HETAUDA CITY COLLEGE

Tribhuvan University
Institute of Science and Technology

VIRTUAL CLASSROOM

Submitted To

Department of Computer Science and Information Technology

Hetauda City College

Under the Supervision of

Avinash Jha

In Partial fulfillment of the requirements for the Bachelor's Degree in Computer Science and Information Technology

Submitted by

Manish Karki(11575/073)

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September, 2020

Hetauda, Nepal

STUDENT DECLARATION

This is to certify that we have completed the Project entitled "**Virtual Classroom**" under the guidance of "**Mr. Avinash Jha**" in partial fulfillment of the requirements for the degree of **Bachelor of Science in Computer Science and Information Technology (Bsc.CSIT)** at Faculty of Institute of Science and Technology, Tribhuvan University. This is our original work and we have not submitted it earlier elsewhere.

PROJECT TEAM

………………………………   …………………………………

Manish Karki   **Nishan Paudel**

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………………………………

Susan Baniya

11584/073

HETAUDA CITY COLLEGE

Tribhuvan University
Institute of Science and Technology

CERTIFICATE FROM THE SUPERVISOR

This is to certify that the project entitled "**Virtual Classrom**" is an academic work done by "**Manish Karki, Susan Baniya and Nishan Paudel"** in the partial fulfillment of the requirements for the degree of **Bachelor of Science in Computer Science and Information Technology** at Faculty of Institute of Science and Technology, Tribhuvan University under my guidance and supervision. To the best of my knowledge, the information presented by them in the project report has not been submitted earlier.

……………………………………

Avinash Jha

Supervisor

Hetauda City College

Date:-

HETAUDA CITY COLLEGE

Tribhuvan University
Institute of Science and Technology

Date: 2076/10/11

Letter of Approval

This is to certify that this project prepared by **Manish Karki**, **Nishan Paudel** and **Susan Baniya** entitled **"Virtual Classroom"** in partial fulfillment of the requirements for the degree of BSc. in **Computer Science and Information Technology** has been well studied. In our opinion it is satisfactory in the scope and quality as a project for the required degree.

....

Avinash Jha

(Supervisor)

Hetauda City College

....

Mr. Saroj Paudel

(Program Coordinator)

Hetauda City College

....

Er.

(External Examiner)

Acknowledgment

The accomplishment of this project would not have been conceivable without the kind support and assistance of numerous peoples and association, and we are immensely blessed to have all of those supports. All that we have done is only due to such support and guidance and we would not forget to thank them.

We are grateful to Hetauda City College for all the consistent direction and supervision, which was necessary for the successful completion of the project. We are likewise keen to the endeavors of our HOD **Mr Saroj Paudel**, without whom the project would have been impossible to complete.

Likewise, we would like to offer our gratitude towards our supervisor, **Mr. Avinash Jha** who took intense and eager interest in our project, by providing us with his insightful knowledge in the industry. We are also thankful for his immense help and encouragement towards making this report standard according to the norms and values.

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Abstract

The physical and traditional learning classroom these days are getting less and less applicable. The expansive growth of Information and Communication Technology has drastically changed the world. The world is looking for easier solutions to everything and the technology have delivered it for them. Virtual Classroom is one of those answers to the easier lifestyle, which makes education and classroom system mobile through the use of technology.

Virtual Classroom is a Learning Management System (LMS) that provides all of your courses, materials and gives you access to your teachers. It is the inexorable trend of the application of modern information technology in education. It is one of the major learning methods in the era of information that allows students and lecturers to go online and continue their normal school activities.

 The traditional method of teaching and learning has some shortfalls. Some of these includes: noise making in the lecture hall, a pandemic situation like COVID-19, which we are currently facing as of now, all of which contribute to the poor performance of students in their academic life. The proposed system is equipped with features that will minimize if not totally eradicate the aforementioned problems. There is a module where the lecturers can create their own classroom. There is a module where students can login to read announcements, there is assessment module where lecturers may post and students can view. This system will encourage learning and mastering of the individual topic contained therein and enhances the student's practical knowledge and broadens their theoretical knowledge while creating a more interacting learning process.

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Abbreviation

LMS	:	Learning Management System
CMS	:	Course Management System
E-Learning	:	Electronic Learning
CD-Rom	:	Compact Disk Read Only Memory
SDLC	:	System Development Life Cycle
DFD	:	Data Flow Diagram
ER-Schema	:	Entity Relationship Schema
HTML	:	Hyper Text Markup Language
CSS	:	Cascading Style Sheets
SASS	:	Syntactically Awesome Style Sheets
Js	:	JavaScript
UI	:	User Interface
API	:	Application Programming Interface
VS Code	:	Visual Studio Code
WebRtc	:	Web Real Time Communication
SQL	:	Structured Query Language
MongoDB	:	Humongous Database
MDN	:	Mozilla Developer Network

CHAPTER I

1.   Introduction:

1.1.   Background

E-learning is an education via the Internet, network, or standalone computer. E-learning refers to using electronic applications and processes to learn. E-learning includes all forms of electronically supported learning and teaching (Tirkes, G,2010). E-learning is the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual education opportunities and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. That is to say E-learning systems contain both Learning Management System and Course management system. It can be self-pace or instructor-led and includes media in the form of text, image, animation, streaming video and audio. It is commonly thought that new technologies can make a big difference in education. In young ages especially, children can use the huge interactivity of new media, and develop their skills, knowledge, and perception of the world, under their parents' monitoring, of course.

Virtual Classroom is a web-application that makes the use of Internet and web technology to carry out learning without having to physically attend the classroom. Learning is the key to achieving our full potential. Our survival in the 21st century as individuals, organizations, and nations will depend upon our capacity to learn and the application of what we learn to our daily lives. E-learning has the potential to transform how and when people learn. Learning will become more integrated with work and will use shorter, more modular, just-in-time delivery systems. By leveraging workplace technologies, e-learning is bridging the gap between learning and work.

1.2. Problem Analysis

1.2.1. Current System

The current situation is very limited to few resources students are unable to get knowledge more than that the lectures provides to them. This, in the end limits student's performances, because everything a student gets is collected from lectures in class.

Here are some of the problems of the current system:

- Students submit assignment to lectures through hard copies or personal emails.
- Students only get help from lecturers, only if the lecturers are in their office.
- Students are required to be physically present in the classroom in order to gain knowledge thereby sacrificing all other responsibilities.
- Students are unable to share resources effectively and hold group discussions that are monitored or supervised by lectures

1.2.2. The Future System

The system will hopefully serve as a centralized database of syllabus for the courses offered at the college allowing students and faculties, to view them. The system will end up bringing an effective communication among students, lectures, and the administration, by accessing information other resources anytime, anywhere.

1.3. Objectives

The main objective behind this project is to provide a user friendly environment to provide knowledge and give everyone a chance to learn, irrespective of where they are, provided they register themselves with the system. Virtual Classroom manages the details of Assignment, Student, Teacher, and Question. It manages all the mentioned information. Other objectives include the following:

- To provide interface between lecturer and student where student don't need to go to every lecturer room just to make a simple discussion.
- To provide a medium where students can be able to download note and watch tutorial in the easy way.
- To provide a system that will support class activities by giving students opportunities for further exploration, discussion, and exchange of ideas outside class. For this purpose, it is necessary to go beyond learning simple reusability of material in repositories of learning objects and find solutions in order to build significant learning scenarios or programs that enable students to achieve real competency gains while reinvesting learning objects.

1.4.   Scope of Study

The scope of work in this project is stated as given:
- To serve administrative function by giving student's access to course documents and other course material for each courses they were taken.
- To send latest announcement and news that is related for each course.
- To display course related information on the link and reference item.
- To provide video conferencing service between teachers and students.

1.5.   Limitation

Although E-learning has many benefits for students and organization, it also has limitations.
- Computer literacy and access to equipment. Any E-learning system involves basic equipment and minimum level of computer knowledge in order to perform the tasks required by the system. A student that does not possess these skills, or have access to these tools, cannot succeed in an E-learning program.

- Some topics are not appropriate for E-learning. Certain subjects that require physical exertion and practice, such as ports and communication skills, are not good candidate for E-learning.
- Students themselves can be a limitation to E-learning. The flexibility and student-centered nature of E-learning requires a high level of student responsibility. A successful E-learning student must be well organized, self-motivated, and have good time management skills.

1.6. Definition of unfamiliar terms

1.6.1. Learning Management System (LMS)

A Learning Management System(LMS) is a software application or web-based technology used to plan, implement, and assess a specific learning process. Typically, a LMS provides an instructor with a way to create and deliver content, monitor student participation, and assess student performance.

1.6.2. Course Management System (CMS)

A course management system is a set of tools that enable the instructor to create online course content and post it on the Web without having to handle HTML or other programming languages.

CHAPTER II

2.   Requirement Engineering

2.1.   Study of existing system

There are different type of web-application and software that are available in the market that are devoted specifically for the purpose of E-learning. Some of these kind of applications include Zoom, Discord, etc. But, they are yet to implemented locally by the education bodies in Nepal. Hence, with the purpose of implementing an Online learning system Virtual Classroom has been developed, dedicated with the sole purpose of implementing the system within the country.

