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# **CSI1007 – Software Engineering Principles (Embedded Lab)**

## **Assessment – 4** **Final Report**

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Faculty Name: Dr. Manjula R

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# INTRODUCTION

The "E-Learning Management System" has been developed to override the problems prevailing in the practicing manual system. This software is supported to eliminate and in some cases reduce the hardships faced by this existing system. Moreover this system is designed for the particular need of the company to carry out operations in a smooth and effective manner.

## SOFTWARE REQUIREMENT SPECIFICATION

### I. INTRODUCTION

#### a) Purpose:

The major aim of this Software Requirement Specification document is to define the specific requirements for an e-learning portal. So that a precise baseline of current requirements is always available and the document must be frequently updated to reflect changes in requirements during the development and use of the E-Learning Management System. This document's scope includes functional and non-functional needs, stakeholders, tutors, administrators, and the e-learning system.

#### b) Scope:

E – Learning portal enables students to engage in cooperative learning through collaborative efforts between instructors and students, constructive participation and interaction on the part of both students and instructors, and effective sharing of new ideas and information. In this portal the tutor can explicitly add new courses and its content and the students can access them. This learning approach attempts to encourage a higher number of students to choose a career in education. Without physically visiting a typical university or academic setting, e-learning enables users to learn for self improvement or to get a graduate qualification. E-learning may be used for all educational levels, from elementary school to graduate degrees, and is adaptable enough to support all learning styles.

#### c) Definition, Acronyms and Abbreviations:

- SRS ⇒ Software Requirement Specification
- JVM ⇒ Java Virtual Machine
- IDE ⇒ Integrated Development Environment
- UML ⇒ Unified Modelling Language

- Stakeholders ⇒ a person who is interested to use the portal, i.e. tutors, students and administrators in this case.

**d) References:**

- <https://epathshala.wordpress.com/2009/08/17/srs-of-pathshala/>
- <https://www.studocu.com/row/document/comsats-university-islamabad/information-security/e-learning-system-srs-re-cd-ssd/21112732>
- A SRS document prepared by NIT students from Rourkela on E learning System in 2018, available on Github.
- Book - Software Engineering: A Practitioner's Approach Fifth Edition By Roger S. Pressman

**e) Overview:**

The upcoming section called General Description explain the main functions of this portal using ER diagrams and also mentions the user characteristics in a detailed manner. Functional Requirements section gives a detailed information on all the functions that can be done in this portal. Non – Functional Requirements section gives a detailed information on performance and safety requirements. The next section to that explains the E – Learning Portal's architecture using class diagram neatly. The system model section explains overall functions of this portal using Use Case Diagram.

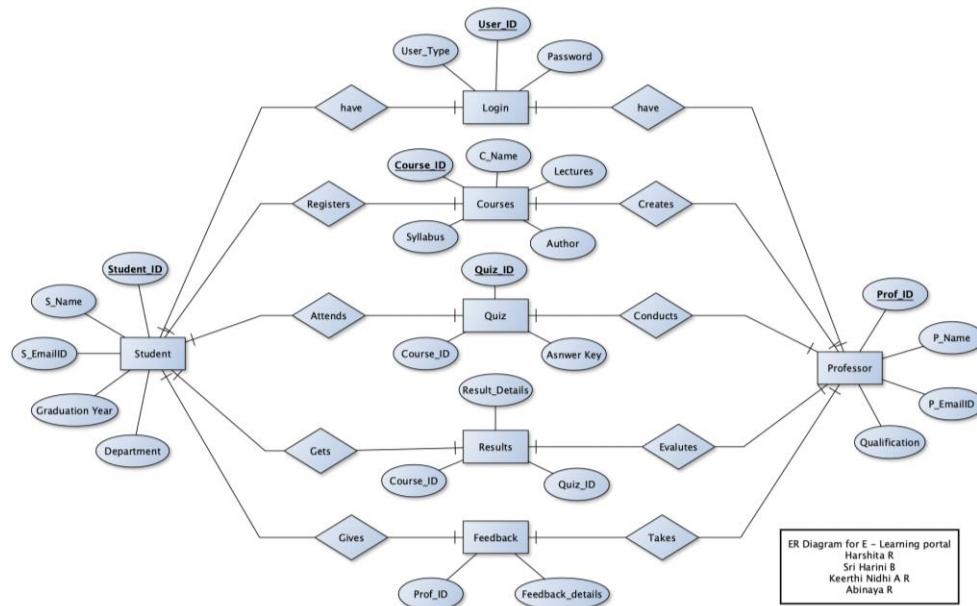
## II. GENERAL DESCRIPTION

**a) Product Perspective:**

E – Learning portal is a web – based portal. This was developed to satisfy the student's desire for education and offers digital content that can be given for the student at anywhere, anytime, and any age through a diverse range of e-learning technologies. It interfaces with all the browsers of the users. It also provides a user – friendly environment for the users.

**b) Product Functions:**

The detailed functions of this portal is explained through this ER – Diagram. In the real time the users can search for all the courses available and register for them, take quiz and analyse their performance. On the other side the professors can create and update all the course for which they are the authors and also create quiz. They can also view their feedback details given by the students. In addition to that, the students can also put up their queries and doubts which can be cleared by the tutors. The professors can also fetch all the details of the students who registered for the particular course whenever required.



### c) User Characteristics:

This E-learning application plays a significant role in progressing the Educational framework of a country specifically our classical India. Here the primary users are of Faculties, Students and Administrator.

- Faculty - The faculties have admin privileges with which they use the necessary functions to handle the courses and maximize the student faculty profit benefit. Faculty's accessible features are listed below.
  - Uploading study materials and lectures
  - Setting up an exam
  - Course creation
  - Answering the queries
  - Checking the feedback
- Students - The students are limited to student level features like study materials. Students accessible features are listed below.
  - Obtaining user accounts
  - Logging in
  - Editing account information
  - Registering a course
  - Dropping a course
  - Taking an exam (i.e. quiz)
  - Sending queries
  - Sending the feedback
- Administrator – Administrator is the core user as he performs administrative tasks such as monitoring the system operation, editing system configuration etc,. Also he facilitates the

maintenance of important records student faculty records. Administrator accessible features are listed below.

- Obtaining user accounts
- Logging in
- Editing account information
- Creating user accounts
- Disabling accounts
- Deleting users
- Modifying course details
- Viewing the feedback

**d) General Constraints:**

• Technological Constraints:

Proposed web application will be implemented with Java for front end design purpose and for the database purpose, we opt for JavaDB/Oracle.

• Interface Constraints:

Since it's a Web based application it should work on major browsers like Internet explorer, Mozilla Firefox, Google Chrome, etc.

• Security Constraints:

The application is intended only for the authenticated users, hence an anonymous person would not be able to access the user's data.

**e) Assumptions:**

- Coding must be effective and errorless.
- It is mandatory to have a User ID and Password for each user to login into their account.
- The portal should in a manner such that everyone can understand and access easily.
- Login credentials of the users, user details, course details and lecture materials should be stored in a database which can be accessed by admin.
- An internet speed of at least 256 kbps is required
- Java medium framework, JVM must be installed in prior.
- Latest version of Chrome, Safari or Firefox browser is must.

**III. FUNCTIONAL REQUIREMENTS**

The requirements are divided into a few basic groups, and each group has a number of specialised needs.

- Registration step – The user must be registered if they are not already.

- Login account – If the user has enrolled already, he or she must enter a user name and password to log in and also mention which category of user i.e. student or professor.
- Profile Administration – The user must be able to modify the profile from settings and apply changes.
- Lecture specifics – The lecture will be available for instructors to upload to the system, where students can access it and learn from it.
- Review courses – The user must examine at the courses that are offered on the site.
- New course update – If a new course meeting the user's interests becomes available, the user must be notified.
- Search Course – The student must have access to all courses on the system and should be able to search the courses on the software.
- Manage course – In order to update, delete, and add videos to his numerous courses, the educator must be able to edit the courses.
- Download course – Students who have paid for the course will be able to download the lectures. The course will be added to their profile once they have paid.
- Payment – The system should monitor if a student has paid for a specific course or not in order to access it.
- Notifications – If the educator makes a modification or if a student need assistance, the system should notify.
- Best rated courses – The system need to display the courses with the top reviews.
- Classification of interest – The system should display courses to the user based on his area of interest.
- Submit feedback – The student must be able to provide detailed feedback based on his or her perspective.
- Logout – The user should be able to log out of the website when he or she wants to.

#### **IV. NON – FUNCTIONAL REQUIREMENTS**

- **Performance requirements**

- Response Time: The response time should be of within 5 seconds.

- Throughput: The portal system shall accommodate 15 users per second.
- Recovery Time: In case there occurs a system failure, redundant system shall resume operations within 30 seconds and the recovery time is of an hour.
- Start-up/Shutdown Time: The system shall be operational within a minute of starting-up.
- Utilization of Resources: The database here can store a million transactions. As time passes, the past data will be backed up and removed from the operational database.

- **Safety requirements**

This requirement does not apply for our software as this does not pose a threat in any way.

