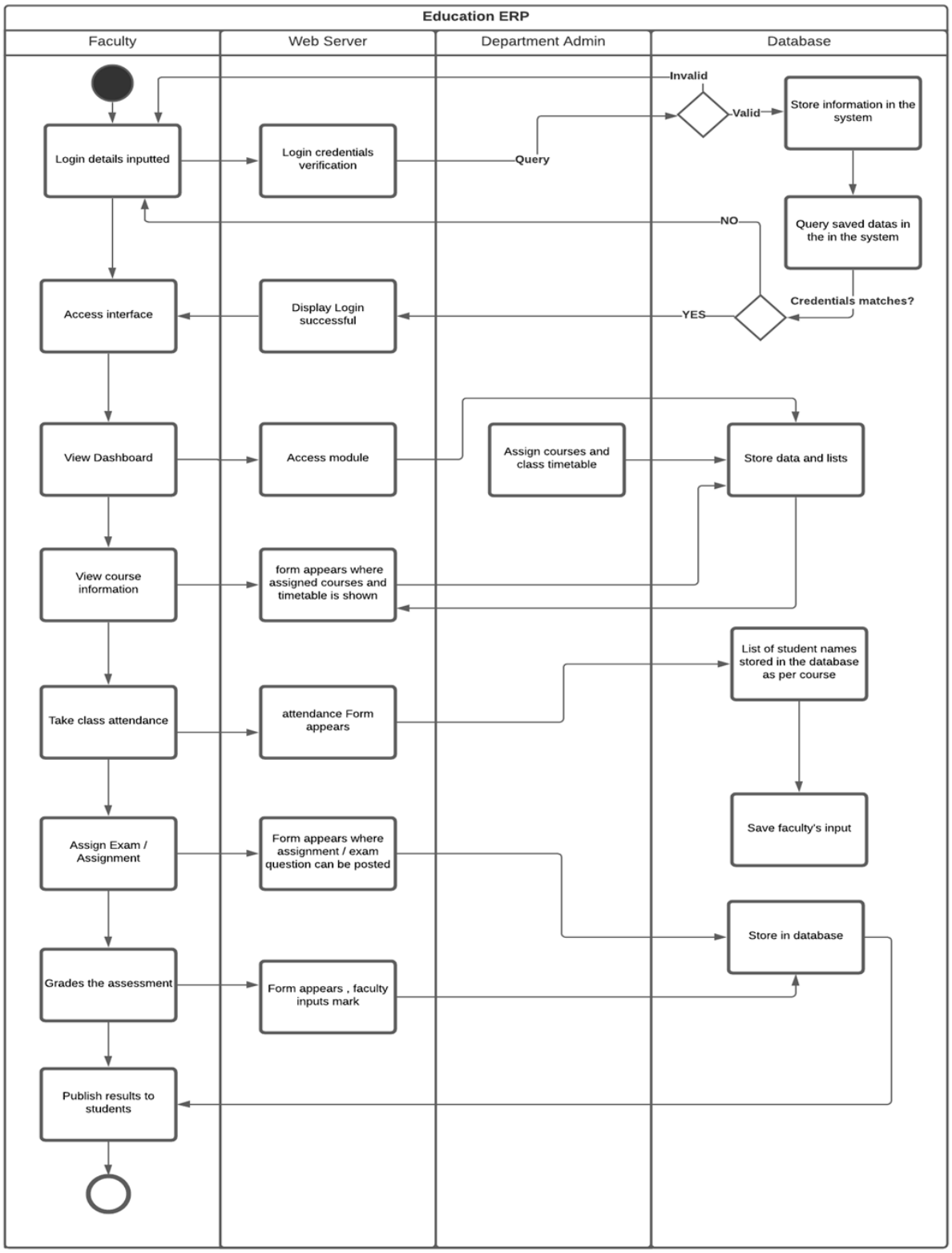


Figure 5.10: Activity Diagram of Faculty

CRUD Matrix

Activity	Student	Faculty	Super Admin	Department Admin
User Signup	C	C		
User Login	R	R	CRUD	R
Recover Password	CRU	CRU	CRU	CRU
Assign timetable	R	R	CRUD	CRUD
Assign Course		R		CUD
Admission application	C		CRUD	RUD
Course Registration	CRUD	CRUD	CRUD	CR
Student invoice	R		CRUD	CRU
Bill Payment			CRUD	RU
Take class attendance	R	CU		R
Assign assignment/ exam	R	CU	CRUD	
Submit Assignment	CRU	RUD		
Publish Result	R	CRU	CRUD	

Figure 5.11: CRUD Matrix

5.4.2 System Architecture

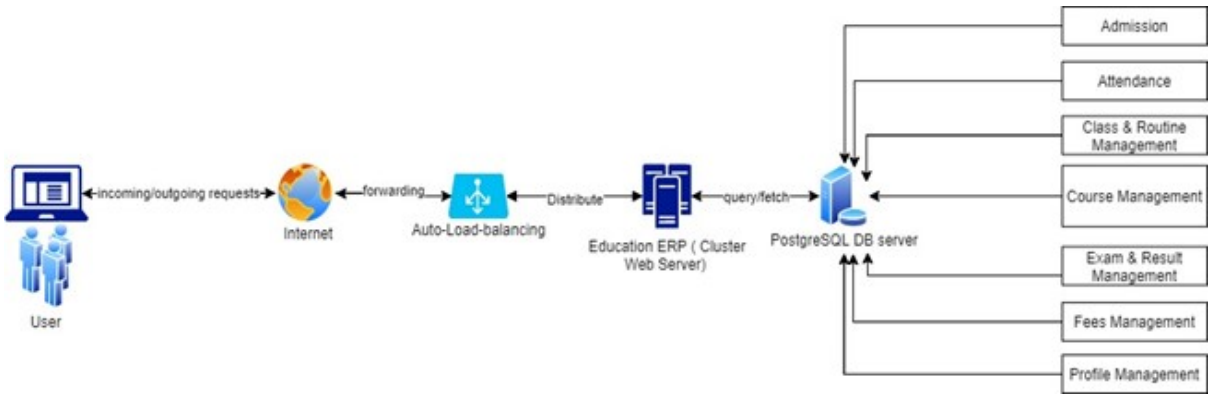


Figure 5.12: System Architecture

As we can see, the diagram displays the overview of the system architecture. It can be evaluated from here that the whole process in system takes place in the cloud infrastructure. The web server is Nginx based, the reason behind this choice is, and it has high usability and is designed for fast, stable, and maximum performance. Also, given that it is an open-source software that has many uses like reverse proxying, caching, load balancing allowing cost efficiency, security and flexibility which is why it is a suitable choice. The database we are utilizing is PostgreSQL which receives request of users from web server, validates and responds to it accordingly.

5.5 Implementation

Education ERP solution provided by Cloud Creative Ltd. offers solutions for educational institutes that lack the infrastructure and software for conducting their processes smoothly. As covid-19 has brought new changes, technological gap has been identified in many institutes and a platform of such is required to be implemented. For this we follow certain procedures for implementation.

1. Assessment

   At first, we need to assess the condition of resource availability, suitability and flexible project timeline and other factors of project with concerned key members of company to have an organized plan of action.

2. Business Modelling Understanding the market demands and competition whilst improvising to better technological advancements is a must, which is why we first build a business model keeping resources and requirements in mind to build a sustainable

platform that provides solution to institutes in Bangladesh.

3. Solution Design We need to address the core problems of educational institutes in Bangladesh currently and provide efficient and affordable solutions for successful implementation which ensures reliability and durability.

4. Gathering the Requirements Gathering requirements is one of the most vital step for Education ERP implementation as the ERP team takes care of workflow, specifications, and design interface which affect the outcome of the software. After verification is done, we move to the next step.

5. Cloud Deployment

   Finally, we deploy the system in a cloud infrastructure availing all the services it has to offer like auto-load-balancing, data backup, data retention, virtualization etc. the web server is connected to bypass a secured IP address. The software then runs on a cloud server (VM) and ensuring data integrity we migrate data into the PostgreSQL database.

6. Set up Education ERP software
   In this phase, we develop the ERP system based on the gathered requirements and make it dynamic. The system offers features that will surely improve the workflow of the educational institutes in Bangladesh that lack infrastructure and proper software.

7. UAT and Training

   With this phase, final installation is done and the software provides optimal workflow to educational institutes. We also then train the teachers/faculty about functionalities, so that the institutes can gain maximum productivity and product utilization is maintained. Also, all the maintenance of the cloud server are provided by us.

8. Support and Warranty

   There will be 24/7 support given for the system and warranty period of 1-2 months will be offered, if there is any need of fixing bugs after customer handover.

5.6 Product Features

Here, I have included all the inputs and outputs features the system provides to a user.