2.2.   Software Requirement Specification

The Software Requirements Specification is produced at the culmination of the analysis task. The function and performance allocated to software as part of system engineering are refined by establishing a complete information description, a detailed function and behavioral description, an indication of performance requirements and design constraints, appropriate validation criteria, and other data pertinent to requirements. Requirement specification can be broken down into functional and non-functional requirements.

2.2.1.   Functional Requirements

Functional requirement defines a system or its component. It describes the functions, software must perform. A function is nothing but inputs, it behavior and outputs.

a) User Registration
Anyone can register to the site as Teacher or Student, but only one role per account. The Admin role will be pre-determined and will be a seed user.

b) User Functions

There are mainly three roles for the users in the site: Admin, Teacher and User. Admin manages the overall users, resources, classes and such. Teacher create classes, share resources and manage their students. Students join classes, organize resources, chat with teachers and other students.

c) User Profile

The site allows registered users to update their personal information and user avatar.

d) Logout

Users can log out of the system after finishing their respective stuff.

2.2.2. Non Functional Requirements:

A non-functional requirement defines the quality attribute of a software system. They represent a set of standards used to judge the specific operation system. It is essential to ensure the usability and effectiveness of the entire software system. Failing to meet non-functional requirements can result in systems that fail to satisfy user needs.

a) Usability

Usability is a measure of how well a specific user in a specific context can use a product to achieve a defined goal effectively, efficiently and satisfactorily. Our project Virtual Classroom is user-friendly. Users with basic skills of computer can easily operate or use the web-application, without having any kind of problem.

b) Easy Access

As our project is a web-based application, it can be accessed anytime from anywhere with a stable internet connection.

c) Reliability

The System must give accurate data to the use continuously. The web application makes sure to avoid making mistakes during data and information retrieval.

d) Security

The system should resist the unauthorized, accidental or unintended usage and provide access to only the legitimate users. Our Virtual Classroom system provides a password enabled login to the user to avoid any foreign entity changing the data in the system. Hence, making the system secure.

2.3.   Feasibility Study

The second face of system development life-cycle is to examine the feasibility of the system. The feasibility study is basically the test of the proposed system in the light of its workability, meeting user's requirements, effective use of resource and of course, the cost effectiveness. In short, a feasibility analysis concludes the project's potential for success.

2.3.1. Technical Feasibility:

The web-application is technically feasible, since there will be not much difficulty in getting required resources for development and maintaining the system. This, web-application is supported by almost all the modern day web-browser.

2.3.2. Operational Feasibility:

Operational feasibility refers to the measure of solving problems with the help of a new proposed system. It helps in taking advantage of the opportunities and fulfills the requirements as identified during the development of the project. It takes care that the

management and the users support the project. There are some challenges such as users being reluctant to change, but there is high operational feasibility in this system.

2.3.3. Economic Feasibility

They system is economically feasible. The only thing this web-application requires is a stable internet connection. There are no charges of any sort associated with contents in web-application. COCO model calculation for the project is as follows:

Webpage Name	Number of Lines of Code
Login	50 LOC
Sign Up	65 LOC
Create Donation Page	190 LOC
Forget Password	125 LOC
Resources	480 LOC
Classes	1030 LOC
Admin Dashboard	290 LOC
Total Line of Code = 2230	

Table 2.3.3(a): COCOMO table

Total Kilo Line of Code (KLOC) = 2230/1000 = 2.23

Effort = 3.0 x (KLOC)$^{1.12}$ PM = 3.0 x 2.23$^{1.12}$ = 7.37 Person Months

Time to develop the software (Tdev) = 2.5 x (Effort)$^{0.35}$ Months = 2.5 x (7.37)$^{0.35}$ = 5 months

Cost required to develop the software = 5 x 8000 = Rs.40000

Basic COCOMO shows that the project will be completed in 6 months at the budget of Rs.40000.

CHAPTER III

3.   System Planning

System Planning is a crucial phase in Software Development Life Cycle (SDLC). A project cannot be move forward into design and development phase without a proper planning.

3.1.   Software Development Model

The software Development models are basically various processes or methodologies that are being selected for the development of the project depending on the project's aims and goals. Therefore, it is absolute necessary to choose the right SDLC model based on the project.

Our project is built by using The Spiral Model. It is one of the most important Software Development Life Cycle models, which provides the support for Risk Handling. It is an iterative from of standard Software Development LifeCycle. This spiral model is an aggregate of the iterative development model and incessant linear development paradigm. In simple terms, i.e, the waterfall model with more stress on the risk identification.

While implementing the Spiral SDLC model, we start through small set of requirement and went through each development phase for those set of requirements. We add functionality for the additional requirement in every-increasing spirals until the application was ready for the production phase.

Basic Principle

The Spiral model basically combines the idea of iterative development with the systematic, controlled aspects of the waterfall model. This Spiral model is a

combination of iterative development process model and sequential linear model i.e. the waterfall model with a very high emphasis on risk analysis. It allows incremental releases of the product or incremental refinement through each iteration around the spiral.

Advantages

Some of the advantages of spiral model include

- The Projects with many unknown risks that occur as the development process, in that case, Spiral Model is the best development model to follow due to the risk analysis and risk handling at every phase.
- Changing requirements can be accommodated.
- Allows extensive use of prototypes.
- It is good for large projects. Hence, recommended when complex and large project arises.
- Customer can see the development of the product at the early phase of the software development and thus, they are habituated with the system by using it before completion of the total product.

Disadvantages

Some of the disadvantages of spiral model include

- The Spiral model is very much complex as compared with other SDLC models.
- Not suitable for small or low risk projects and could be expensive for small projects.
- Many intermediate stages may require excessive documentation.
- As, the spiral may go to indefinite loop, time management is very complex.

When to use Spiral Methodology?

- When project is large

- For medium to high risk projects.

- When requirements are unclear and complex.

- When long term project commitment is not feasible due to change in economic priorities.
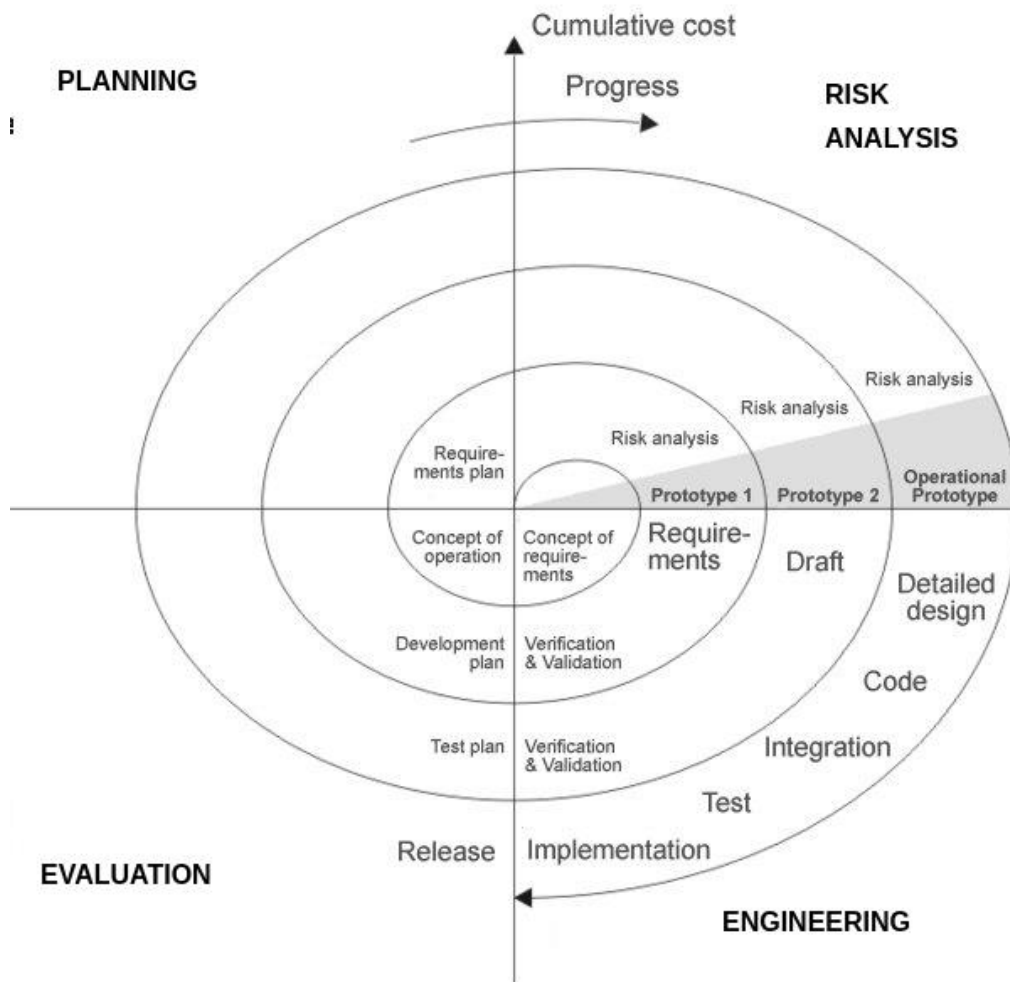

Figure 3.1(a): Spiral Model

Each phase of Spiral model is divided into four quadrants as shown in the figure. These quadrants include:

a) Planning

In the baseline spiral, it all started with gathering the requirements of the project. Identifications of system, sub-system and unit requirements were performed in this stage as project was executed. Feasibility study was also carried out in this quadrant.

b) Risk Analysis

During the second quadrant all the possible solutions were evaluated to select the best possible solution. Then, the risks associated with that solution was identified and the risks were resolved using the best strategy possible. Once the risks were identified, risk mitigation strategy was planned and finalized.

c) Engineering

Once the planning and risk analysis was carried out, all the coding and construction was carried out. The identified features were developed and verified through testing. At that point in the resulting spiral, a model of the product with version number was created. Coding was simplified as far as practicable. Node JS was used for the Server Side Validation, for interactive user interface SCSS was used. At the end of the quadrant, the next version of the product was available.

d) Evaluation

In the fourth quadrant of the Spiral, the so far developed version of the project was evaluated. In, the end planning for the next spiral was carried out.