- **Security requirements**

- The students and faculties have their own login credentials shouldn't be shared with anyone (students/faculty/or anyone else), hence an unauthorized person can't access our portal.
- The policy framework is accessible only by faculties.
- The user created files that is stored in MySQL database is accessible only by the admin and these are not sharable.
- The E- Learning portal runs within a protected firewall.

- **Software quality attributes**

- Efficiency: The portal is provided with suitable tools supporting its features.
- Testability: To ensure the accuracy the portal should be testable.
- Portability: Unanimous programming language is used as this portal runs on several platforms.
- Availability: E- learning Portal is 24/7 available to the users.
- Scalability: The portal is scaled to numerous users.

- **Business Rules**

Enforcing and Implementation of business policies is defined as Business rules though which decision making. The users are obliged to follow these business rules.

- **User requirement**

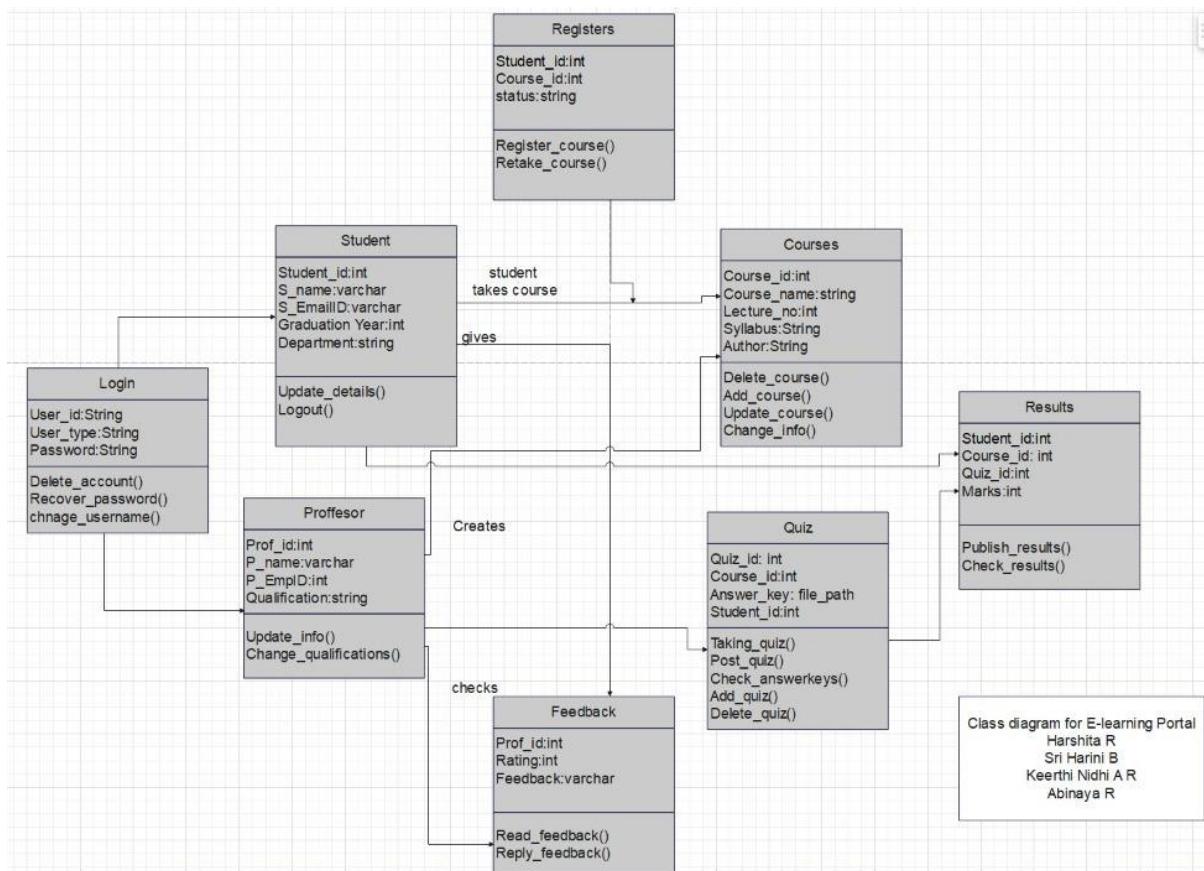
Users include students and faculties. The admins should be qualified with the technical to rectify the problems caused such as connectivity. Online guides and directories are provided with acceptable user interface to ensure the genuine usage of the portal.

User facilities provided by the Admin are as follows:

- Forgot and change password
- Auto Recovery
- Backup and Recovery
- File organization
- Data migration (new user registration data is stored in the server).
- Data replication

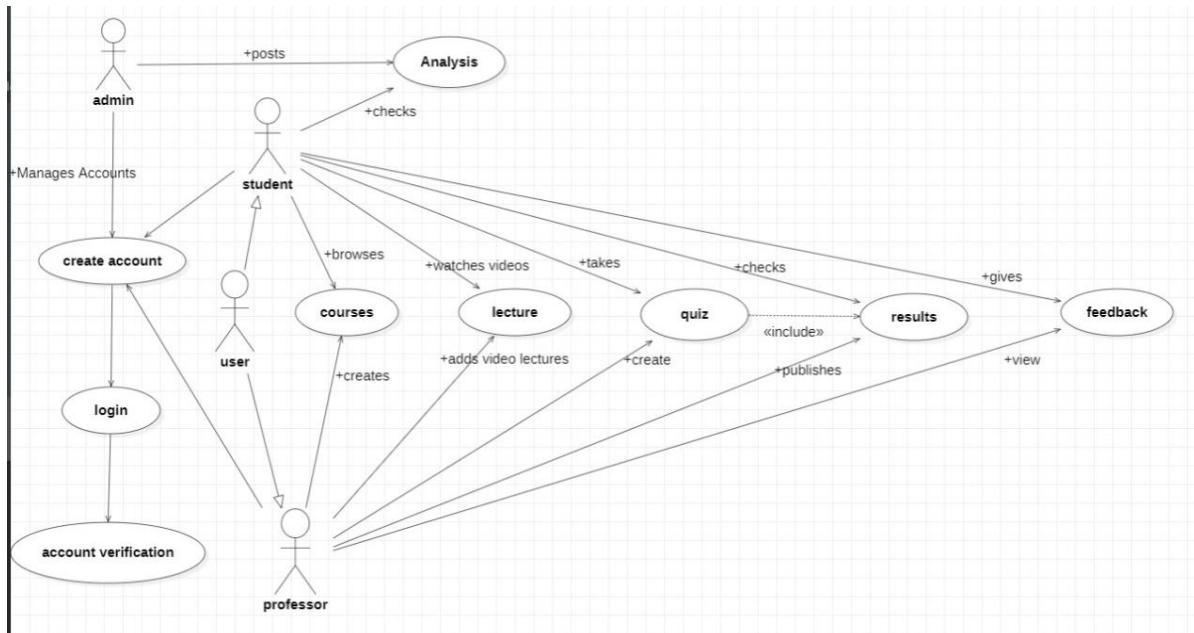
## V. SYSTEM ARCHITECTURE

A class is an user-defined way of describing the type of data with required features of the data and also the operations and tasks that can be performed on the instances of the class. The attributes in the class describes the characteristics of the class object. In this project of E – Learning portal many classes has been created as mentioned in \_\_\_\_\_ part of this document. The following class diagram shows the data and attributes of each class and also the relationship of each classes with each other according to the working of the portal. Here, the most important classes are Student, Professor and Courses which are related to many other classes.



## VI. SYSTEM MODELS

The below Use Case Diagram shows the entire and a very basic overview of this project. The main stakeholders of this software are students and tutors. In this system the student can search for a course and register for it while the professor can create and update the course contents including creating quiz and so on. This also includes feedback review function.