5.6.1 Input

Login Page

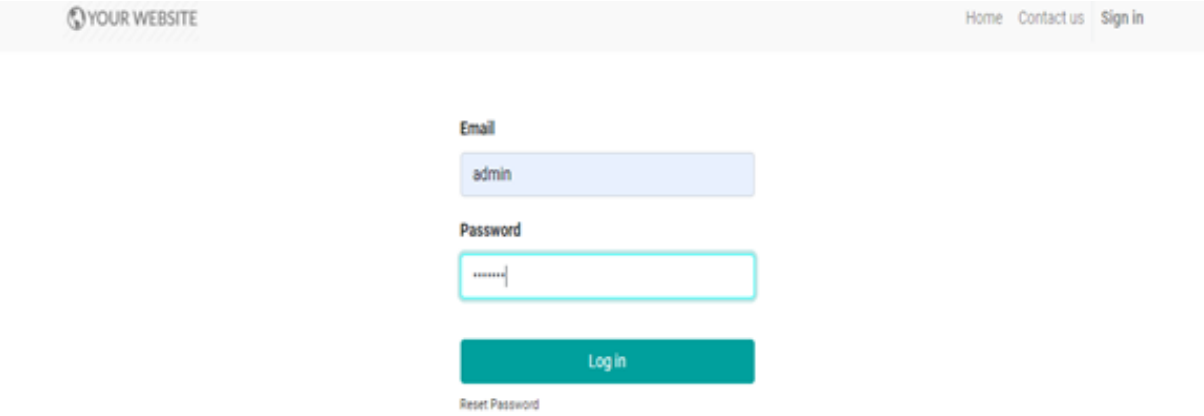


Figure 5.13: Login Page

Student Application for Admission

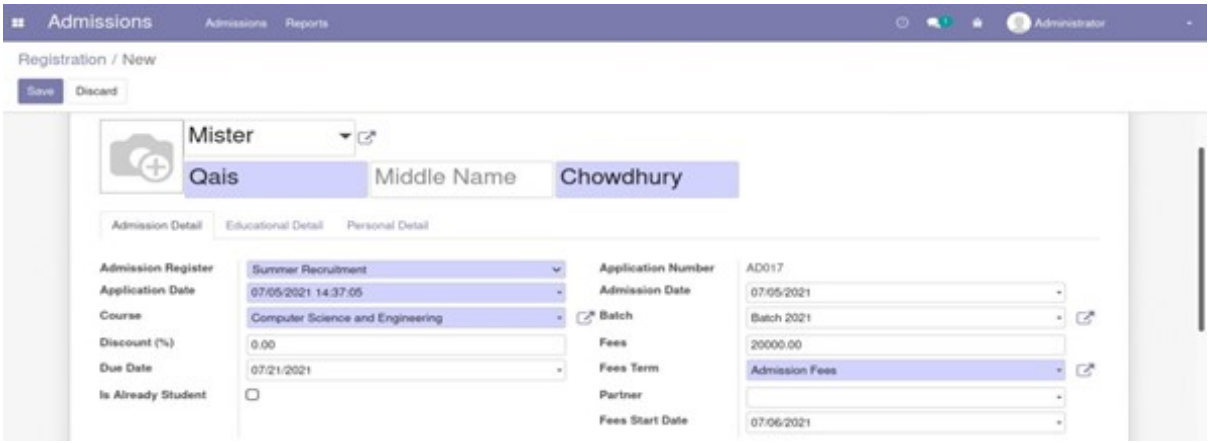


Figure 5.14: Student application for admission

Subject Registration

Figure 5.15: students' subject registration

Input time slots

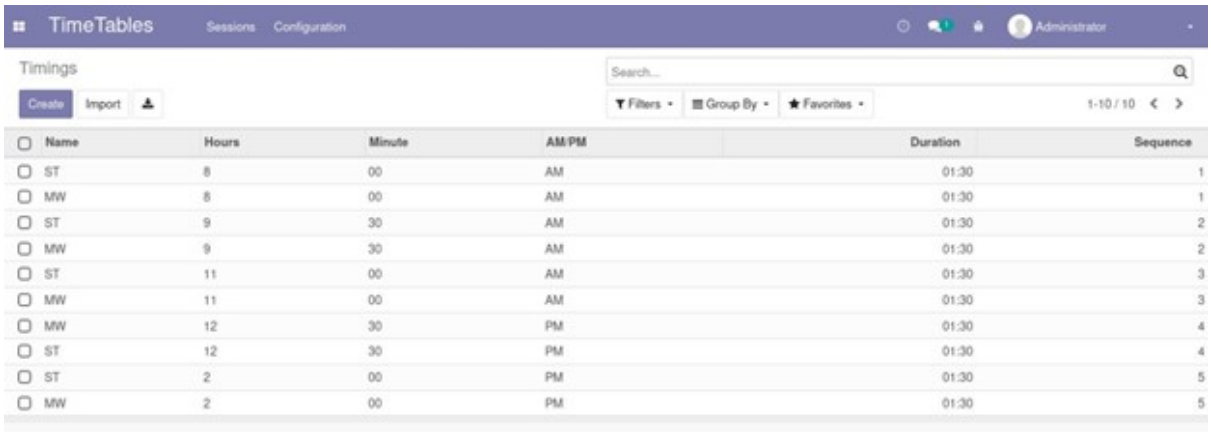


Figure 5.16: Time slot allocation

Faculty Takes attendance

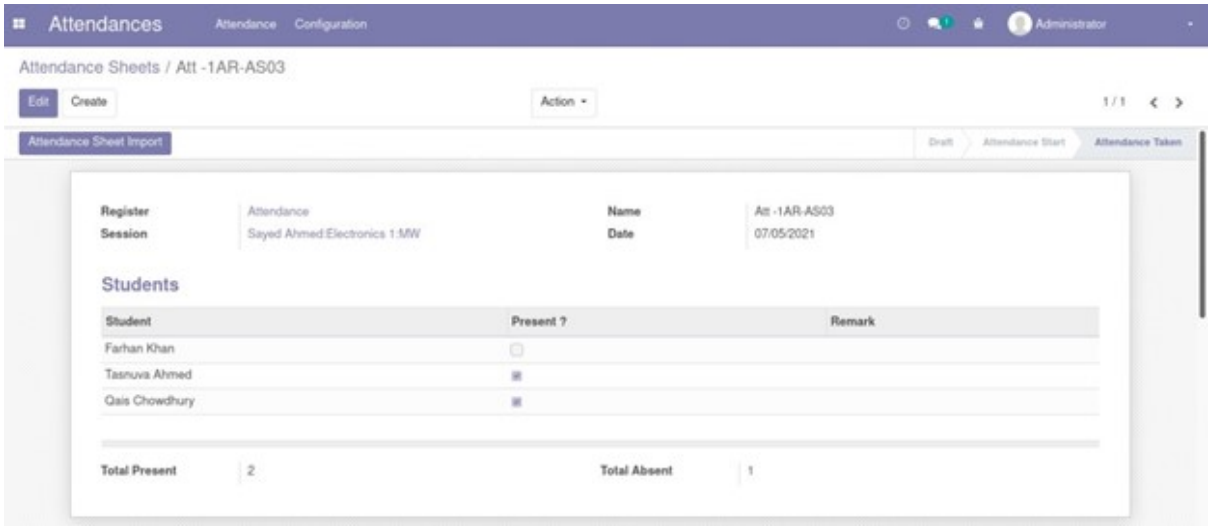


Figure 5.17: Faculty takes Attendance

Faculty assigns assignment

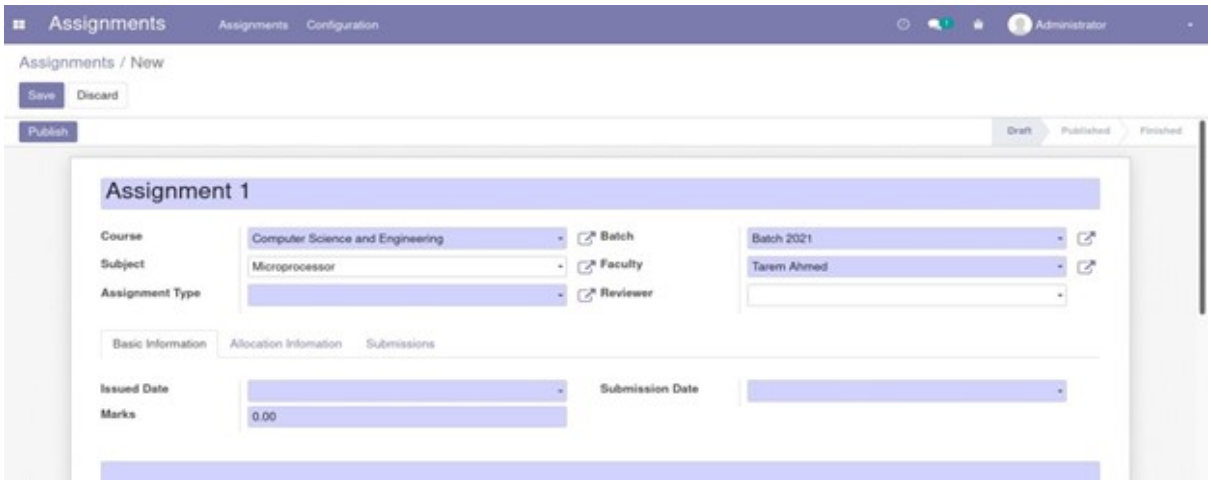


Figure 5.18: Faculty assigns assignment

faculty inputs mark

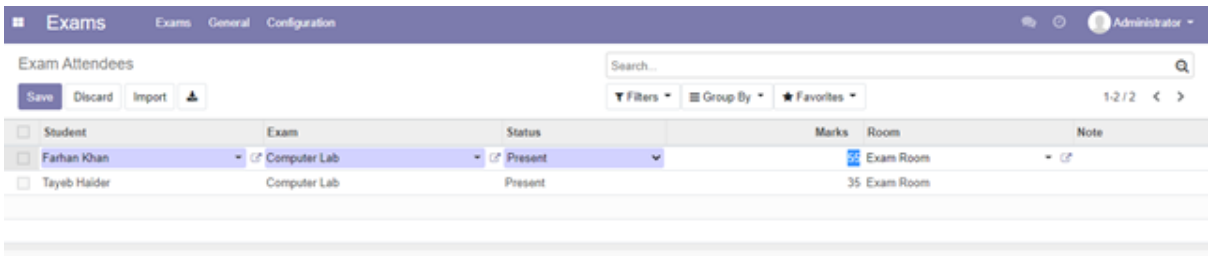


Figure 5.19: Faculty inputs mark

5.6.2 Output

When entered wrong credentials this output will show

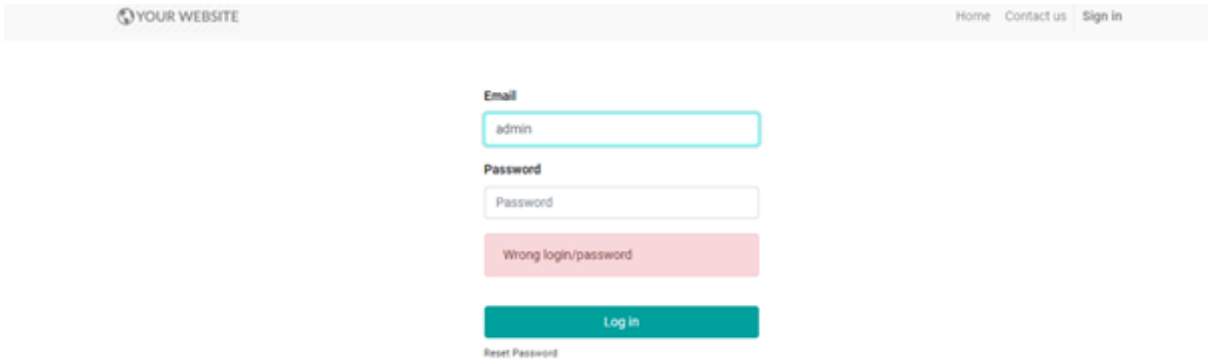


Figure 5.20: Invalid Login

Student applications accept/reject

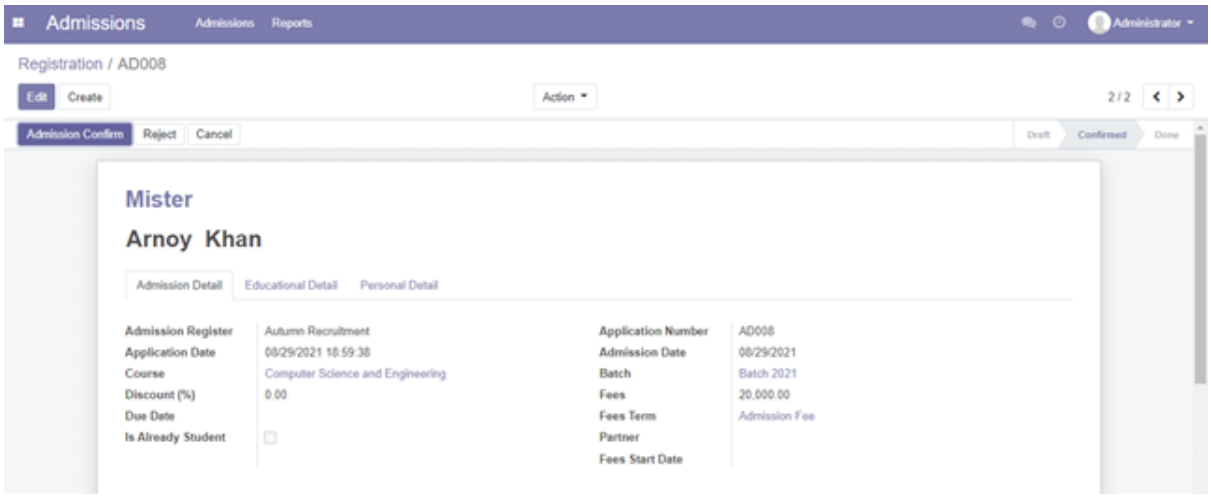


Figure 5.21: student application approval

Student subject registration done