CHAPTER IV

4.   System Design

System design is the process of defining the architecture, modules, interfaces and data for a system to satisfy specified requirements. System design could be seen as the application of systems theory to product development. System Design describes the components, modules, system activities, and system architecture of Virtual Classroom. Various system design aspect has been followed and explained below

4.1.   System Diagrams

4.1.1. Flow Chart

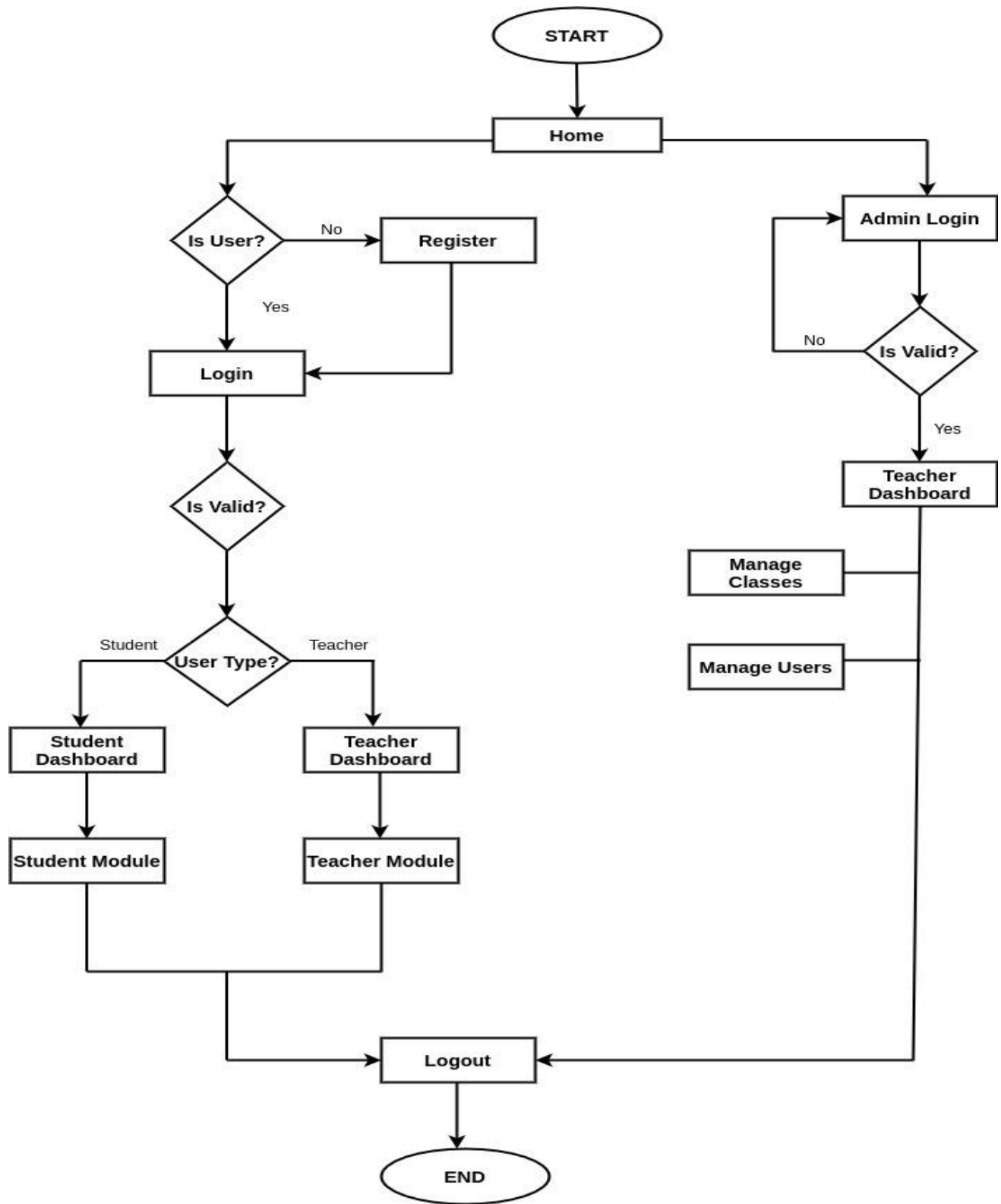The overall flow of our system is show in the figure below:

Figure 4.1.1(a): Flow Chart

4.1.2. Use Case Diagram

4.1.3. DFD (Data Flow Diagram)

Data Flow Diagram also known as DFD, are used to graphically represent the flow of data in a system. It includes data inputs and outputs, data stores, and the various sub processes the data moves through.
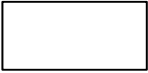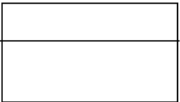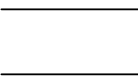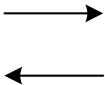
Notations	Represent	Description
	Entity	Source and destination of information data
	Data Process	Activities and action taken on the data
	Data Store	Data storage
	Data Flow	Data movement

Table 4.1.3: DFD Notation

a)   Level 0 DFD Diagram

A level 0 data flow diagram (DFD), also known as context diagram, shows a system as a whole and emphasizes the way it interacts with external entities. The following figure is our level 0 DFD diagram
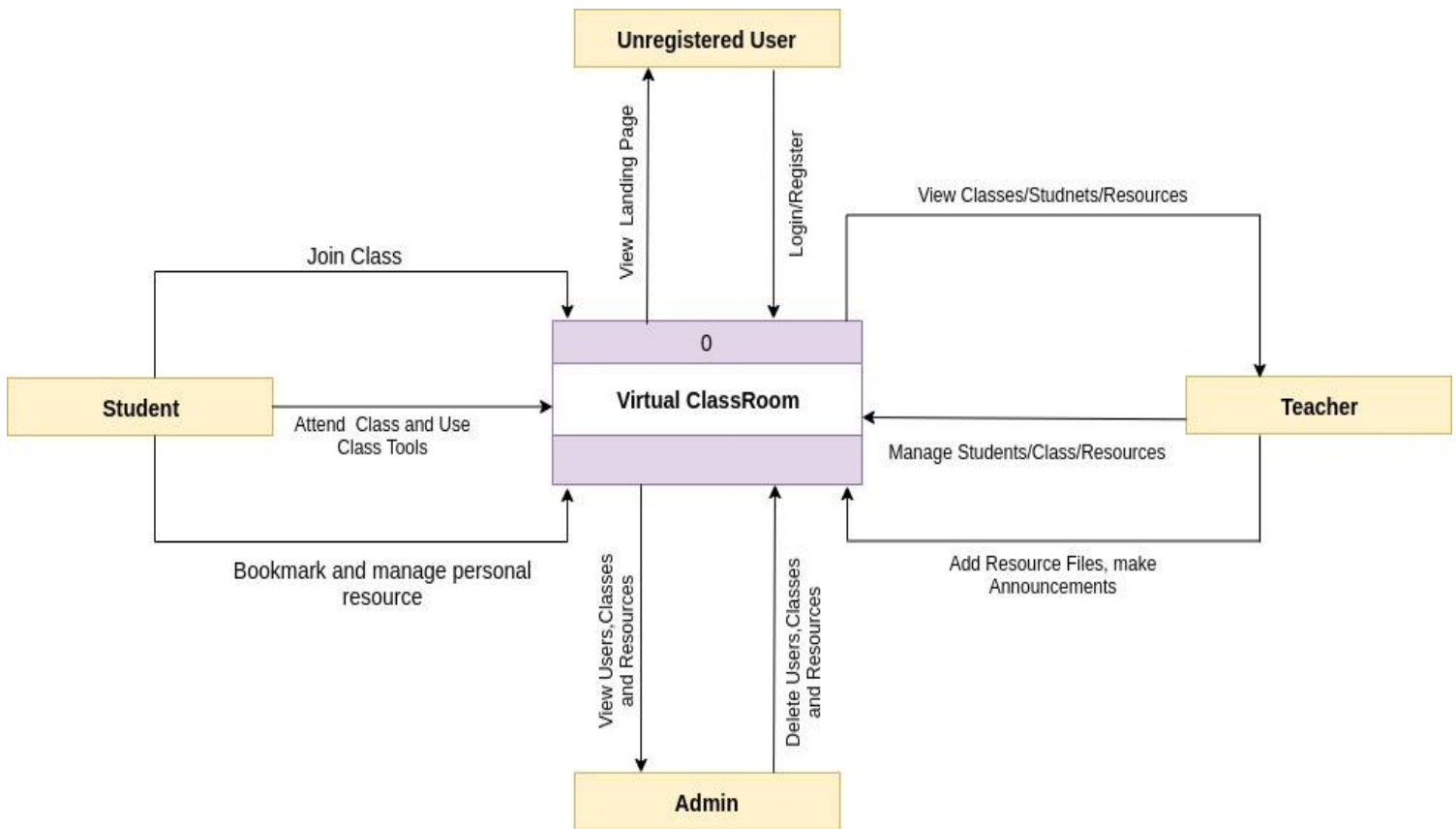
Figure 4.1.3(a): Level 0 DFD