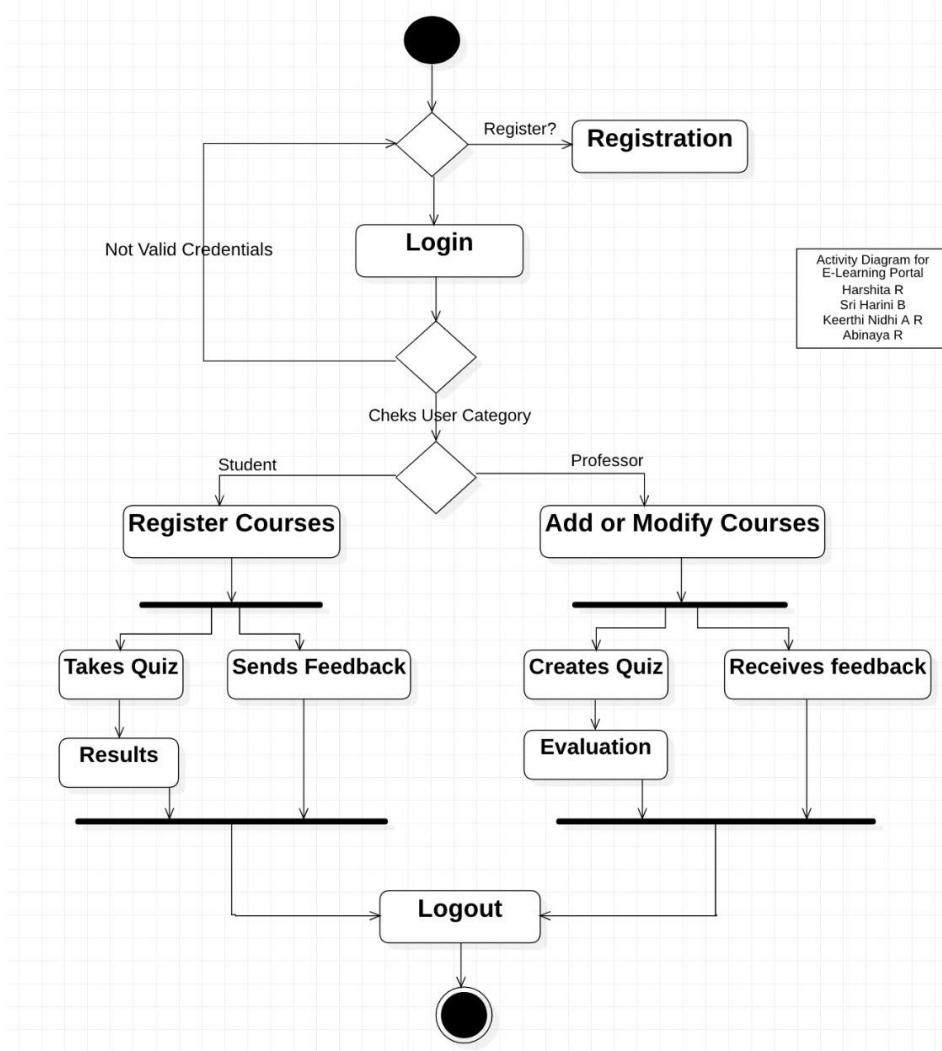


## SOFTWARE DESIGN SPECIFICATION

### I. Behaviour Diagrams:

#### 1. Activity Diagram:

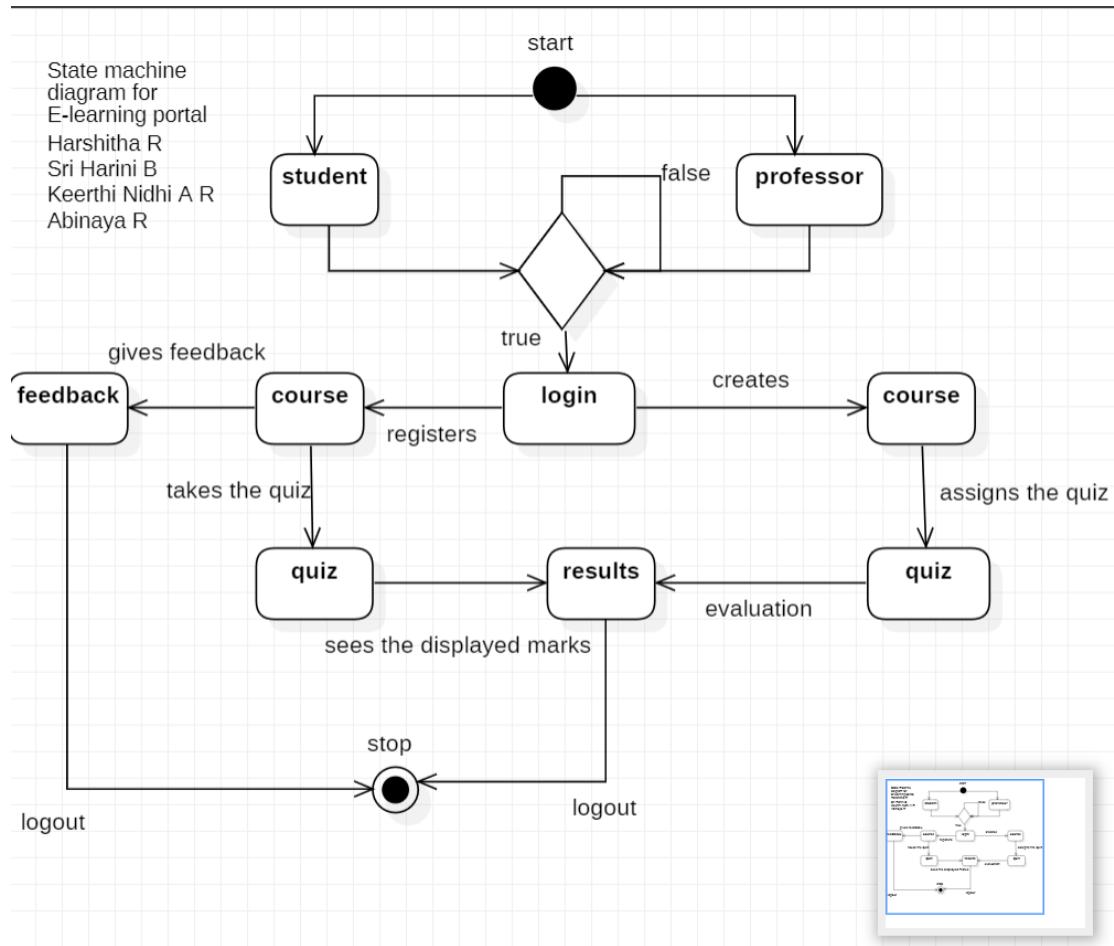
- Activity Diagrams are one of the most important UML Diagrams. It is used to describe the flow of actions and different activities that are carried out in the software.
- The flow can be either be sequential or parallel or even both. They also describe the relationship between the activities.



- This diagram shows demonstrates the flow of control within the E-Learning system rather than implementation. It shows the concurrent and sequential activities.
- In the initial state, the user if has an account already can directly login and proceed using the portal. If not, he/she has to register and create a new account and proceed with login steps. After successful login, the portal categorizes the user has student or professor and accordingly functions are provided.
- If the user is student, he/she can register for courses, and under that he/she can take quiz and send feedback about the course tutor and the course. After taking the quiz, he/she can check for their scoring and results.
- If the user is a professor, he/she can add courses or modify the existing courses according new changes in the syllabus and recent trends. Under that he/she can also create quiz assessments and receive feedback from the students. As soon as the student takes the quiz, the professor can evaluate the answers and post them. When the work is done the users can logout form the portal and come out, where all their work is saved automatically and reaches the final state.

## 2. State Machine Diagram:

- State machine diagrams are also called as Statechart diagrams. This is used to describe the different states of the component within a system.
- It is more or less like a machine that describes several states of an object and how it can change on external and internal events.



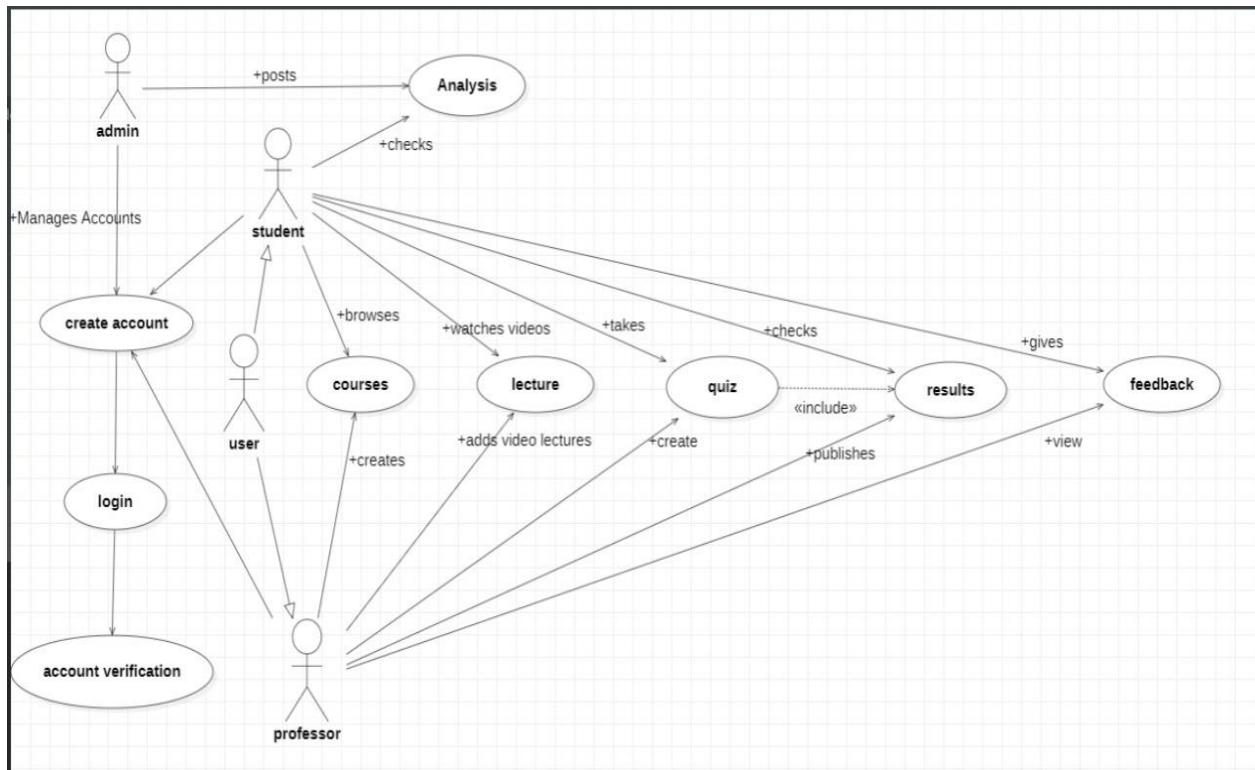
- The above diagram is the State Diagram that captures the behaviour of the E-learning portal. It models the behaviour of a class, a subsystem, a package, or even an entire system.
- It's also referred as State chart. These provide us an efficient way to model the interactions or communication that occur within the external entities and a system.
- They are also used to model the event-based system and describe various states of an entity within the application system.