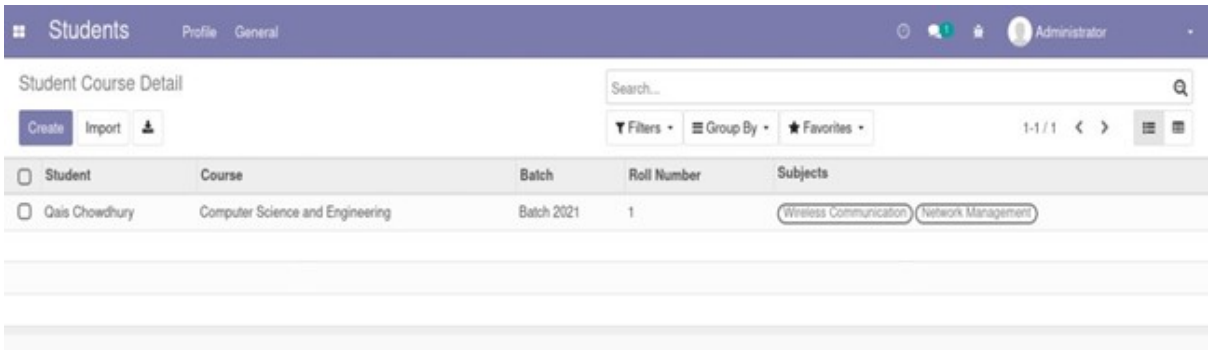


Figure 5.22: Student Registration

5.6.3 Course session created by department admin

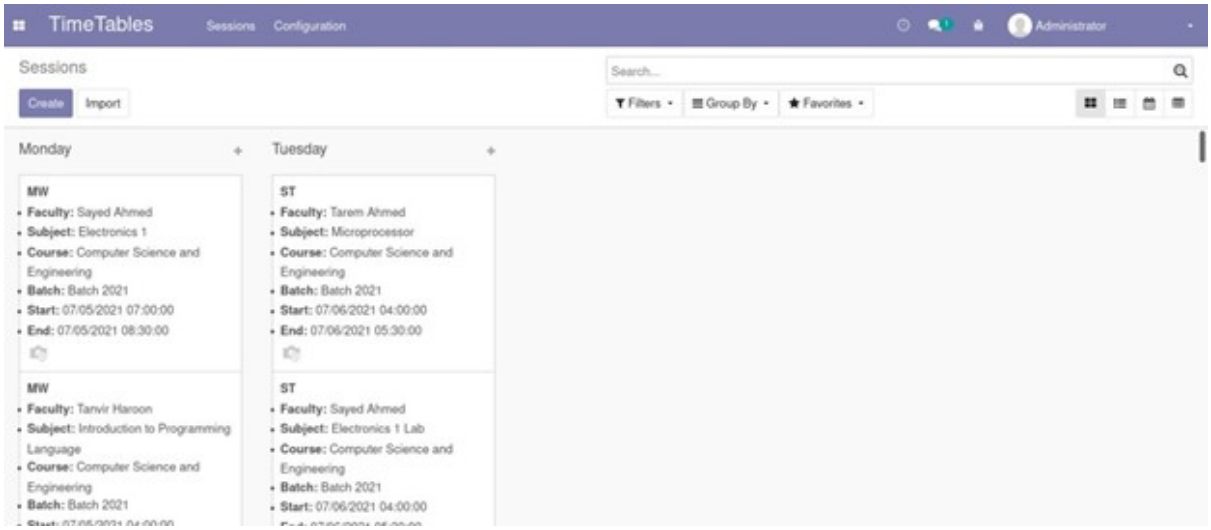


Figure 5.23: course session created

5.6.4 Faculty has taken attendance

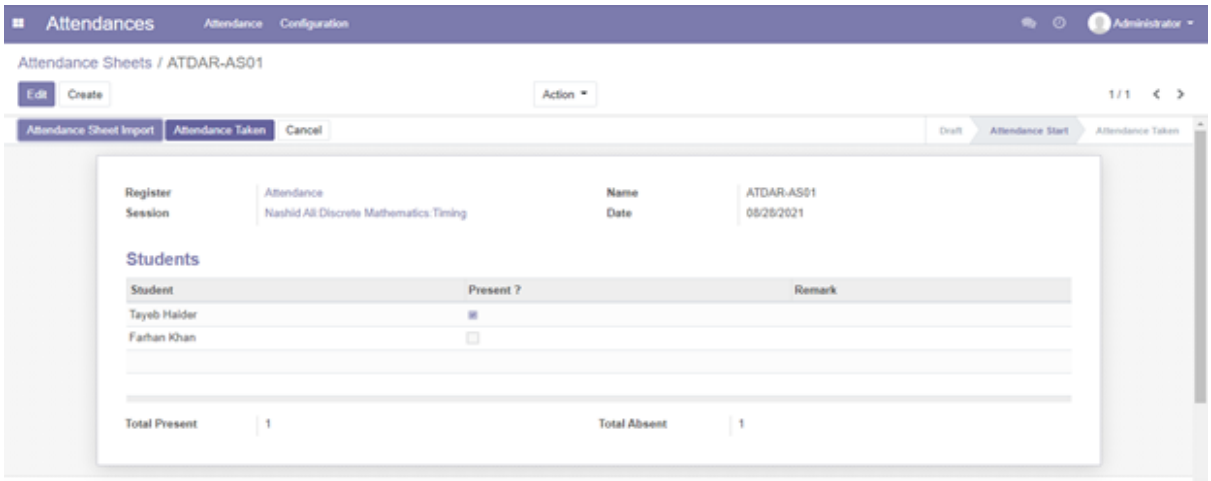


Figure 5.24: Class attendance taken by faculty

5.6.5 student submits assignment

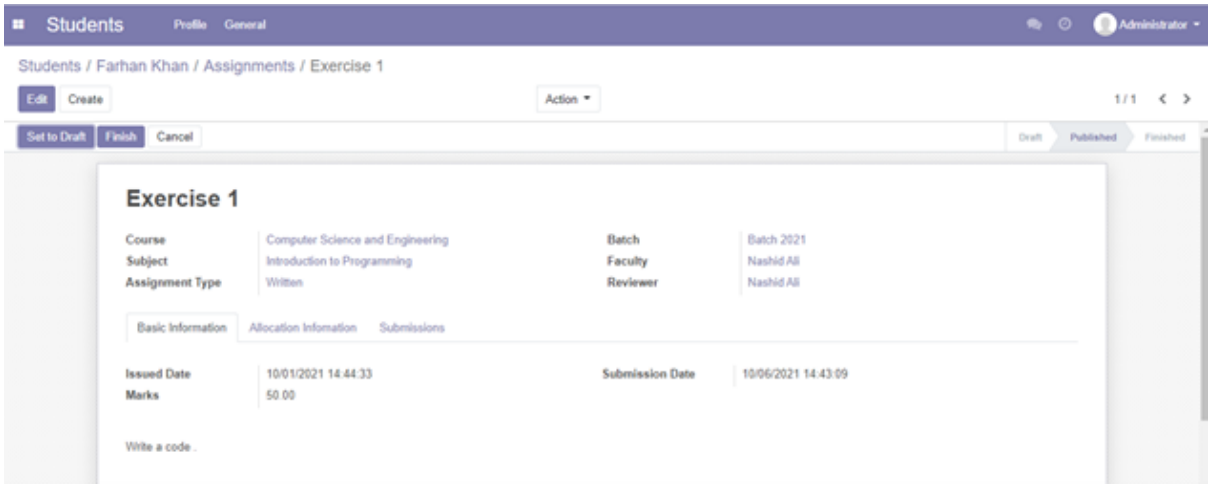


Figure 5.25: Student submits assignment

5.6.6 Faculty has done grading

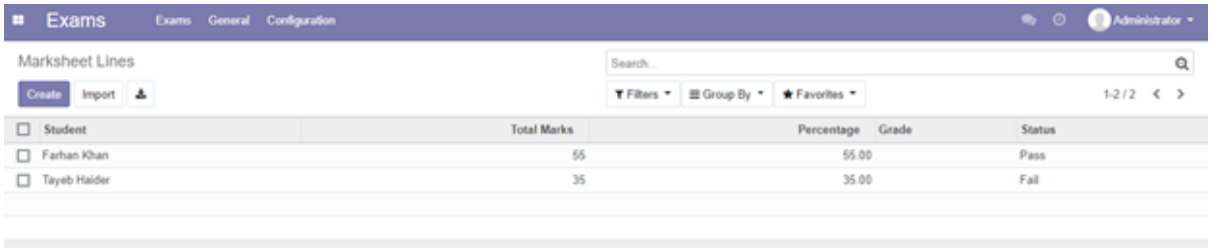


Figure 5.26: Marking of student done

Chapter 6

Results & Analysis

This chapter contains the necessary screenshots of the Education ERP software with analysis of what functionalities it performs. This software focuses on solving issues for educational institutes that lack infrastructure and resources as shifting to this software and cloud will allow them to operate much more efficiently and will come in handy for them, in terms of utilization, cost saving and automation of processes.