b)   Level 1 DFD Diagram

A level 1 Data Flow Diagram (DFD) is more detailed than a level 0 DFD. It can then be analyzed and improved on a more intimate level. It aims to give an overview of the full system. They look at the system in more detail. Major processes are broken down into sub-processes. Level 1 DFD's also identifies data stores that are used by the major processes.

For simplicity, we have decomposed our Virtual Classroom Data Flow Diagram into three parts, DFD for student, teacher, admin.

LEVEL 1 DFD for Students
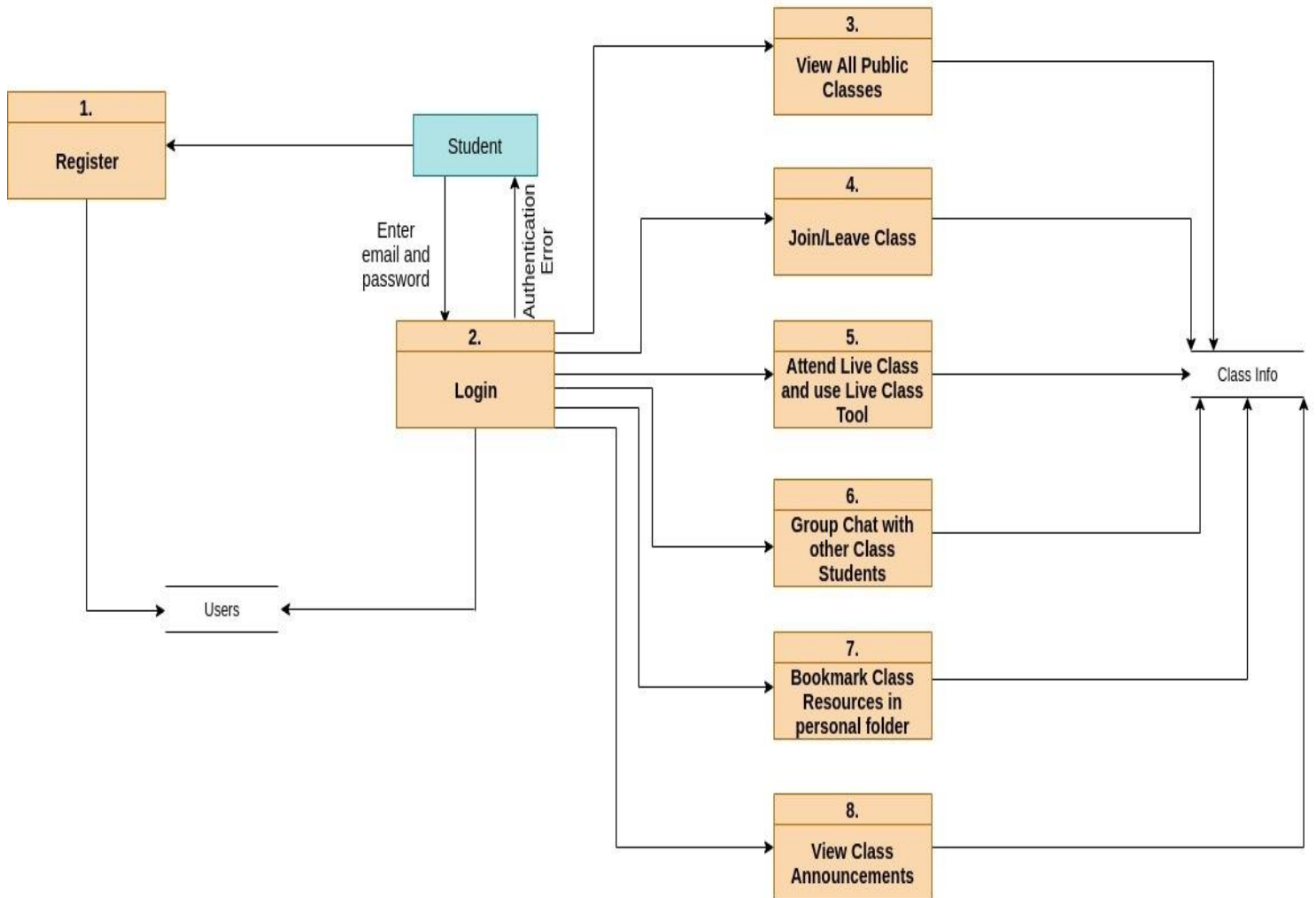
Figure 4.1.3(b): Level 1 DFD for Student