## 3. Use case Diagram:

- A use case consists of actors, and their set of use cases. A use case represents a particular functionality of a system. Hence, use case diagram is used to describe

the relationships among the functionalities and their internal/external controllers. These controllers are known as actors.

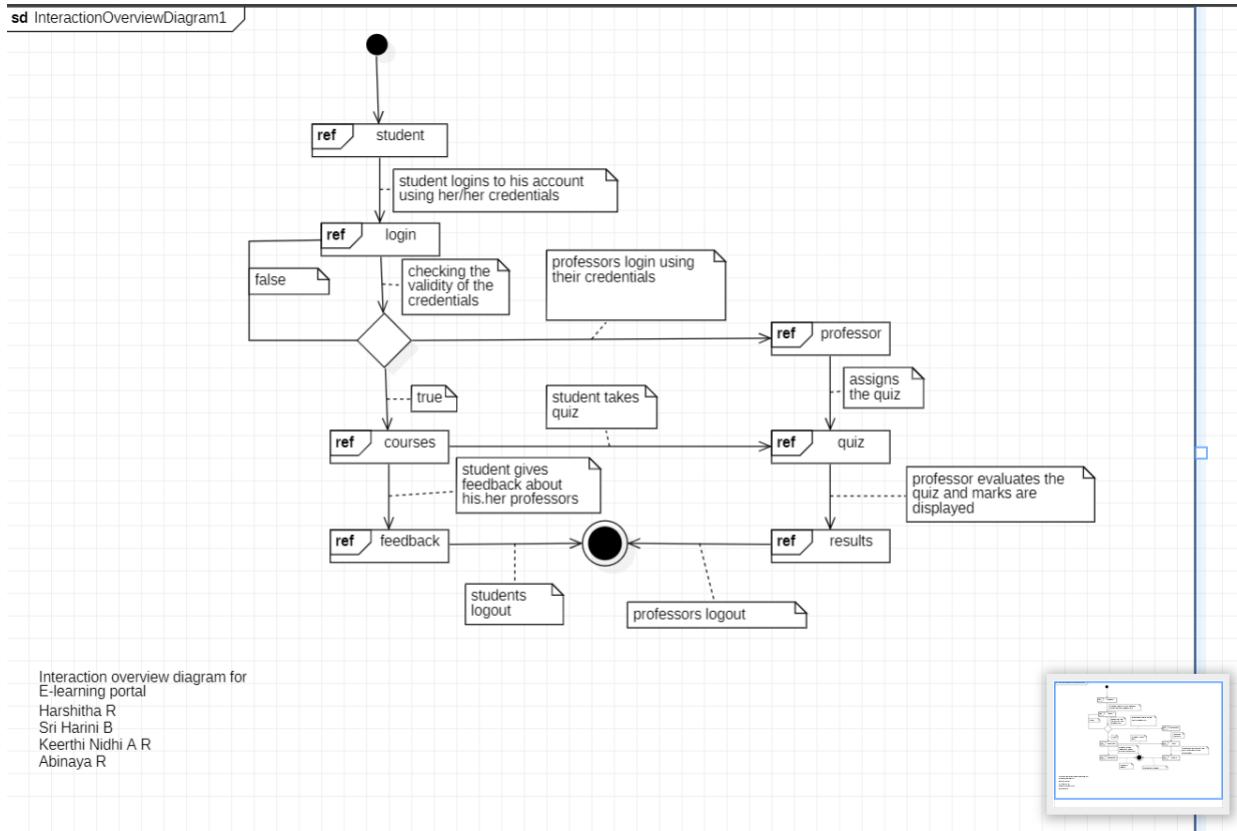
- Use case diagrams helps in expressing the high-level requirements of the system



- The above Use Case Diagram shows the entire and a very basic overview of this project. The main stakeholders of this software are students and tutors.
- In this system the student can search for a course and register for it while the professor can create and update the course contents including creating quiz and so on. This also includes feedback review function.

#### 4. Interaction Overview Diagram:

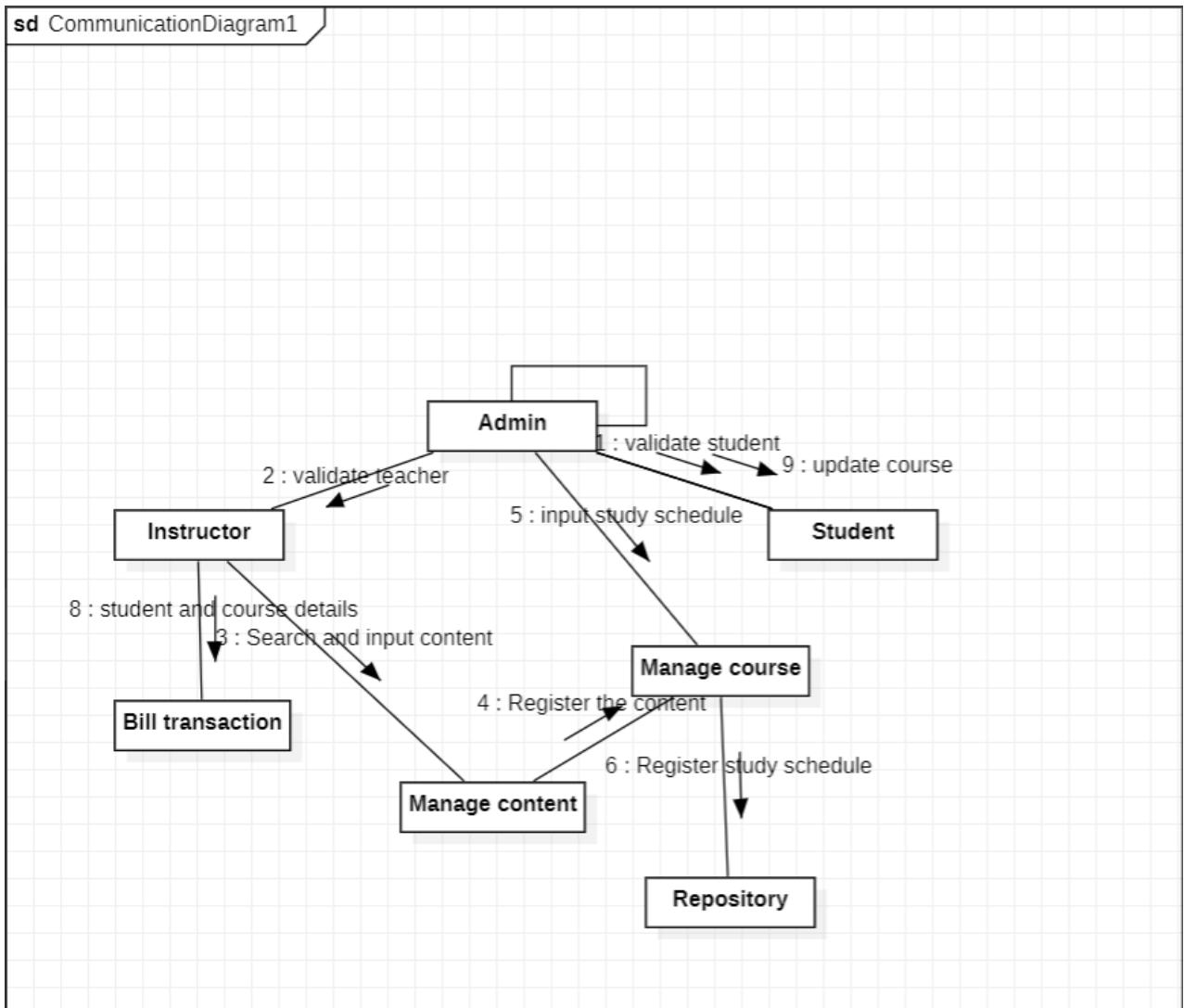
- An interaction overview diagram is a form of activity diagram in which the nodes represent interaction diagrams.
- Interaction diagrams can include sequence, communication, interaction overview and timing diagrams. Most of the notation for interaction overview diagrams is the same for activity diagrams.