Below are the UI of system with analysis:

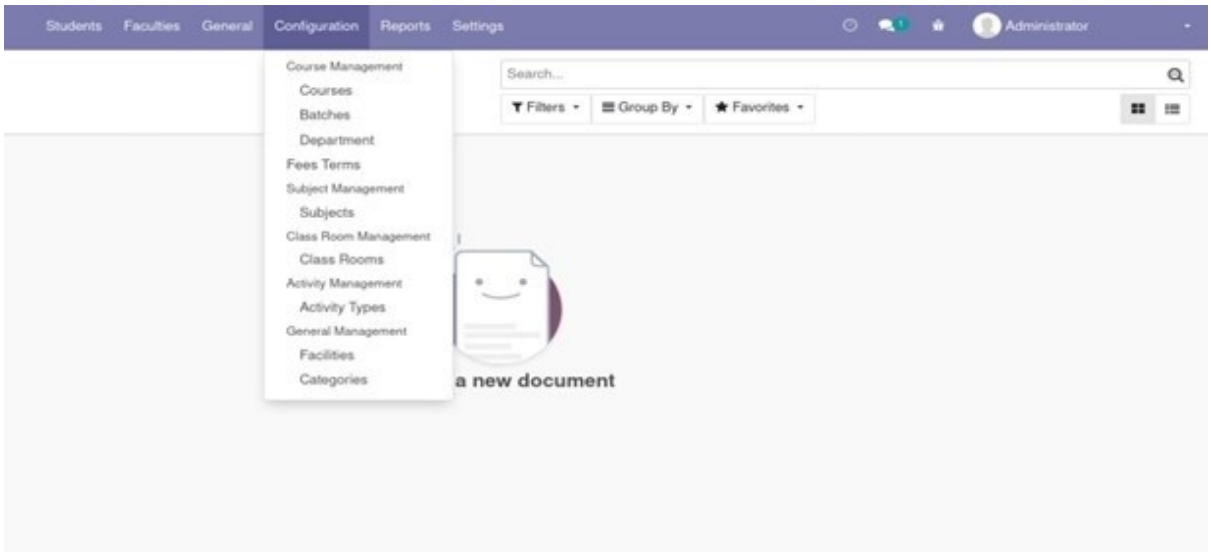


Figure 6.1: Configuration of system setting by admin

Here, the Admin mainly does configurations which deal with classroom and routine, course, admission, and fees management modules. The admin first department like SETS and assigns a batch for new admissions. Also, the admin sets the classrooms information and the facilities it will contain in it like AC, whiteboard etc. Later, following these steps admin creates a course like CSE/ EEE/ETE under which it assigns subjects to it like CSE 101. Finally, the admin schedules faculties timings for courses. All these are configured

through this interface. Below you will get to see the detailed look of results and the steps followed by admin for configurations. Also, admin has control over system through which he/she can perform CRUD operations as per comfort. All the forms function properly and are interconnected.