Level 1 DFD for Teachers

Figure 4.1.3(c): Level 1 DFD for Teacher

LEVEL 1 DFD for Admin

Figure 4.1.3(d): Level 1 DFD for Admin

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4.1.4. Entity Relationship Schema
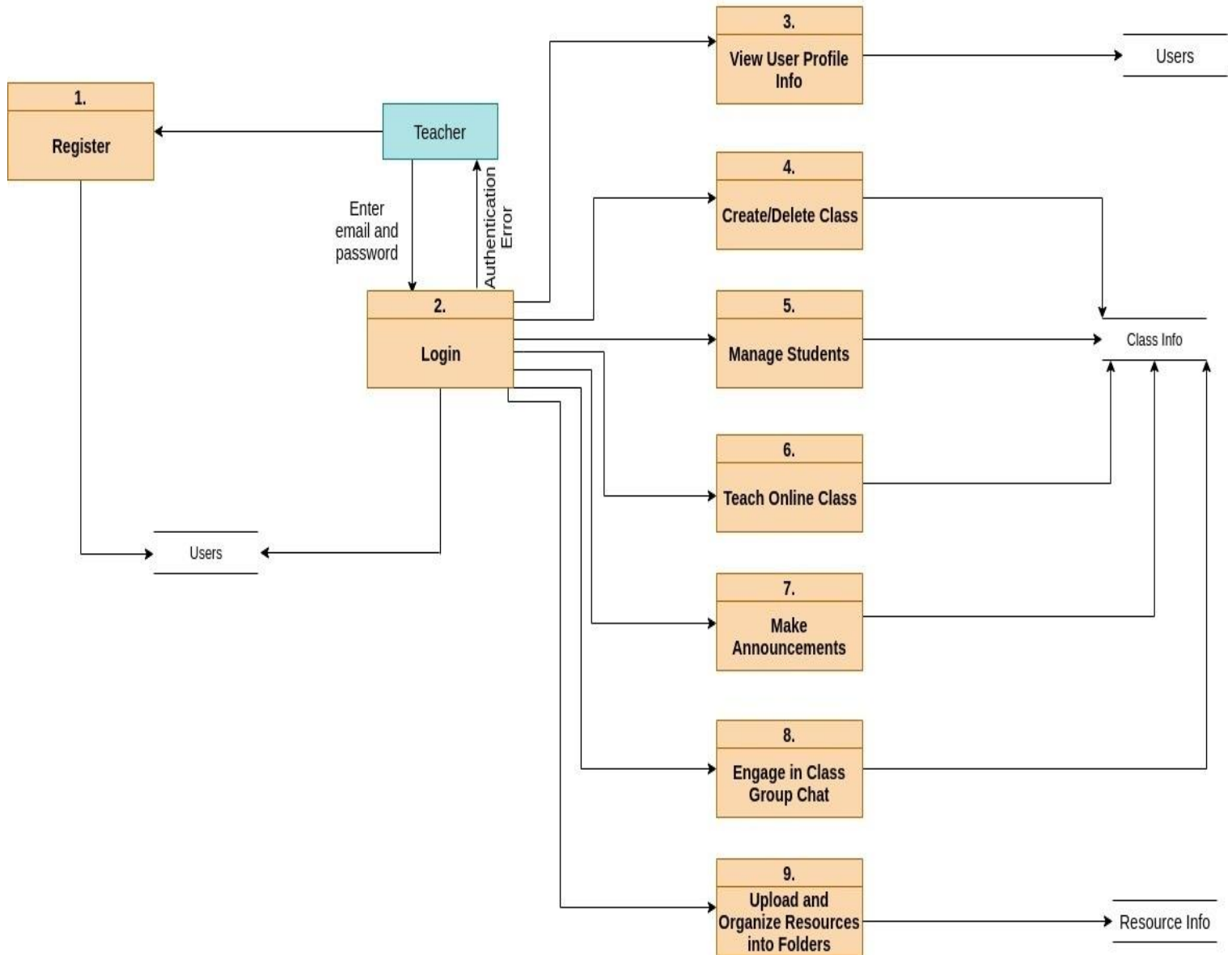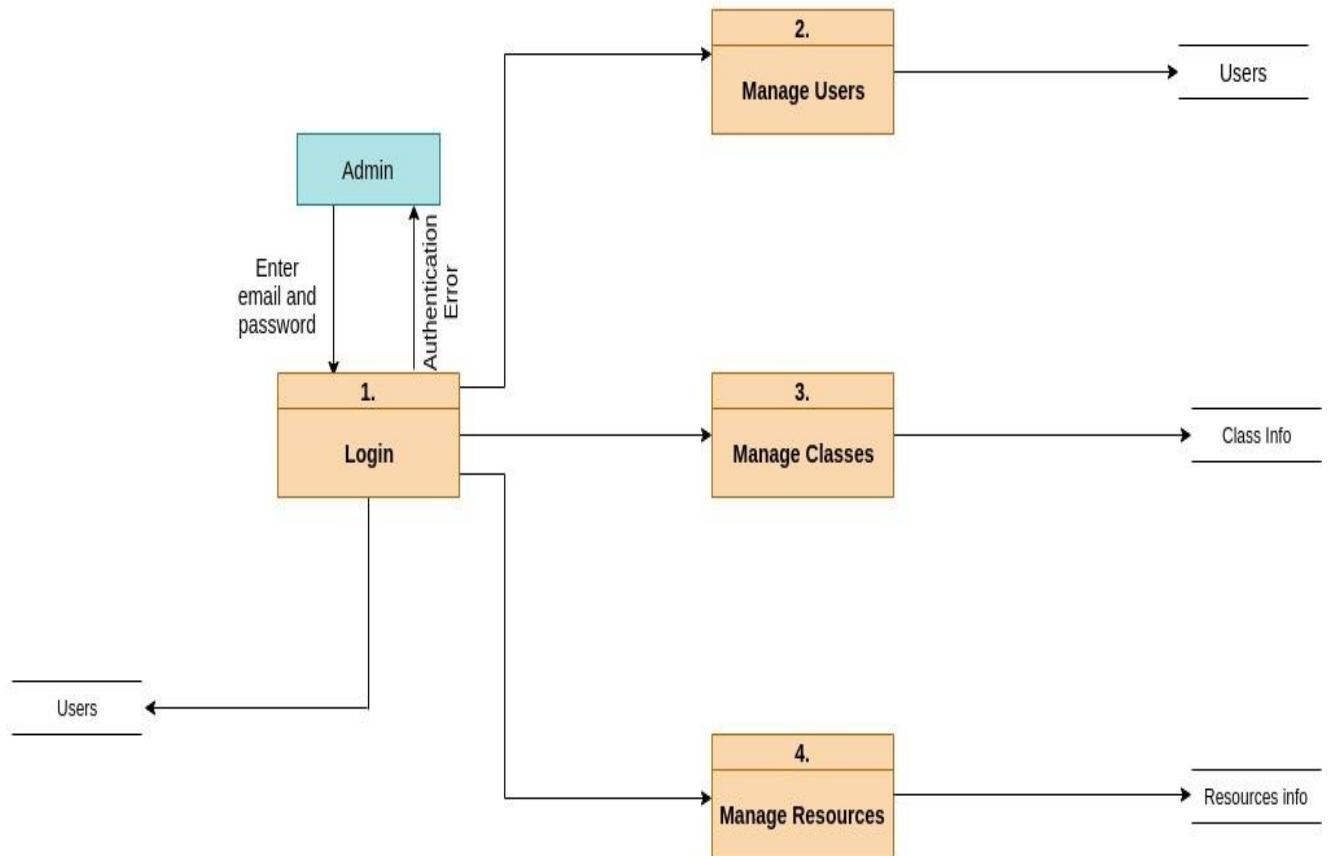
An entity-relationship model shows the relationships of entity sets stored in databases. An entity in this context is an object, a component of data. ER schema of Virtual Classroom is given below.

Schema
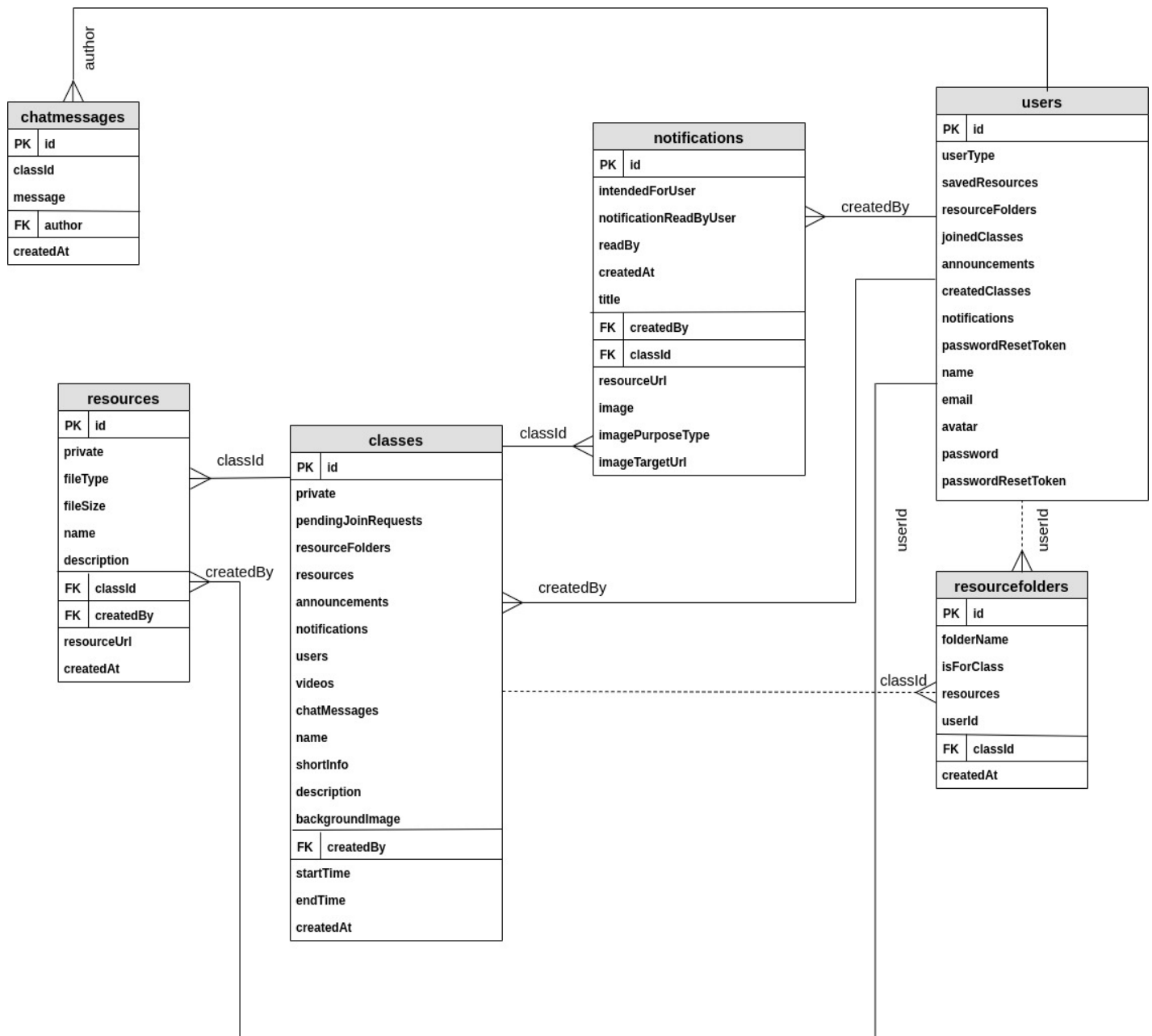
Figure 4.1.4(a): ER Schema

4.1.5. Data Dictionary

Data Dictionary is a centralized repository that contains metadata i.e information about the data such as meaning, relationships to other data, origin, usage and format. The users of the database normally don't interact with the data dictionary. It is only handled by the database administrators.