- The above diagram is the Interaction Overview diagram visualizing the cooperation between student, professor, login, courses, feedback, quiz, results to illustrate a control flow between them that serves as an encompassing purpose.
- As this is a variant of activity diagrams, it is conceptualized in the same way as the flow moves into an interaction, the respective interaction's process must be followed before the Interaction Overview's flow can advance.

## 5. Communication Diagram:

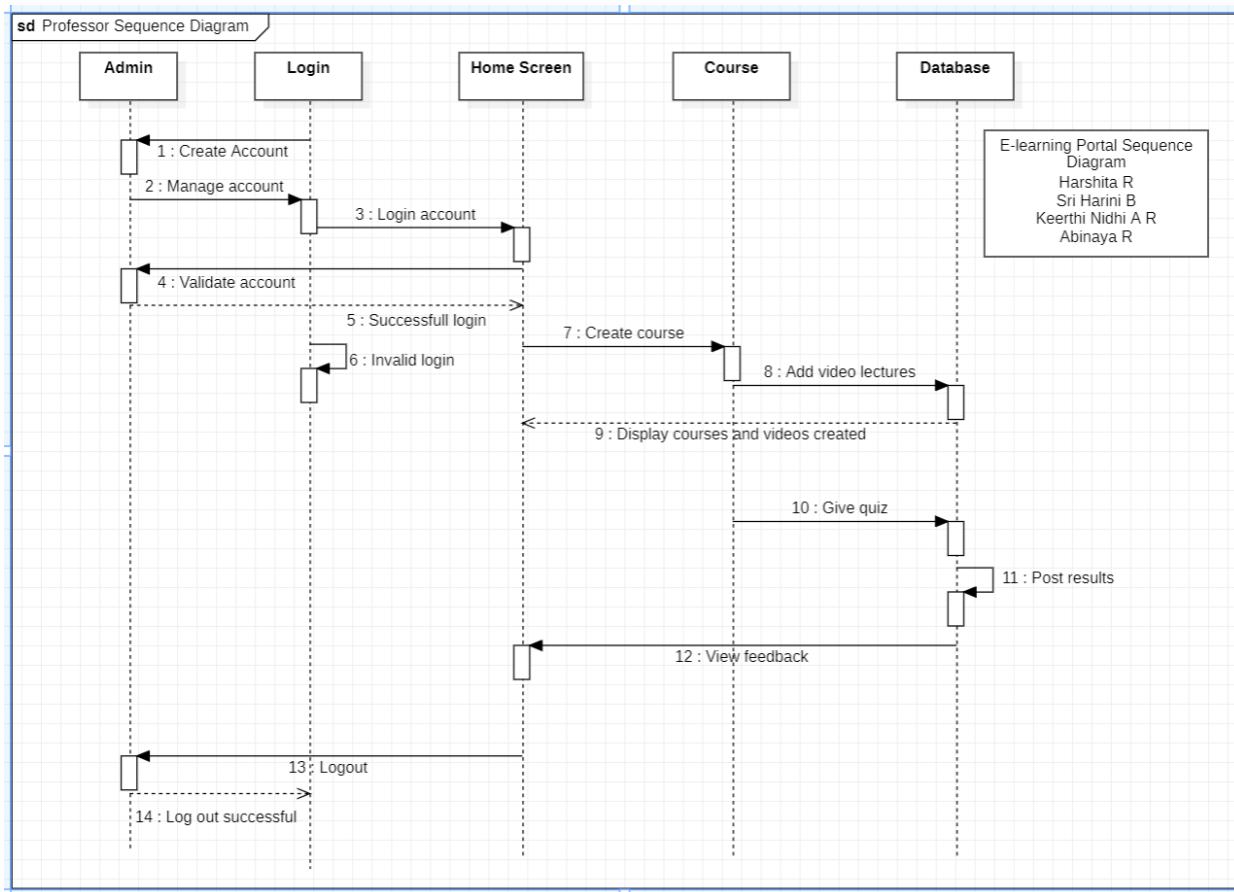
- Communications diagram is almost identical to UML sequence diagrams. It is previously called collaboration diagrams.
- It focuses more on the relationships of objects, emphasising how they associate and link through messages in a sequence rather than interactions.

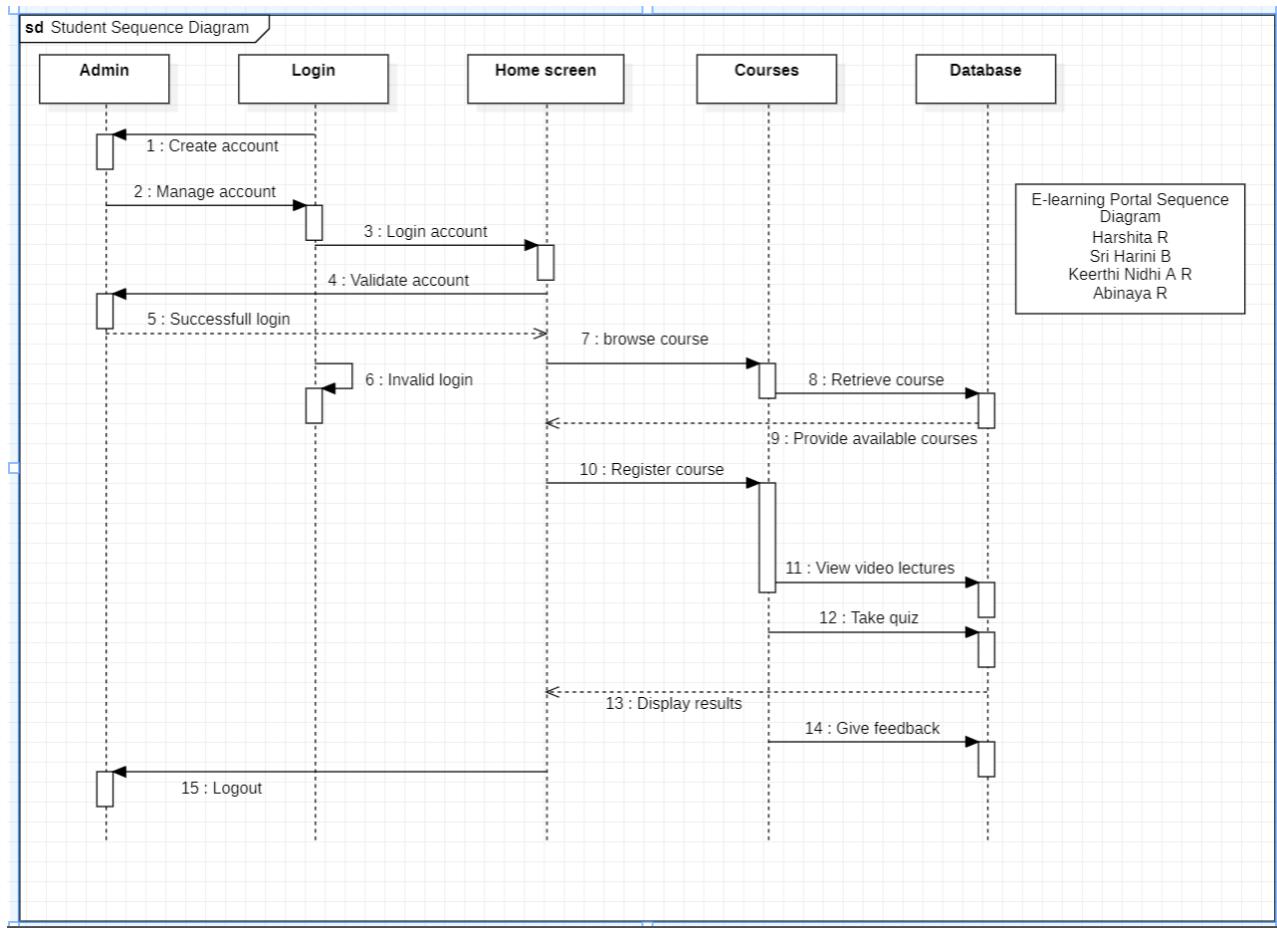


- The communication diagram provided for the E-learning management system, shows the relationships between the objects through interactive connectors that indicate the directions.
- The Actor is Admin, and the included objects are Instructor, Student, Bill Transaction, Manage Content, Manage Course, and Repository.
- It has become easier to display the communication details between the objects by using a labelled arrow next to a link, which represents a message between objects.

## 6. Sequence Diagram:

- A sequence diagram is an interaction diagram. As the name suggests, sequence diagrams describe the sequence of messages and interactions that happen between actors and objects.
- All communications are represented in a chronological manner. Sequence diagram is used to visualize the sequence of calls in a system to perform a specific functionality.