Configure Department

Figure 6.2: Configure department details

Configure school of Department

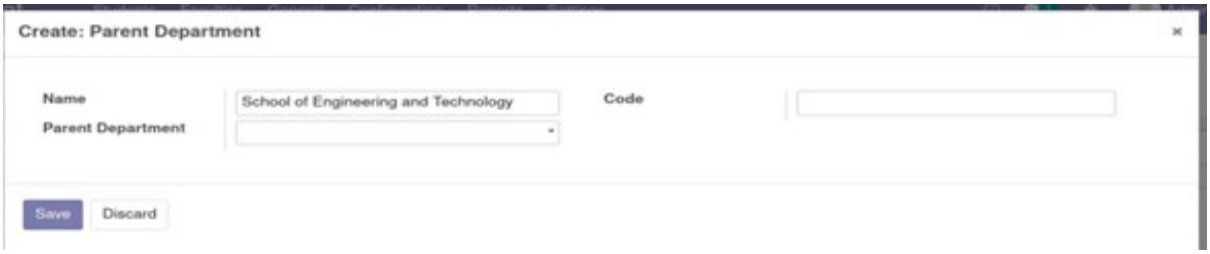


Figure 6.3: Configure school of department details

Configure classroom and assign facilities

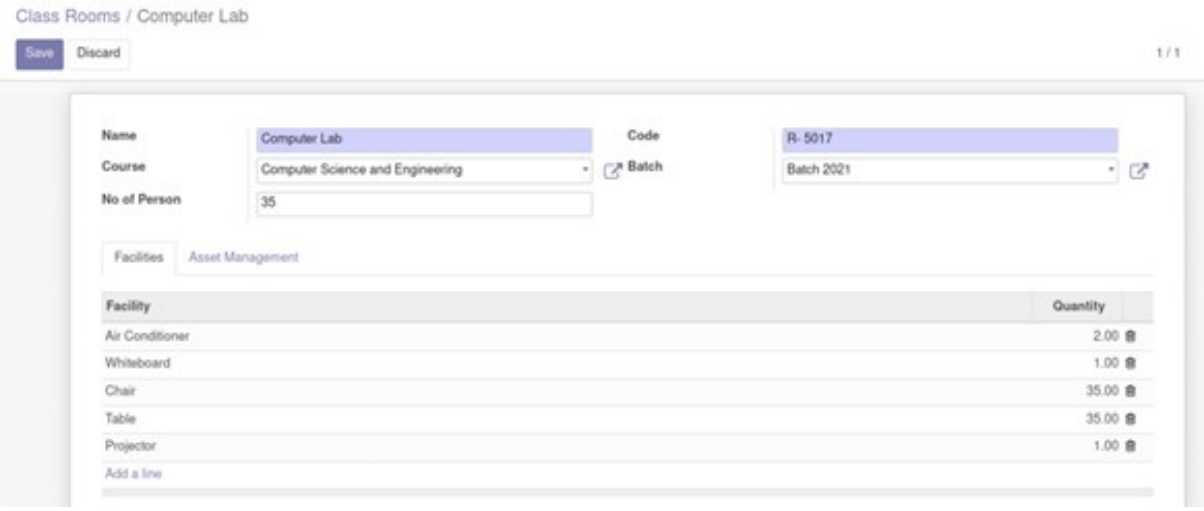


Figure 6.4: Configure classroom details

Configure batch

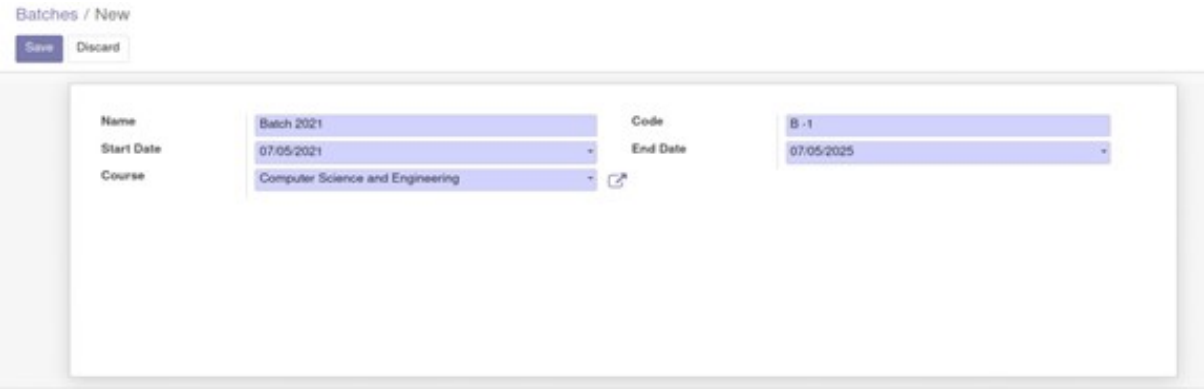


Figure 6.5: Configure batch of students

Add/ Delete courses in degree programme

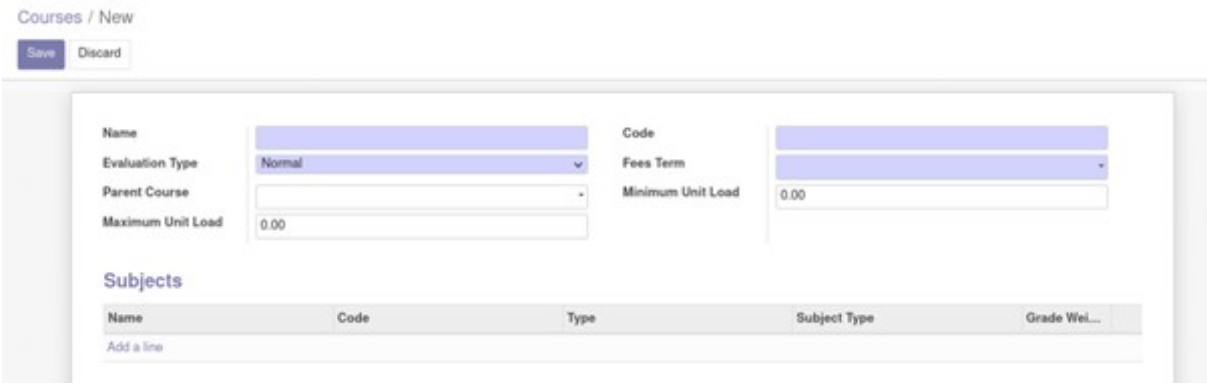


Figure 6.6: add / delete courses

Add/ Delete subject

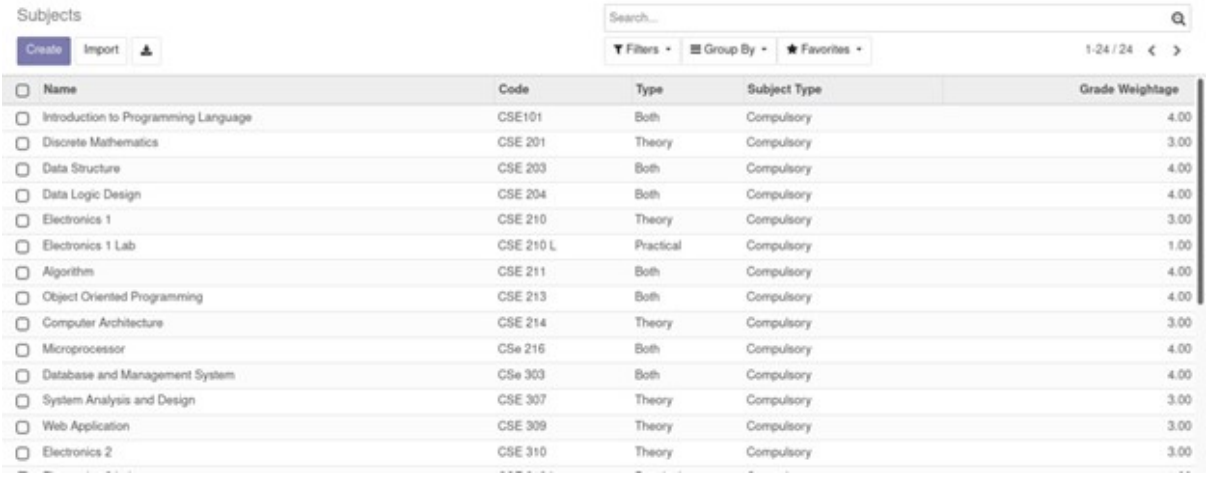


Figure 6.7: add / delete subject

Configure Course Fee

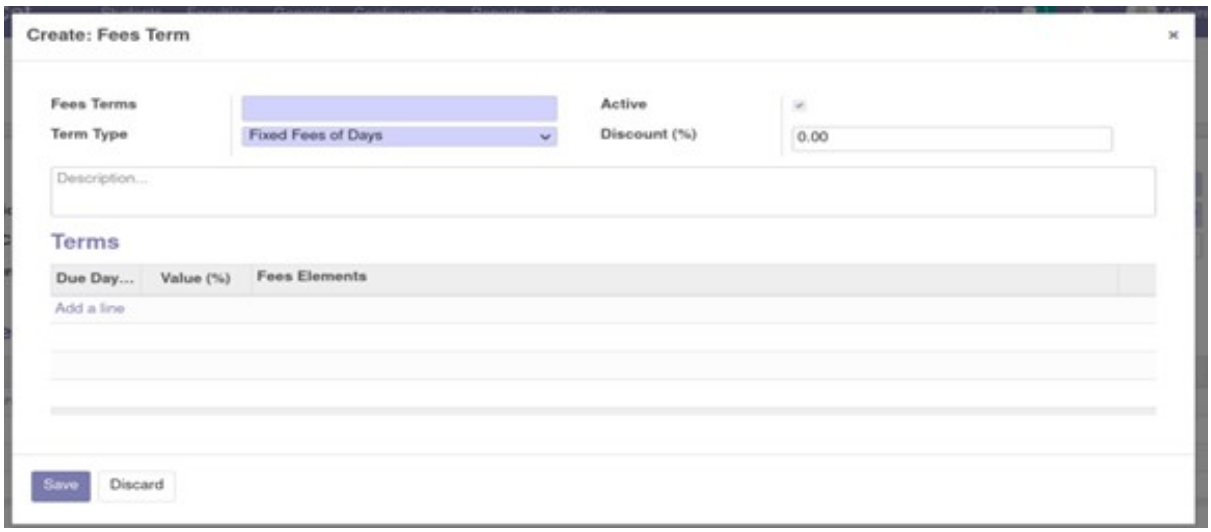


Figure 6.8: configure course fee

Define Course Fee

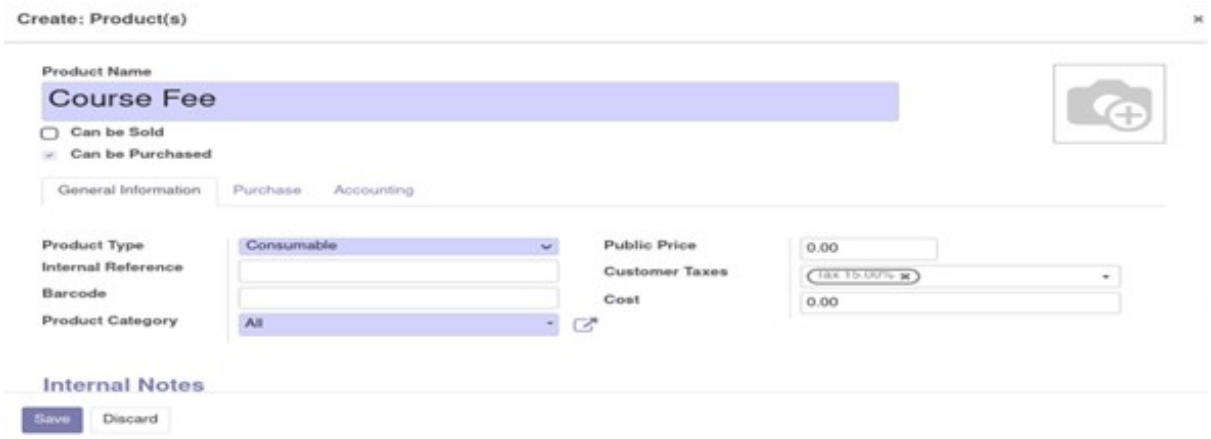


Figure 6.9: define course fee

Allocate time slots

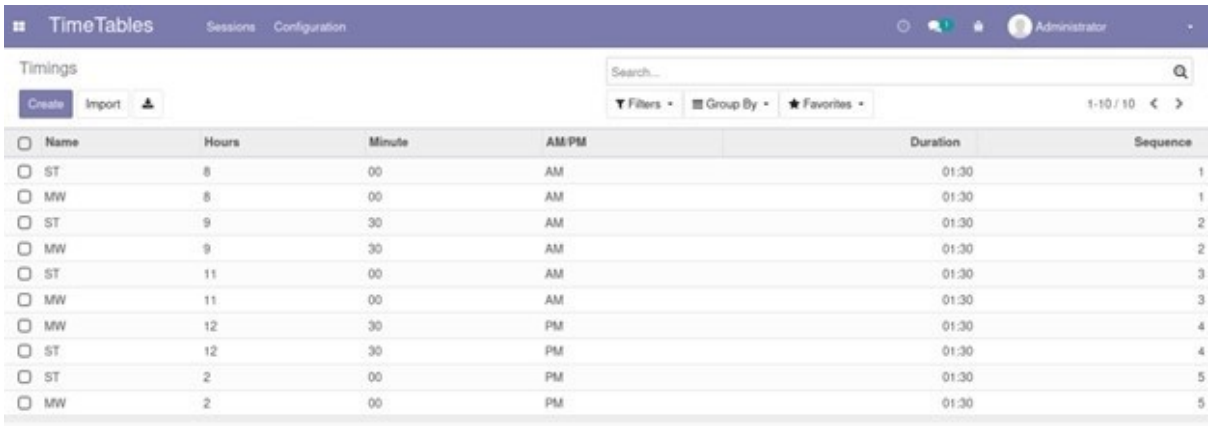


Figure 6.10: Allocate time slots

Generate Sessions of faculty

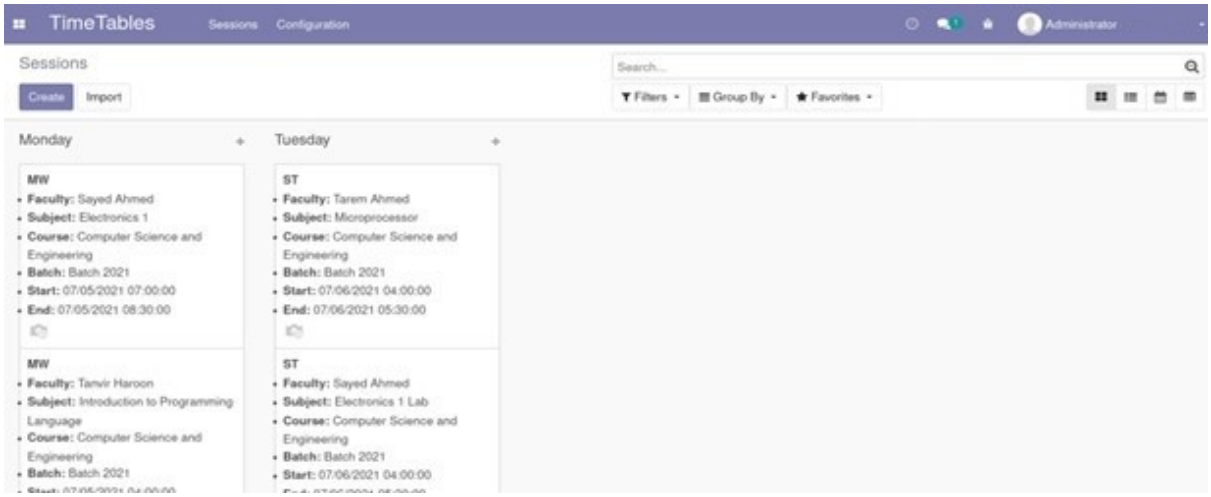


Figure 6.11: generate sessions of faculty

As we have seen the input and output features of our product previously from (figures 5.8 – 5.21) in chapter 5. Here, those features will be discussed thoroughly. As you can see, we have two user perspectives addressed, the faculties and then the