The data dictionary in general contains information about:

- Names of all the database tables and their schemas
- Details about all the tables in the database, such as their owners, security constraints, their creation dates etc.
- Physical information about the tables such as where and how they are stored
- Information about the database views that are visible

Table 4.1.5(a): Data Dictionary 1

S/N	Entity	Attribute	DataType	Field Size	Constraint	Format
1	users	_id	ObjectId	12	Required	54759eb3c094
		userType	String	8	Required	TEACHER
		isKickedOut	Boolean	6	Required	false
		name	String	128	Required	Random Name
		email	String	128	Required	rn@gmail.com
		avatar	String	128	Required	abc.com/image/abc.jpg

		password	String	128	Required	S3a2X23 koi7asd8 2
		passwordRes etExpiration Date	Date	32		17772823 8238223
		createdAt	Date	32		32218372 8323232
		savedResour ces	Array			[]
		resourceFold ers	Array			[]
		joinedClasse s	Array			[]
		createdClass es	Array			[]
		announceme nts	Array			[]
		notification	Array			[]
2	classes	_id	ObjectId	12	Required	54759eb3 c094
		private	Boolean	6		false
		name	String	32		Java Program ming
		shortInfo	String	300		This is a class for Java

		description	String	700		Random Description
		backgroundImage	String	128		g.com/image.jpg
		createdBy	ObjectId	12	Required	54759eb3 c094
		startTime	String	12	Required	7:00AM
		endTime	String	12	Required	9:00AM
		assignments	Array			[]
		resources	Array			[]
		announcements	Array			[]
		resourceFolders	Array			[]
		notification	Array			[]
		users	Array			[]
		chatMessages	Array			[]
		pendingJoinRequests	Array			[]
3	notifications	_id	ObjectId	12	Required	54759eb3 c094
		intendedForUser	Boolean	6		false
		notificationReadByUser	Boolean	6		false

		readBy	Array			[]
		createdAt	Date	12		12321398 23
		title	String	128	Required	Notificati on
		description	String	500		Descripti on
		classId	ObjectId	12	Required	54759eb3 c094
		createdBy	ObjectId	12	Required	54759eb3 c094
		intendedUser	ObjectId	12	Required Required	54759eb3 c094
		Image	String	32		h.com/ab c.jpg
		resourceUrl	String	32		asd.com/p .jpg
4	announcement s	_id	ObjectId	12	Required	54759eb3 c094
		readBy	Array			[]
		ritle	String	128		Title
		description	String	500	Required	Descripti on
		userId	ObjectId	12	Required	54759eb3 c094
		classId	ObjectId	12	Required	54759eb3 c094
		createdAt	Date	12		31232131

						23
5	chatmessages	_id	ObjectId	12	Required	54759eb3 c094
		classId	ObjectId	12	Required	54759eb3 c094
		message	String	300	Required	Message
		author	ObjectId	12	Required	54759eb3 c094
		createdAt	Date	12		12312312 32323
6	userassignme nts	_id	ObjectId	12	Required	54759eb3 c094
		isAccepted	Boolean	6		true
		userId	ObjectId	12	Required	54759eb3 c094
		assignementI d	ObjectId	12	Required	54759eb3 c094
		classId	ObjectId	12	Required	54759eb3 c094
		note	String	300		Random note
		assignement FileName	String	128		Filename. pdf
		submittedAt	Date	12		13123812 39
		updatedAt	Date	12		12312382 32923

7	resourcefolders	_id	ObjectId	12	Required	54759eb3c094
		folderName	String	32		Important
		isForClass	Boolean	6		false
		userId	ObjectId	12	Required	54759eb3c094
		classId	ObjectId	12	Required	54759eb3c094
		resources	Array			[]
		createdAt	Date	12		123123213223
8	resources	_id	ObjectId	12	Required	54759eb3c094
		isDeleted	Boolean	6		false
		private	Boolean	6		false
		fileType	String	12		IMAGE
		fileSize	String	32		1123232
		name	String	32		Note.pdf
		description	String	300		Description of the file
		classId	ObjectId	12	Required	54759eb3c094
		createdBy	ObjectId	12	Required	54759eb3c094
		resourceUrl	String	32		Asd.com/a.pdf

|		createdAt	Date	12		12312312 3213
9	assignments	_id	ObjectId	12	Required	54759eb3 c094
		title	String	32	Required	Project Work
		Description	String	300		Descripti on of the assignme nt
		classId	ObjectId	12	Required	54759eb3 c094
		dueDate	Date	12	Required	21321323 12323
		approved	Boolean	6		false
		rejected	Boolean	6		True
		createdAt	Date	12		12312312 31
		submittedBy	Array			[]
		yetToBeSub mittedBy	Array			[]

4.1.6. Gantt Chart
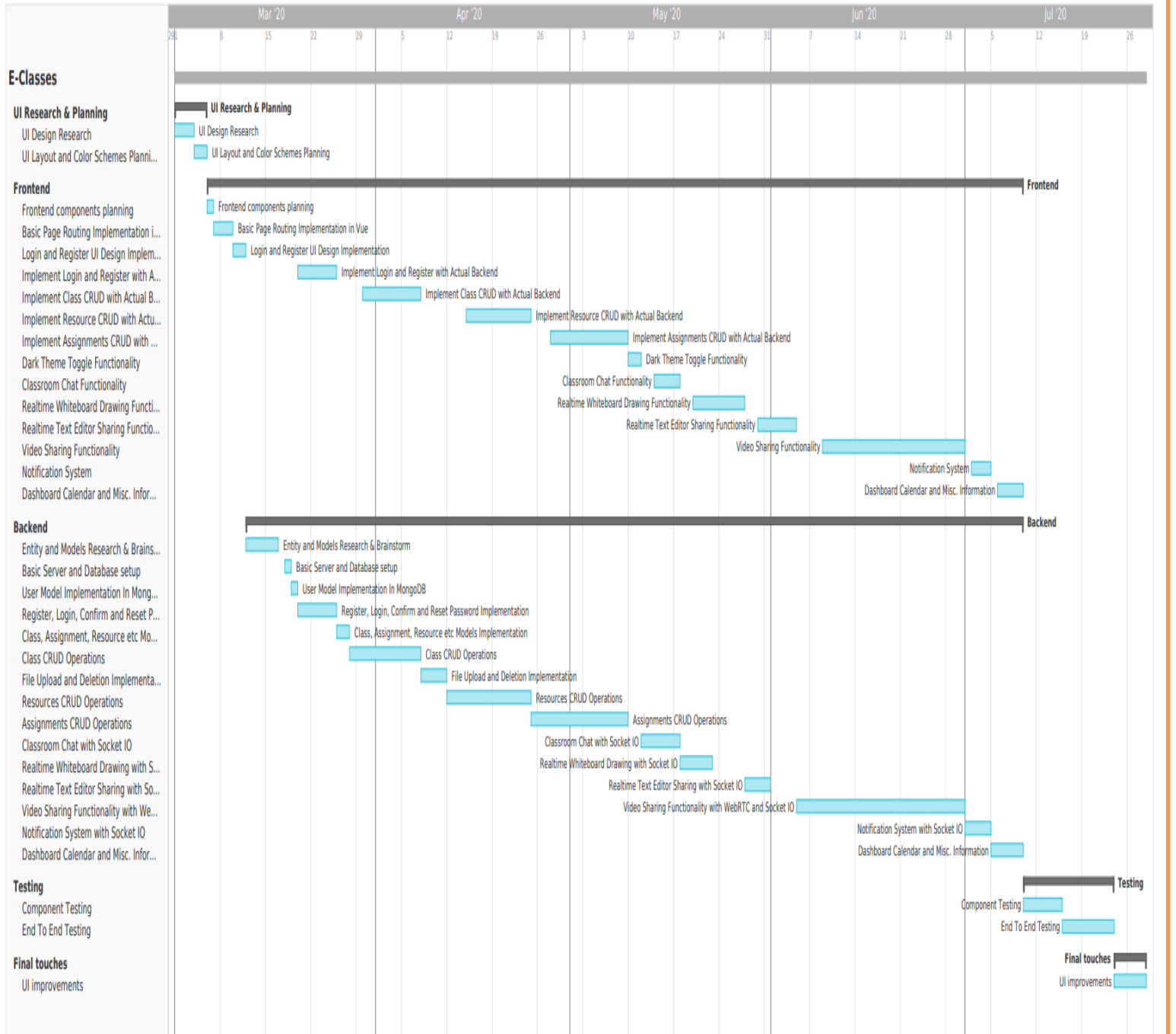
Figure 4.1.7(a): Gantt Chart

CHAPTER V

5. System Development and Testing

The overall software development process is complex procedure and involves not only tasks like planning, requirement gathering, designing and coding, but also ensuring whether the developed product meets the requirement.

Software /System Testing is defined as an activity to check whether the actual results match the expected results and to ensure that the software system is defect free. It involves the execution of a software component or system component to evaluate one or more properties of interest. Software testing also helps to identify errors, gaps, or missing requirements in contrary to the actual requirements. It can be either done manually or using automated tools.

5.1. Coding Tools

A coding tool is simply different type of programming tool used for creating, debugging and maintaining any kind of software related project. As the process of software development is a complex process, we have divided the section of coding tool into frontend development tool and backend tool.