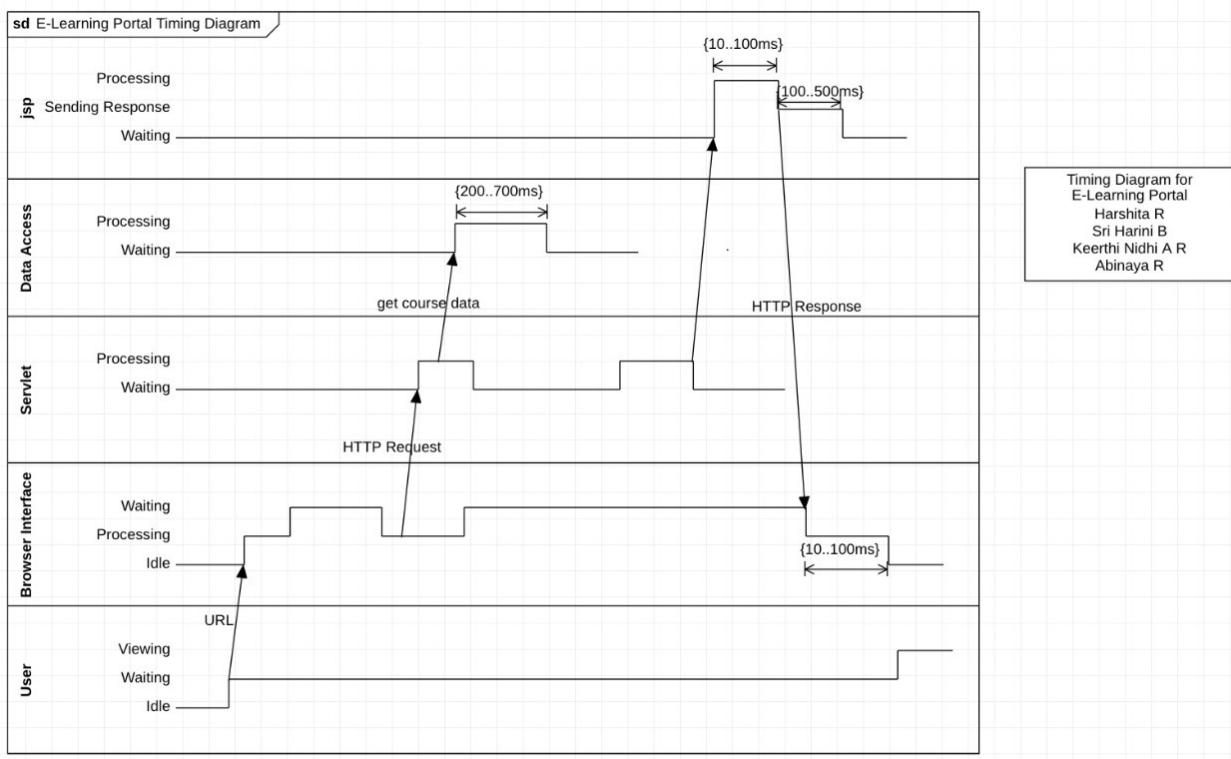




- The above sequence diagram of E-learning portal is done for both the student interface and professor interface. This describes the activities/functions done in the E learning portal sequentially.

## 7. Timing Diagram:

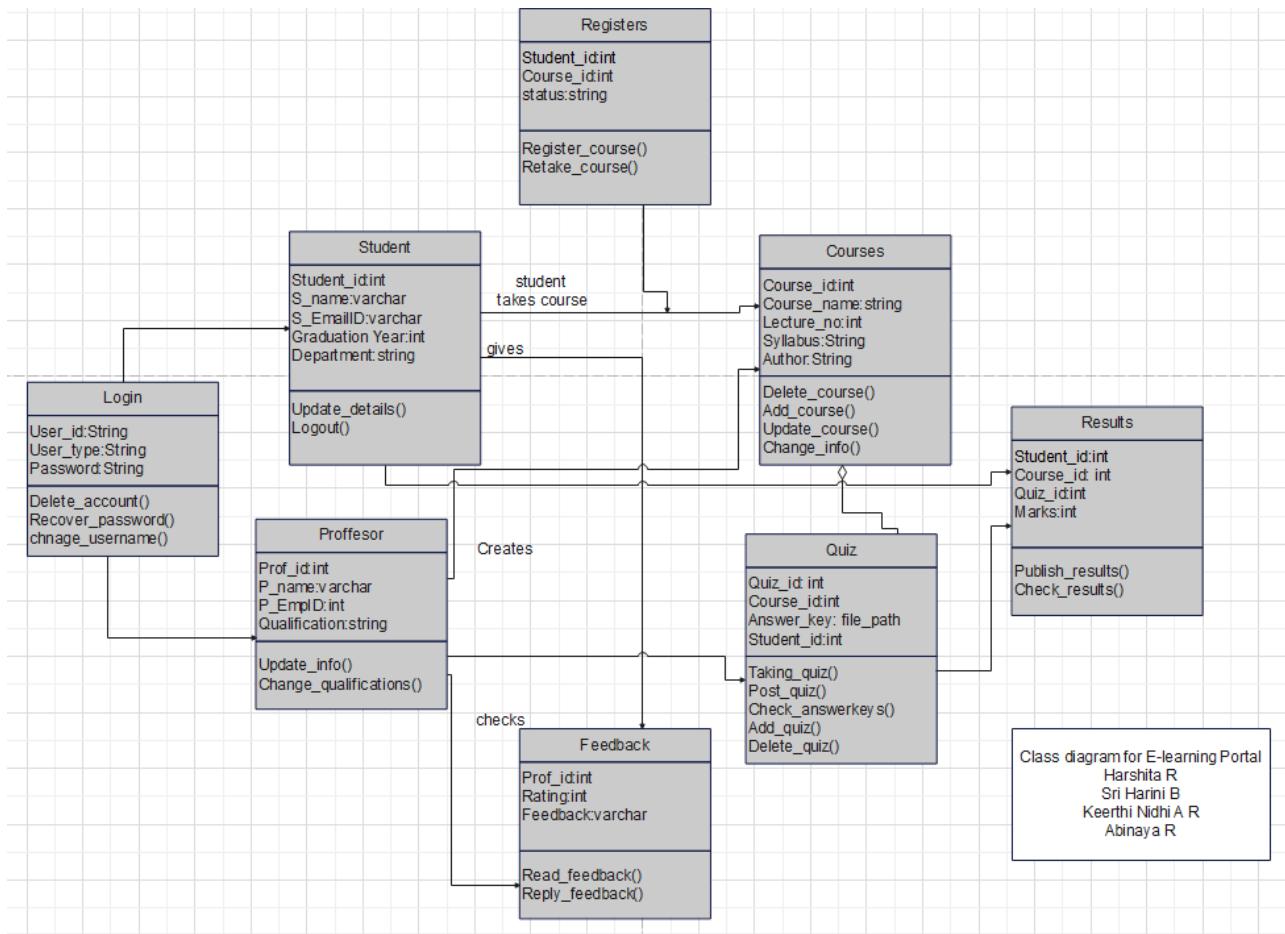
- When the focus is on time, object relationships are represented using timing UML diagrams. We want to describe how things and actors operate along a linear time axis rather than how they interact or influence one another.
- The below timing diagram for E-Learning Portal shows how each object undergo change from one state to another. This waveform portrays the flow among the software programs at several instances of time.



## II. Structure diagram:

### 8. Class diagram:

- Class diagram consists of classes, interfaces, associations, and collaboration. Class diagrams basically represent the object-oriented view of a system, which is static in nature.
- Class diagram consist classes along with their attributes (data fields) and their behaviours(functions). The relationship between the classes are represented by a connecting line

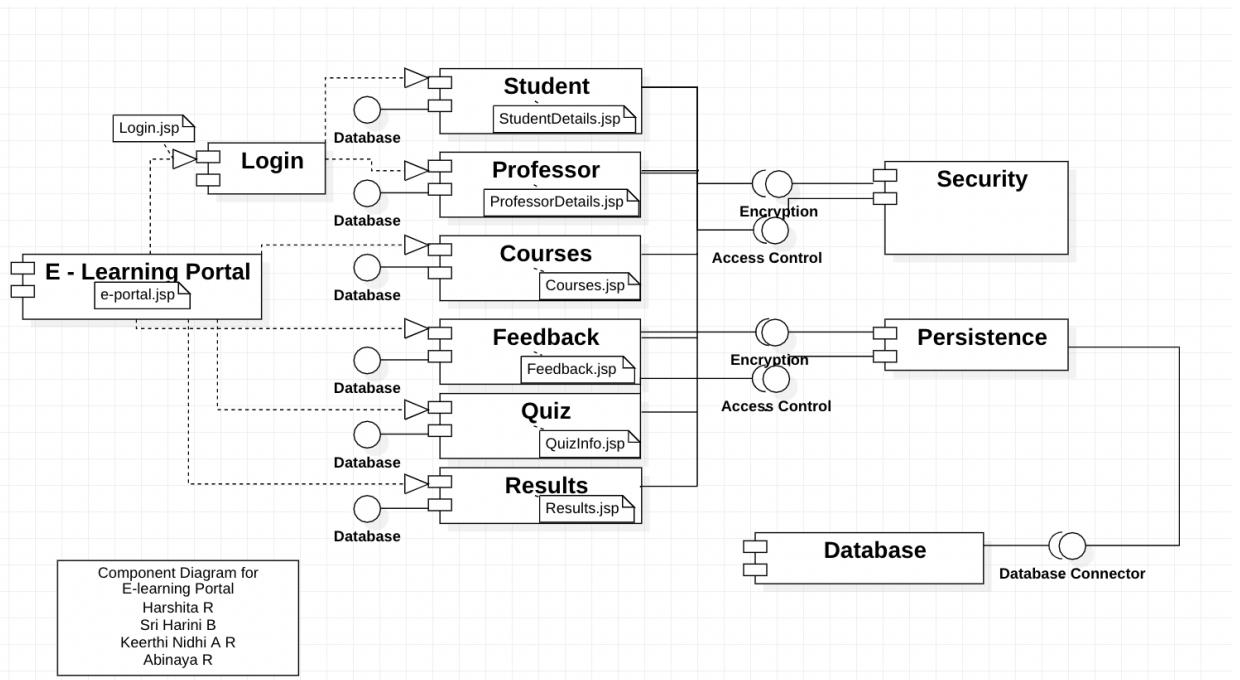


- The above class diagram of E-learning portal describes about the classes, and their functions describing regarding to each of the classes.
- The database consists of the student, professor table and all the course and quiz related tables, the course table aggregates to the quiz table and also a result table which stores the results of the courses.