students. Here, we show the process flow of students from applying for admission to registration to submission of assignment and finally, viewing grades. All these are accessible by student and admin users. Later, from faculties perspective we can see that faculties can take attendance, assign assignments, view submitted assignment and Input marks and after submitting grade through their portal it will be visible to students. These are the results and analysis done through users like admin, student, faculty perspective.

In addition, we then deployed the system in cloud where VM was created and using Linux as operating system (OS), we installed web servers, and then configured the server settings and deployed it in cloud infrastructure. Here are the screenshots:

At first, we create a VM on Microsoft Azure

6.0.1 Create a VM and configure services and settings

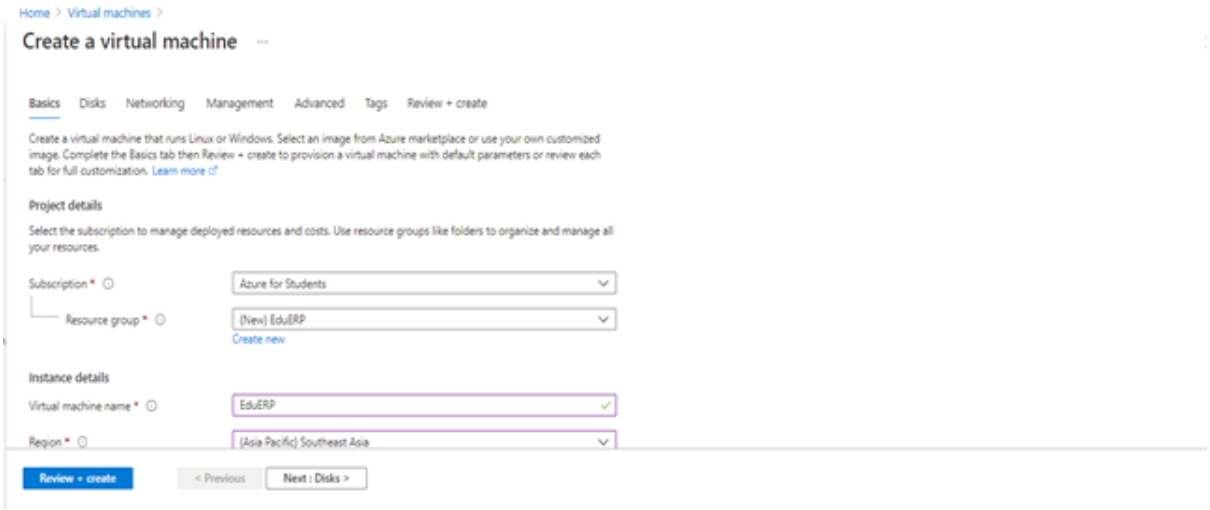


Figure 6.12: Create a VM

After VM has been created a private key is given that is used to access the VM. The private key is encrypted using the command chmod 400 so that it can be accessed via Linux for configuration and installation of basic required python packages, Odoo server, web server, security rules and using GitHub to fetch the software for launching purposes.