5.1.1. Frontend

Front-end is the practices of converting data into graphical interface, through the use of different frontend tools like HTML, CSS, and JavaScript, so that the users can view and interact with the data. In Client/Server application, the client side of the program is the front end while the server part is called the back end. While creating the front-end of Virtual Classroom, following components were used.

a) HTML/Sass:

HTML is a markup language used to design the webpages. It uses predefined tags to create the webpages. These websites can then be viewed by anyone else connected to the Internet. We have used HTML to create the front-end of our system. As it is relatively easy to learn and implement HTML.

Sass, short for **Syntactically Awesome Style Sheets** is a preprocessor scripting language that is interpreted or compiled into Cascading Style Sheets(CSS). We used Sass to make the interface of our web-application more clean and stylish. Sass also allowed us the feature of switching from light to dark theme. But the main reason behind using Sass was for making "mixin" which is like a reusable code, used for global button styles and form inputs.

b) Vue Js

Vue Js is a Javascript front-end framework, widely used for front-end development. It is commonly used for building a single-page applications and user interfaces(UI). The use of Vue Js made our front end development extremely easy because of the data rendering and component composition feature of this framework. On top of Vue Js, we have additionally used Nuxt-Js, which is subset of Vue Js. The use of Nuxt-Js ensured that, we didn't have to separate router file to defines routes for our app. Nuxt also provided us with features of Server Side Rendering. Nuxt also provides out of the box route validation, different layouts, axios settings and different modules.

c) VS Code

Unlike above mentioned tools, VS Code is not a programming language but a code editor. It is an open source code editor made by Microsoft. VS Code has a smooth and easy interface which made our task of writing the code much easier. It also made debugging, syntax highlighting, code refactoring a lot easier.

5.1.2. Backend

Backend is server side of the application. It stores and arranges data, and also makes sure everything on the client-side of the application works fine. It is basically the part of the web-application that the client cannot see and interact with. It is the portion of the software that does not come in direct contact with the users. Backend possess database and administrator manages it. The following tools were used for the backend of our system.

a) Node Js:

Node Js is an open source, cross-platform, JavaScript runtime environment or Framework that executes JavaScript code outside a web browser. As, we have used Vue Js as our front-end framework, using Node Js made our job of server-side scripting faster and easier. API of Node.js library is asynchronous, that is non-blocking. It essentially means our server never waits for an API to return data. The server moves the next API after calling it and a notification mechanism of Events of Node.js helps the server to get a response from the previous API Call. As, we have used Socket IO, Webrtc. Their implementation is made simple through the use of different third party libraries offered by Javascript.

b) MongoDB

MongoDB is a cross-platform document-oriented database program. It is classified as a NoSQL database program, which means, instead of using tables and rows, MongoDB makes use of collections and documents.

5.2. Testing

5.2.1. Unit Testing

Unit Testing is a level of software testing where individual units/components of software are tested. The purpose is to validate that each unit of the software performs as designed. A unit is the smallest testable part of any software.

Table 5.2.1(a): Test case for teacher and student

S N	Description	Input Test Data	Expected Result	Actual Result	Pass/Fail
1	Enter valid user details	Name: StarScream Email:starscream247@gmail.com Password: asdasdasd	Display success notification and redirect confirm email page	Success notification and redirect to confirm email page	Pass
2	Enter mismatching passwords	Name:StarScream Username:starscream97 Password:asdasdqwe RepeatPassword: asdqweasd	Display an error notification	Error notification pops up	Pass
3	Leave out required field	Name: StarScream Username: Password:weasdasdwqe	Display an error notification	Error notification pops up	Pass
4	Confirm email	Name:StarScream Username:starscream97	Send a confirmatio	Email sent with	Pass

SN	Description	Input Test Data	Expected Result	Actual Result	Pass/Fail
		Password:asdasdasd	n token to the email, and activate account on confirmation	confirmation link, and on clicking, redirects to confirmation page	

Table 5.2.1(b): Test Case for teacher, admin and student login

SN	Description	Input Test Data	Expected Result	Actual Result	Pass/Fail
1	Enter valid username and password	Username: StarScream97 Password:asdasdasd	Should redirect to dashboard	Redirect to respective dashboard	Pass
2	Enter invalid username and/or password	Username:starscream97 Password:123123123	Display an error notification	Error notification pops up	Pass
3	Empty username and/or password	Username: Password:	Display an error notification	Error notification pops up	Pass

Table 5.2.1.c. Test case for Forgot Password

S N	Description	Input Test Data	Expected Result	Actual Result	Pass/Fail
1	Enter valid and registered email	Email: starscream247@gmail.com	Send a password reset token to the email	Password reset link set to the email	Passed
2	Enter invalid unregistered email	Email: starscream100@gmail.com	Display an error notification with appropriate message	Error notification pops up with appropriate message	Passed
3	Reset password	Username: starscream97 Password:123123123 RepeatPassword:123123123	Reset the password and show success notification	Password reset and success notification pops up	Passed

5.2.2. Integration Testing

Integration testing is a level of software testing where individual units are combined and tested as group. The purpose of this level of testing is to expose faults in the interaction between integrated units. Test drivers and test stubs are used to assist in Integration Testing. The test is often done on both the interfaces between the

components and the larger structure being constructed, if its quality property cannot be assessed from its components. After integrating the requirements, we tested it, it was fine and satisfactory.

5.2.3. System Testing

System testing is a level of testing that validates the complete and fully integrated software product. The purpose of a system test is to evaluate the end-to-end system specifications. System Testing is actually a series of different tests whose sole purpose is to exercise the full computer-based system. Two category of System Testing are:

a) Black Box Testing

Black Box Testing, also known as Behavioral Testing, is a software testing method in which the internal structure/design/implementation of the item being tested is not known to the tester. During this phase of testing, we ran through every input to verify that the result is as expected. After performing Equivalence Class Testing and boundary Value Testing, we concluded that our projects was ready for the implementation on the real world.

b) White Box Testing

White Box Testing also known as Clear Box Testing, Open Box Testing, is a software testing method in which the internal structure/design/implementation of the item being tested is known to the tester. It is the testing beyond the user interface and info the nitty-gritty of a system. We choose inputs to exercise paths through the code and determined the appropriate outputs. We performed Branch Coverage technique and our system passed this testing as every code is working as expected.

CHAPTER VI

6.   Conclusion and Future Works

The conclusion of this project work is based on the advantage of computer based system over a manual system. This project work in success has produced a E-learning classroom which can be used for taking online class.

6.1.   Conclusion of Project E-learning

Our project is only a humble venture to satisfy the need of today's world. This project might prove to be a powerful package in satisfying all the requirements of the school. At the end it is conclude that we have made effort on following points…

- This project helps lecturers/teachers to teach student virtually by conducting real time video conferencing.
- This project also allows users/student or teachers to share notes in from of text, document, audio and video.

6.2.   Future Works

It can be summarized that the future scope of the project circles around maintaining information regarding:

- We will host the platform on online servers to make it accessible worldwide.
- Integrate multiple load balancers to distribute the loads of the system.
- Create the master and slave database structure to reduce the overload of the database queries.
- Implement the backup mechanism for taking backup of codebase and database one regular basis on different servers.

The above mentioned points are the enhancements which can be done to increase the applicability and usage of this project. We have left all the options open so that if there is any other future requirement in the system by the user for the enhancement of the system then it is possible to implement them. At last we would like to thanks everyone involved in the development of the system directly or indirectly. We hope the project will server its purpose for which it is develop, thereby underlining success of process.

APPENDIX

Snapshots

Landing Page
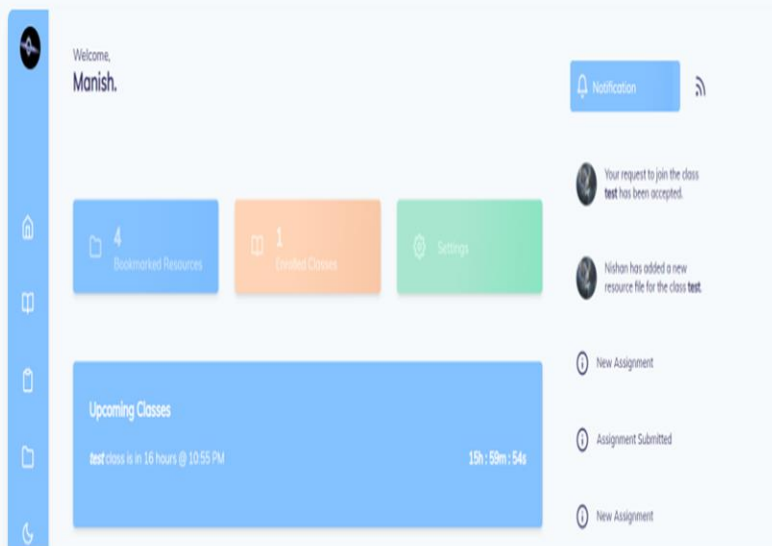
Registration Page

Virtual Classroom

Create an account

Name

Email

Password

Confirm Password

Avatar

Choose File | No file chosen

User Type

[∨]

Register

Already have an account? **Login**

Login Page

Virtual Classroom

Email

Password

Login

Don't have an account? **Signup**

Reset Password

Dashboard for Student

Welcome,
hello.