## 9. Component diagram:

- Component diagrams represent a set of components and their relationships. Component UML diagrams help in break down of the system into smaller components.
- This represents the implementation view of a system. In short, we can say that component diagram helps in visualizing the implementation.

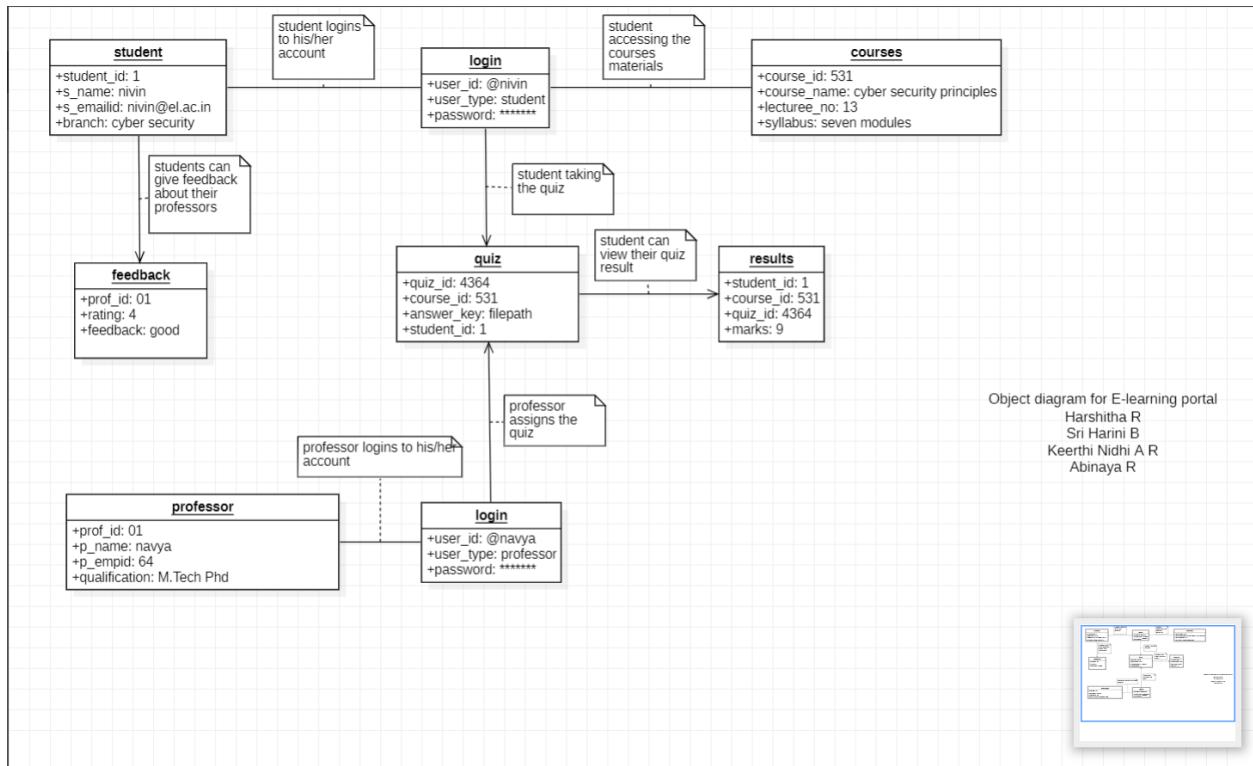
Class diagram for E-learning Portal  
 Harshita R  
 Sri Harini B  
 Keerthi Nidhi A R  
 Abinaya R



- The above component diagram for E-learning Portal shows the components involved in the system.
- It helps in visualizing the structure and the organization of the E-Learning System. It includes Student, Professor, Courses, Feedback, Results.
- There is also a database which stores all the data of all the components. The interface in each component shows that these access data from the database.
- It has been made sure that these component details are secured using security component using encryption. This shows how each component are connected with each other

## 10. Object Diagram:

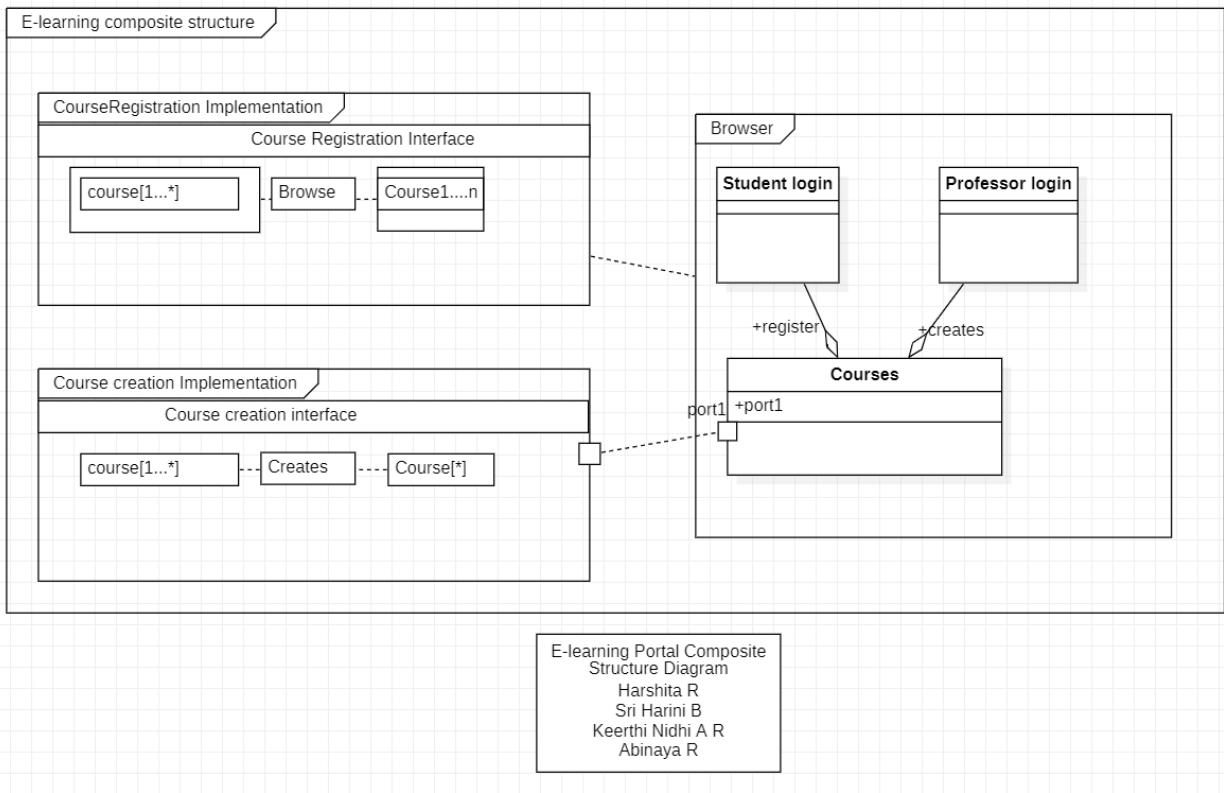
- Object diagrams can be described as an instance of class diagram. Object diagram help software developers to check whether the generic abstract structure that they have created represents a viable structure when put to practice.
- Just like class diagram, Object diagrams are set of objects and their relationships. They also represent the static view of the system.



- The above mentioned Object Diagram for the E-learning portal can be referred to as a screenshot of the instances namely student, professor, login, courses, quiz, feedback, results in the portal and the relationship that exists between them.
- Since it depicts the behaviour when objects have been instantiated, we are able to study the behaviour of it at a certain instant.
- An object diagram is similar to a class diagram with an exception of that it shows the instances of classes in the portal.