6.0.2 Encrypt PEM key

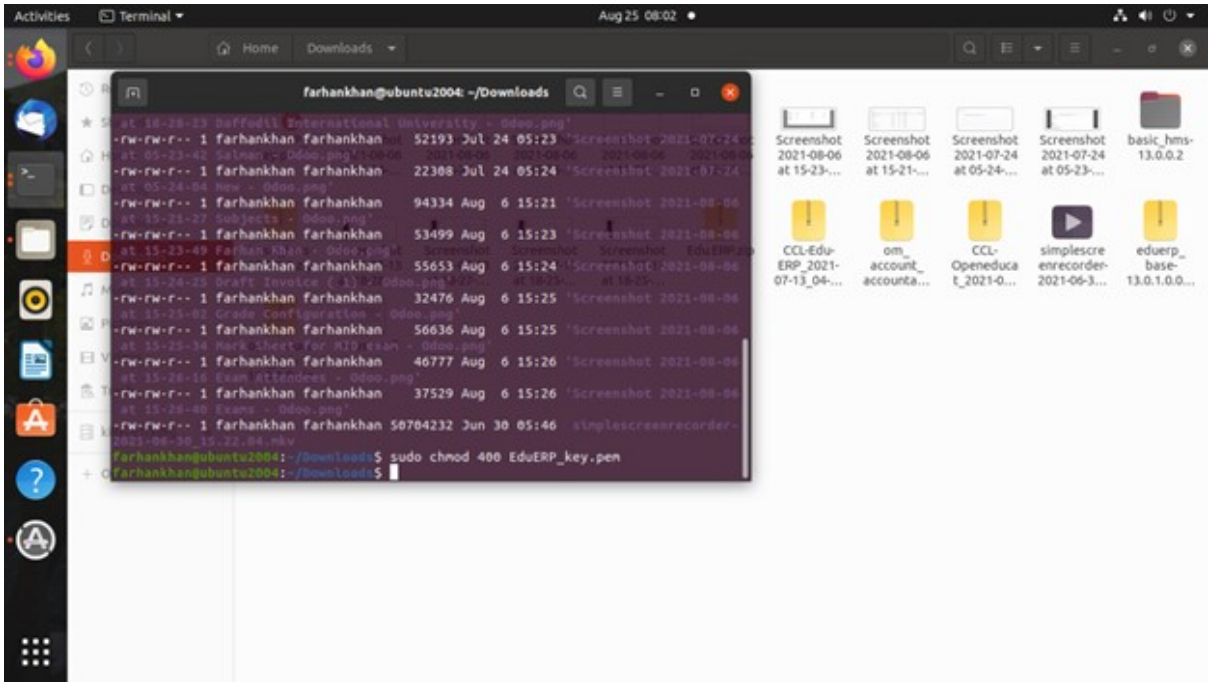


Figure 6.13: Encrypt PEM key

6.0.3 Encrypt PEM key

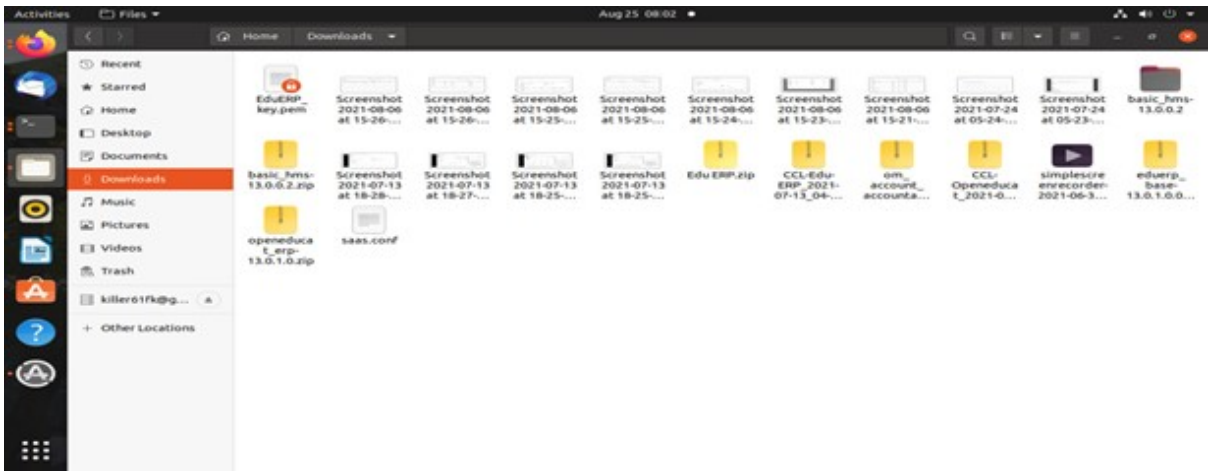


Figure 6.14: PEM key encrypted

6.0.4 Access VM via Linux OS

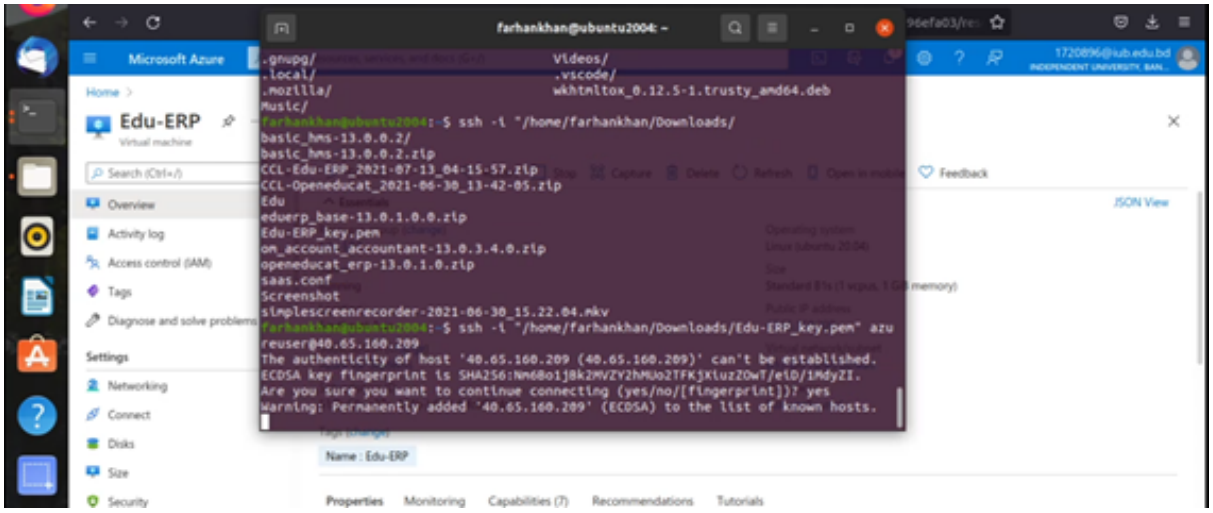


Figure 6.15: Access VM for configuration

6.0.5 Update Python Package

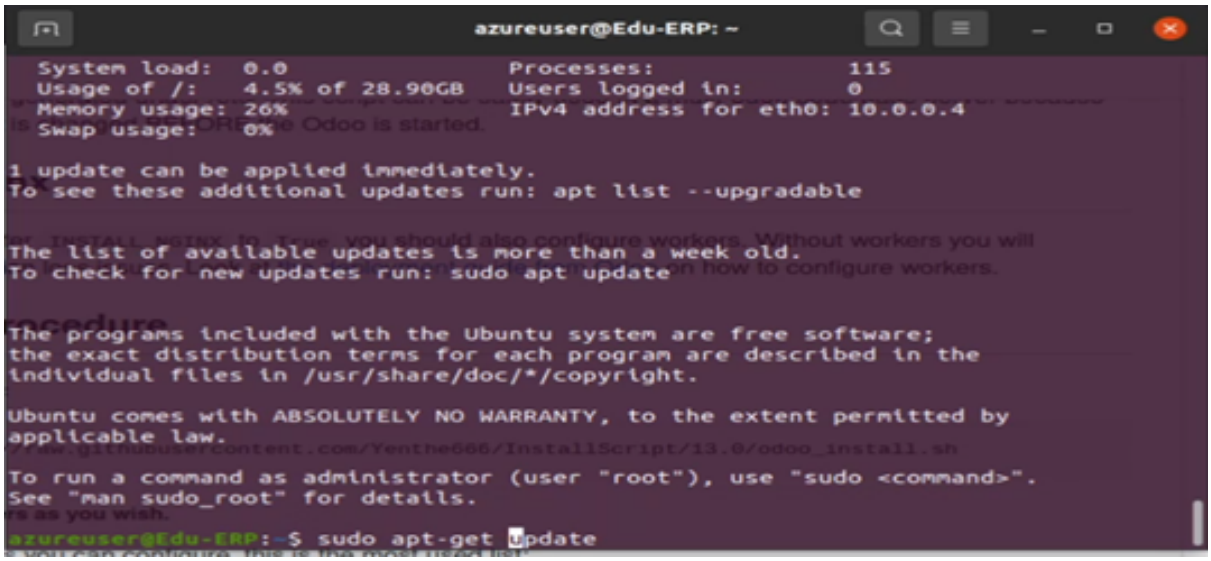


Figure 6.16: Python package update

Step-2

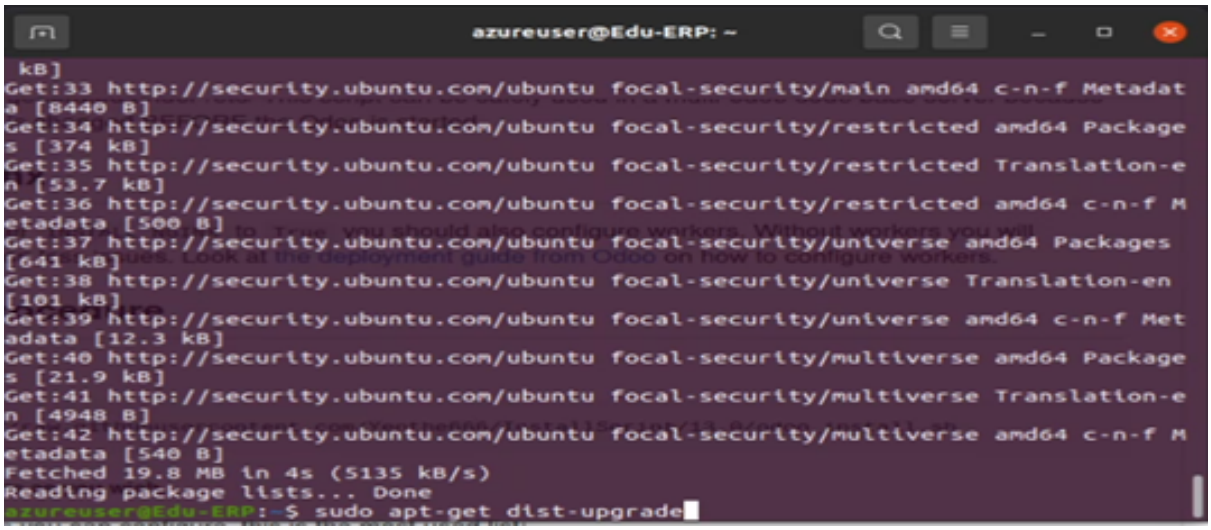


Figure 6.17: Updating packages

Step-3

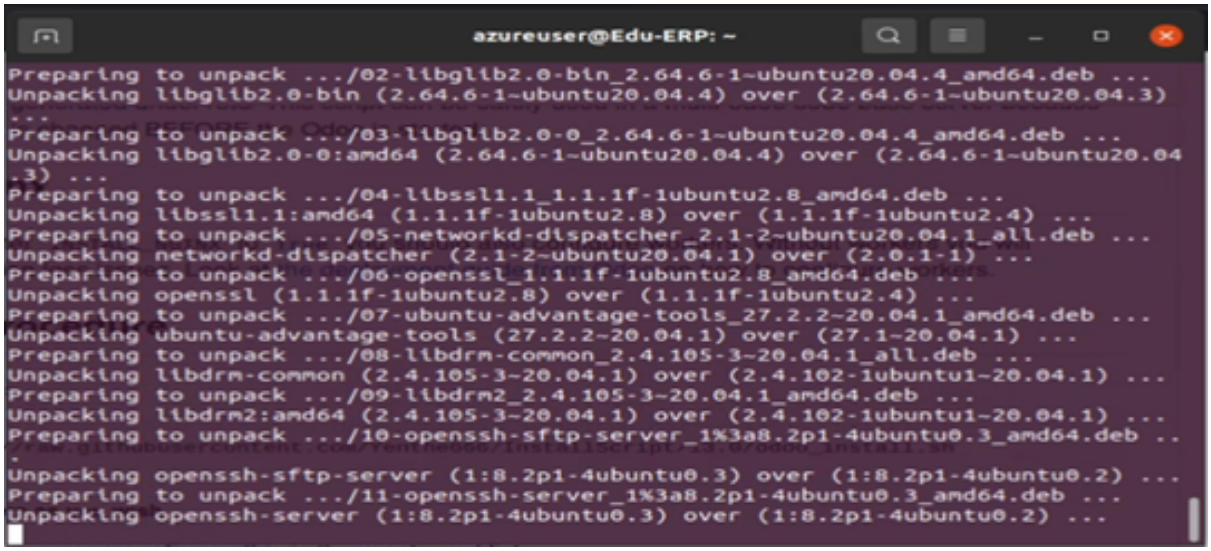


Figure 6.18: Packages Updated

6.0.6 Fetch software workload from GitHub

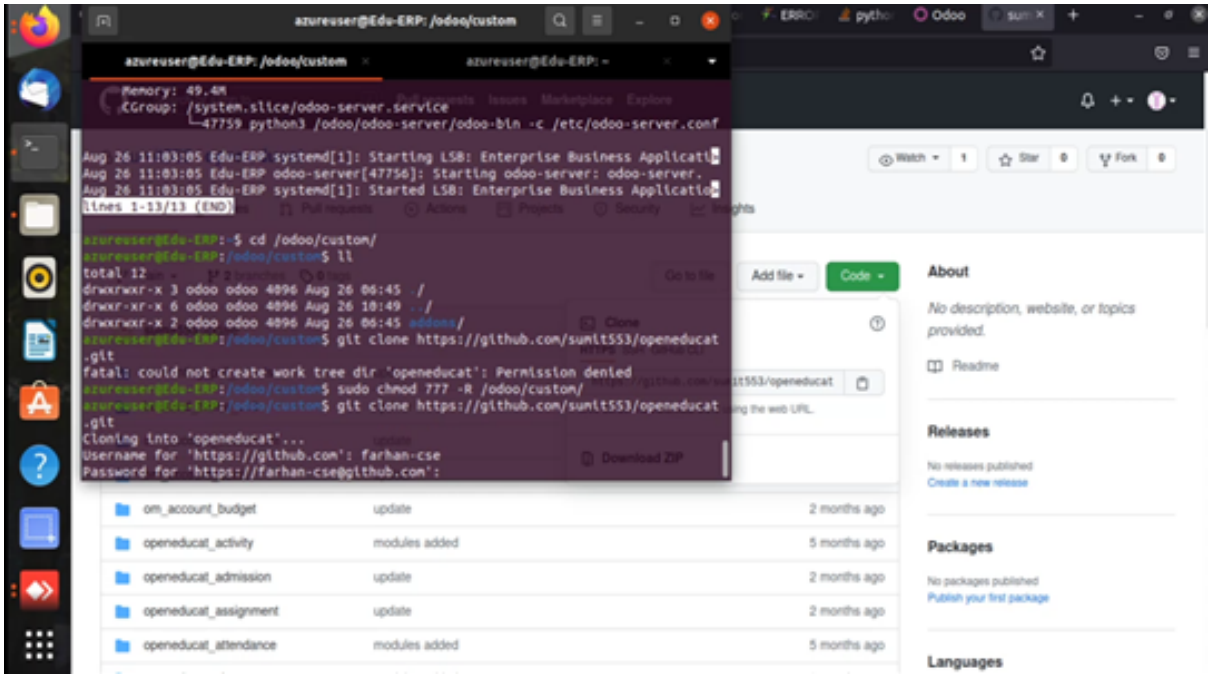


Figure 6.19: Push software from GitHub to server

System is deployed in cloud and available for use over the internet.

Chapter 7

Project as Engineering Problem Analysis

7.1 Sustainability of the Project/Work

At first, we need to know what sustainability means in terms of the project. Basically, sustainability involves different concerns such as economic, social, environmental, administrative perceptions which emphasize on the affordability, usefulness for society, less wastage and more efficiency and resource utilization goals for project to achieve. These elements are considered when project sustainability is built. [4]

Now, why is sustainability, an important part of the project? because it allows us to have a trust and belief that the project will give a useful outcome for a certain period of time and will prove to be a worthful investment that will provide profit and benefits to sustain expenditure costs. Also, maintaining and updating the system accordingly is part of sustainability. [5]

As we have seen the project is sustainable as it provides cheap, affordable solution to institutions and decreases their workload by a huge margin, this allows society to adapt to new changes and utilize the software to store data in much more efficient and automated way rather than wasting papers when everything was manual. The stakeholders such as the institution will be benefited from this software. The system is user friendly and easy to navigate through and as admin has access to all the modules of the system there are no sight of issues to be faced. The advantage of this ERP system is that it offers easier and convenient process flow which saves time and money. Also, the maintenance as it is under observation all the time by the vendor and if there are bugs found it will be fixed immediately allowing the system sustainability to increase. Moreover, the software will be maintained and supported by a maintenance team. It will be updated twice in a year according to the requirements of the customer's needs and all the bugs and problems are

regularly updated. All these aspects offer a sustainable Education ERP system.

7.2 Social and Environmental Effects and Analysis

Social Effects

The main goal of this project is to help educational institutes that lack infrastructure to utilize the software and adapt cloud for IaaS, PaaS advancement. As the system is automated no manual work is needed providing more efficiency. The system provides all functionalities that an institute requires starting from saving records of students in database, managing their subject registration, allocating schedules, allowing faculties to take attendance and tracking fees payment. All these functionalities and features are available to user within their fingertips and have a social effect on the traditional process flow practiced. [6]

Environmental Effects

The system can play its best role in the global pandemic of covid-19. The educational institute faculty employee, students can stay at home and continue their work process through the system. Also, as many modules are automated it decreases the use and wastage of paper allowing positive environmental impact. Few administrative employees such as accountant, they need to be present at the institute as their work requires the need to be done physically, other than that, the system allows user access to many information within the comfort of their homes rather than going out in this pandemic. [7]

7.3 Addressing Ethics and Ethical Issues

In this modern world with technological advancements happening at a fast rate, many have key concerns regarding data collection, data manipulation, data integrity and to address this concern we follow certain ethics and consider ethical issues beforehand to avoid improper practices. The developers made sure that there was no breach of conduct like secretly retrieving personal information through eavesdropping and other aspects were also considered. Here are some of the considerations we did:

Data Collection: Only necessary data are collected and are transmitted done through a encrypted secure channel to avoid breach of privacy. This ensures privacy and security.

Data Storage: All the data is stored in the Microsoft Azure cloud and is backed up. The admin only has access to the backend server and database. As it is hosted in cloud only the admin using private key credentials can access the DB server. Hence, there is less risk of data manipulation, breach of data integrity and since the database is backed up, there are low chances of data loss due to system failure or disaster. This ensures authorization, safety and fault management.

Data Security: Data in the cloud are secured rather than the data on premises as there is less chance to get hacked. A super admin account is provided to the customer to manage other user accounts and give access to the server. This ensures authorization, authentication, reliability.