No Notifications

📁 **1**
Bookmarked Resources

📖 **1**
Enrolled Classes

Upcoming Classes

javascript class is in 6 hours @ 12:00 PM   05h : 59m : 50s

Unsubmitted Assignments
No assignments

41

Dashboard for Teacher

Welcome,
Naix.

🔔 Notification   📶

No Notifications

📂 **1**
Bookmarked Resources

👥 **1**
Teaching Classes

Upcoming Classes

Classroom view for Teacher

Online Users

Naix

hello

Naix

Naix

Dark Theme Preview

Welcome,

Nishan.

🔔 Notification

No Notifications

📁 1
Bookmarked Resources

📖 0
Enrolled Classes

Upcoming Classes

Unsubmitted Assignments
No assignments
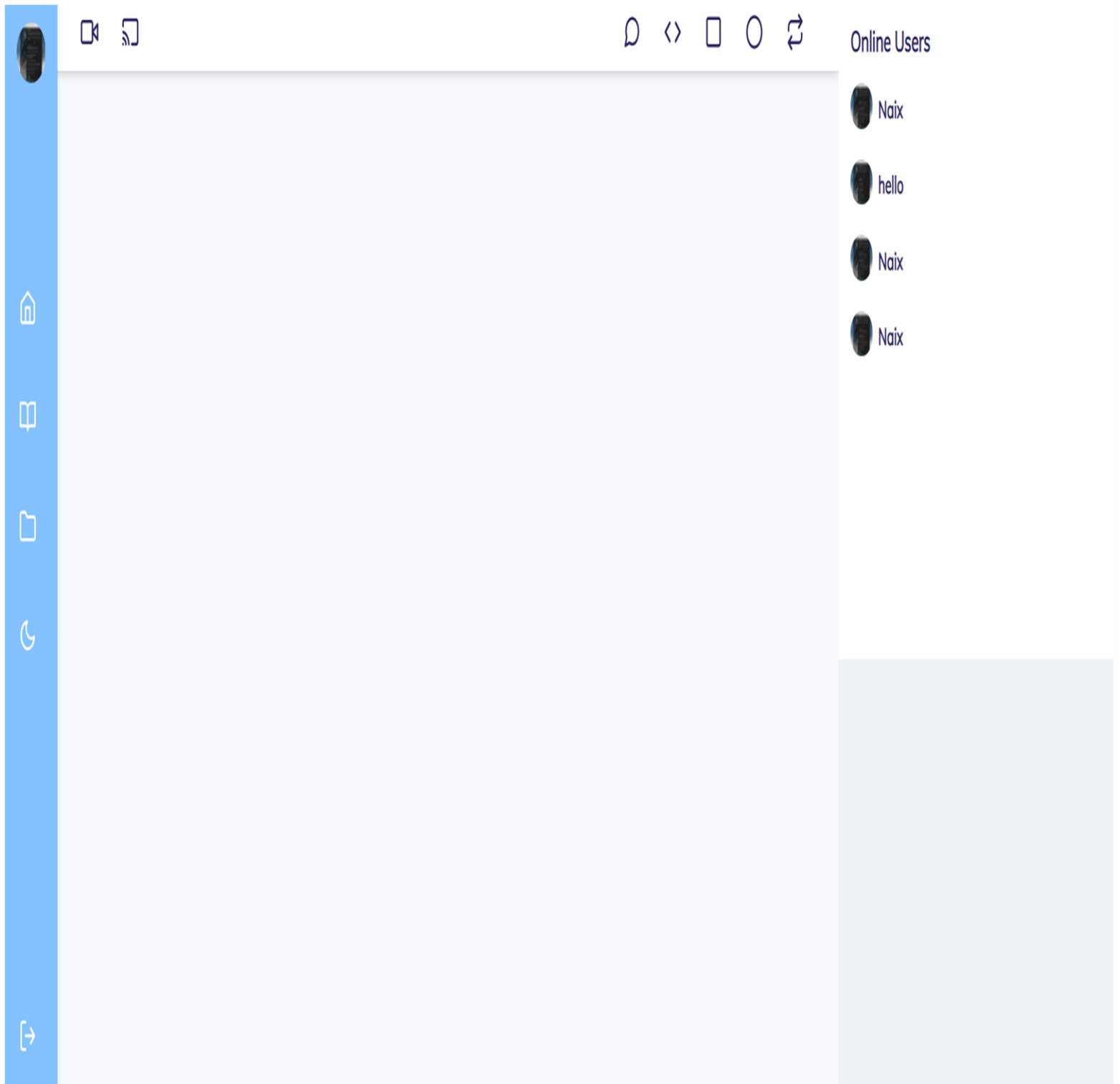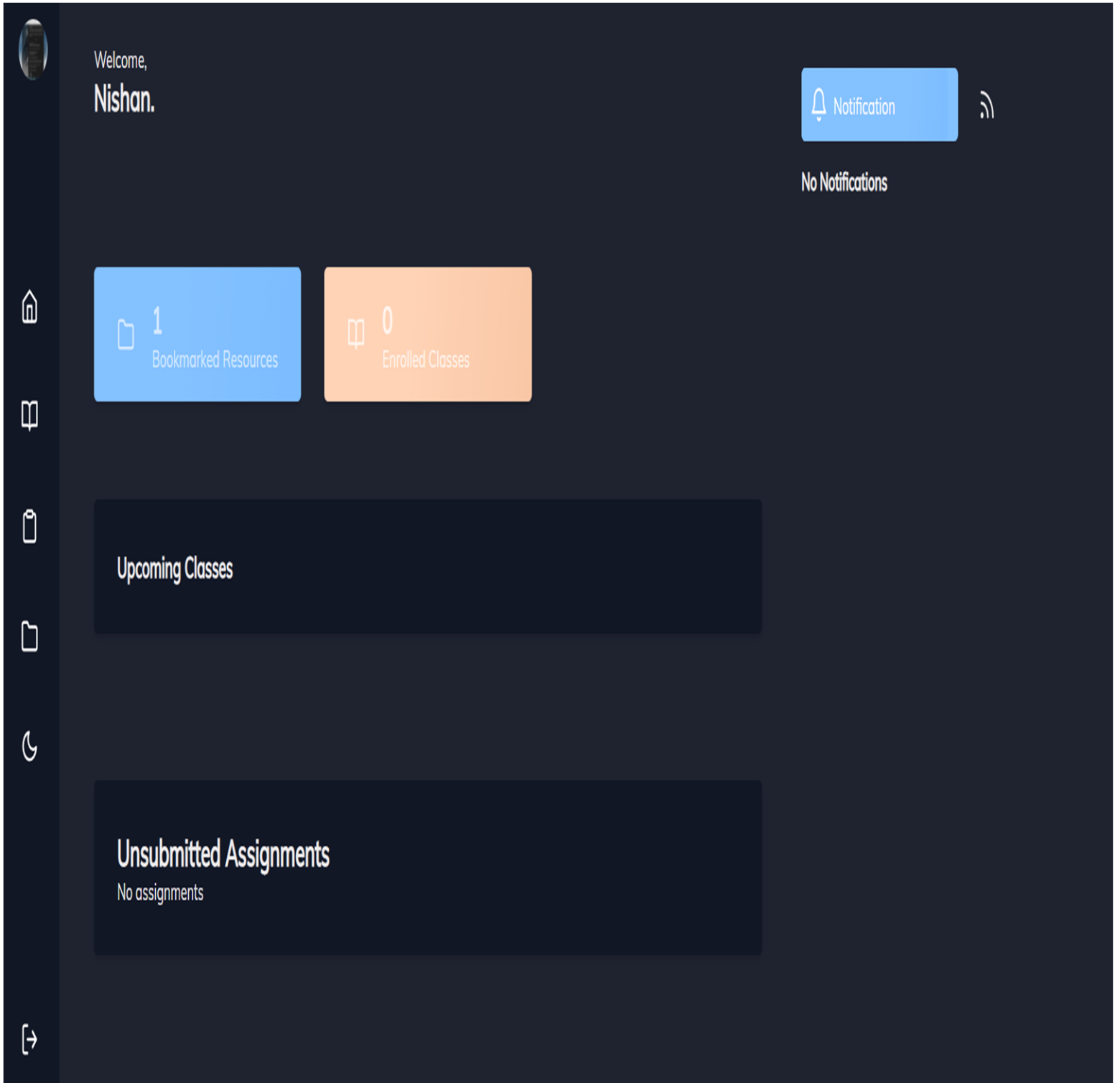
Dashboard for Admin

Welcome,
Nishan

7 Users	**1** Classes	**1** Folders	**1** Resources

Users

Nishan

naix@gmail.com

Ram

ram@gmail.com

shyam

shyam@gmail.com

Hari

hari@gmail.com

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