Discrimination: There is no categorization of users by religious beliefs, color, language, all are equal and are respected.

Chapter 8

Lesson Learned

8.1 Problems Faced During this Period

There are always problems and there are solutions to them too, during my internship, I have also faced problems. It was tough for me as I had to work six days a week from 10 AM to 7 PM, learning new terms and new work meant putting myself outside my comfort zone. Also, ERP and Microsoft Azure were new topics for me, and it took time for me to navigate through the process. The difficult part was doing research, requirement analysis and collecting data which is the foundation of the SDLC. The designing phase required many changes from architecture, cost analysis, resource utilization perspective. I also had a few difficulties when deploying the ERP software in the cloud as there were data compatibility issues, missing of packages and etc. These were some problems I faced during my internship period.

8.2 Solution of those Problems

As problems came across, there were also solutions to it through analysis. Understanding this, during my internship period I have gained knowledge, skills and socialized with employees which have played an important role in identifying solutions. Starting from adjusting to new time, learning about cloud, the tools it offers. My project manager helped me with solving few problems by guiding me through the process work and due to there being active interactive communication between teams many problem aspects were covered immediately and efficiently. I faced an issue regarding deployment also, where my fellow colleague helped me to analyse the error that caused it. Since, I worked with both the ERP development team which combines research, design, development and then secondly, the cloud infrastructure team which is responsible for deployments and architecting the cloud environment for the ERP system. I learned about Odoo, ERP, Azure cloud VMs, and policies which helped me gain knowledge in these platforms.

Due to working with different people and observing different perspectives in team meetings, it helped me to identify the requirements for successful project deployment and necessity of positive team communication.

Chapter 9

Future Work & Conclusion

9.1 Future Works

The project is still under development as more modules have to be implemented, the company plans on adding more features like Blood bank - where students can register as donors and other users can post for blood donation, Campus Advisor - focuses on new students who need guidance regarding registration, campus familiarity and advices related to course, AI chatbots are also, a complementary feature to this answering some common questions that most students ask, CGPA calculator – for students to calculate their predicted grades, Sell/buy course books – where students can utilize the software for their own. This will be the next step to smart education management system. Hopefully, it will be more appealing to students and universities but that's something for the future. Other than that, the website will be made more interactive and there will be software updates according to the needs of institutes every few months. The project is evolving, and the company has many future plans regarding its development as it falls under the vision of our CEO. This internship also opens new gateways that will help me accelerate my career.

9.2 Conclusion

In conclusion, we can say that changing career paths is not easy for everyone as I had only theoretical knowledge of cloud computing but during the process through implementation, I received actual experience that aided in the resolution of issues. This internship was a great experience overall with interesting new learnings and implementations. During my project, I cooperated with my mentors to solve the challenges faced. Despite their workload, my supervisors were always there to answer any queries and helped me settle nicely therefore, I am thankful to them. Lastly, thanks to this project, I learned to work under pressure and fulfil SDLC before the deadline. Also, I acquired deeper

knowledge concerning my technical skills from which I personally benefited. There are huge opportunities available for the students who want to work as a cloud engineer or consultant and let's see what the future holds.

Bibliography

[1] H. B., "How to write a good project plan," *Project Management*, 2021.

[2] S. Maguire, U. Ojiako, and A. Said, "Erp implementation in omantel: a case study," *Industrial Management & Data Systems*, 2010.

[3] B. Blanchard, "Cloud migration in the cloud adoption framework," *Microsoft Documents*, 2020.

[4] APM, "What is sustainability in project management?," *Body of Knowledge 7th Edition*, 2021.

[5] K. Frazee and M. R. Khan, "Erp implementation for corporate growth and sustainability," *International Journal of Business and Social Science*, vol. 3, no. 3, 2012.

[6] M. Niedeggen, N. Sarauli, S. Cacciola, and S. Weschke, "Are there benefits of social overinclusion? behavioral and erp effects in the cyberball paradigm," *Frontiers in Human Neuroscience*, vol. 8, p. 935, 2014.

[7] V. S. Lai, F. Lai, and P. B. Lowry, "Technology evaluation and imitation: do they have differential or dichotomous effects on erp adoption and assimilation in china?," *Journal of Management Information Systems*, vol. 33, no. 4, pp. 1209–1251, 2016.