## 11. Composite Structure Diagram:

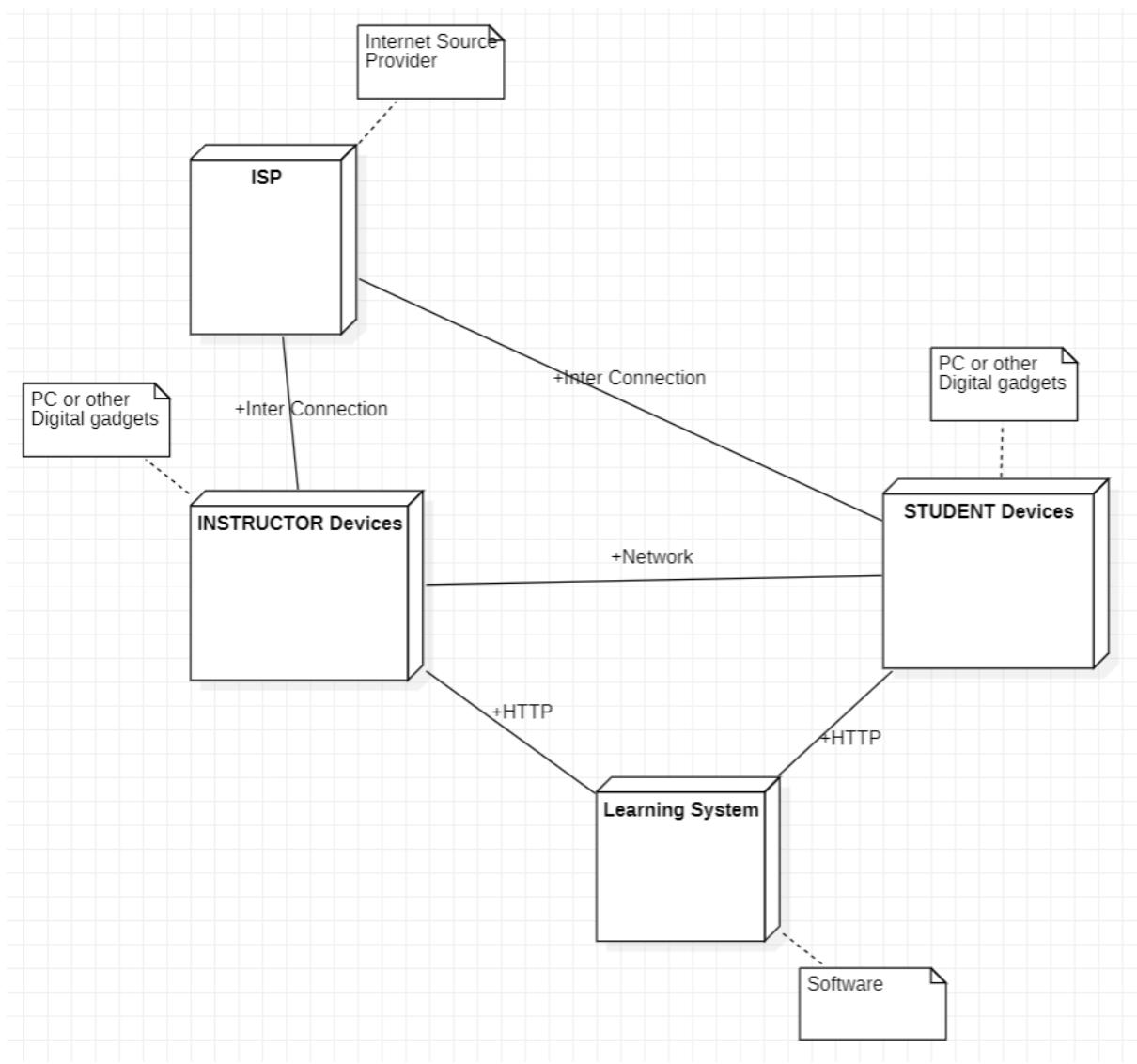
- A composite structure diagram performs a similar role to the class diagram but this helps in going further to the internal structure (including parts and connectors) of the classes and showing the interactions and associations between them.
- This consists of classes interfaces, packages, and their relationships, and that gives the logical view of all or the parts of the software system.



- This composite structure diagram above describes about the internal structure of the E-learning Portal, where the course registration and course creation is connected to database and the browser.

## 12. Deployment Diagram:

- Deployment diagrams are set of nodes and their relationships. The nodes are the physical entities where the components are deployed.
- Deployment diagrams are used to visualize relation between hardware and software. That is, we can visualize how the software components are deployed on hardware components. This shows where the software component was developed.



- The execution architecture or deployment diagram of the e-learning system is shown in the diagram above. This deployment diagram model shows the physical architecture relationships between the hardware and software elements such as the learning system, ISP, instructor devices, and student devices.

### 13.Package Diagram:

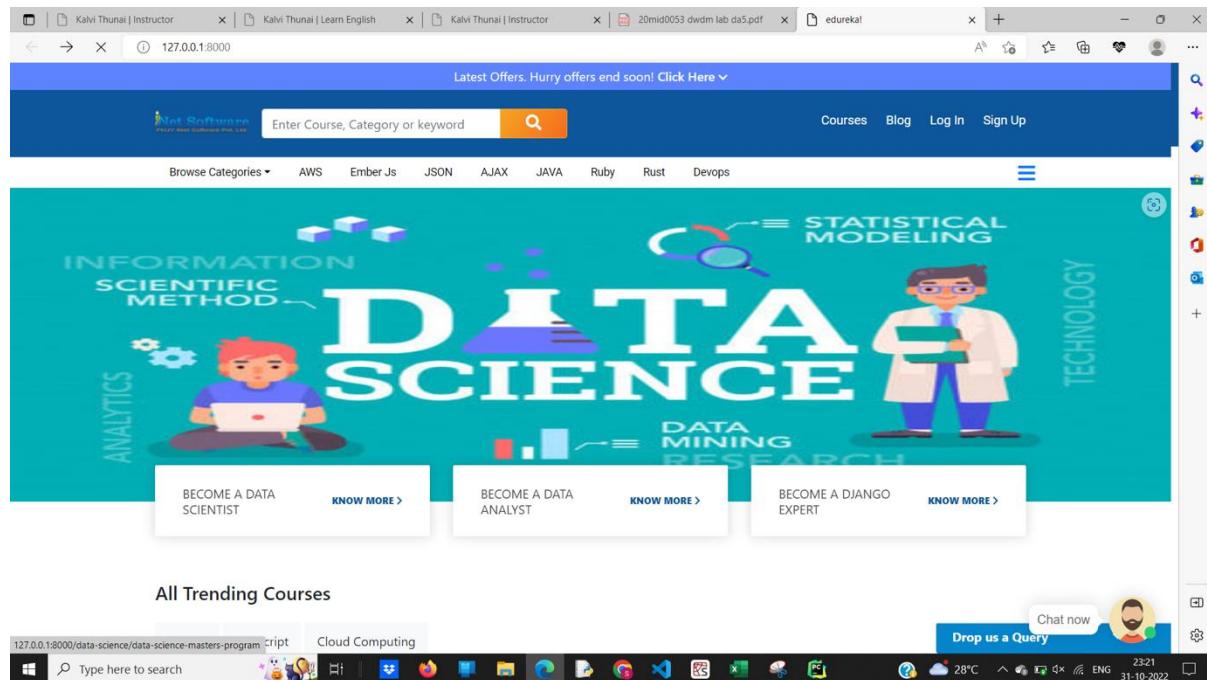
- Package diagrams are structural diagrams used to show the organization and arrangement of various model elements in the form of packages.

- The main purpose of a package diagram is to show the relations between the different large components that make up a complex system.
- Different packages contain nodes and artifacts. A package grouping of diagrams, documents, classes or even other packages.
- It mainly provides help in visual organisation of layered architecture of the system software.

## CODE AND IMPLEMENTATION

[https://drive.google.com/drive/folders/1CpiXGomirHyftb7I0B8SdizqylCu3efm?usp=share\\_link](https://drive.google.com/drive/folders/1CpiXGomirHyftb7I0B8SdizqylCu3efm?usp=share_link)

## TESTING



Kalvi Thunai | Instructor | 127.0.0.1:8000/rust/rust-certificate | edureka! | + - X

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The Rust programming language helps you write faster, more reliable software. High-level ergonomics and low-level control are often at odds in programming language design; Rust challenges that conflict. Through balancing powerful technical capacity and a great developer experience, Rust gives you the option to control low-level details (such as memory usage) without all the hassle traditionally associated with such control.

★★★★★ 87k+ satisfied learners [Read Reviews](#)

Why should you take ?

 DeisLabs developers also chose Rust because of its "strong safety and security guarantees"

 Despite early troubles with Rust that put a drag on productivity they realized they could save time downstream by not exposing null pointers, thread safety issues, and other bugs.

 Rust's syntax and language metaphors ensure that common memory-related problems in other languages—null or dangling pointers, data races, and so on—never make it into production.

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Kalvi Thunai | Instructor | 127.0.0.1:8000/ruby/ruby-course | edureka! | + - X

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A dynamic, open source programming language with a focus on simplicity and productivity. It has an elegant syntax that is natural to read and easy to write.

★★★★★ 87k+ satisfied learners [Read Reviews](#)

Why should you take ?

 You can use Ruby just like you would use any other general-purpose scripting language. A few examples would be web applications, web servers, system utilities, database work, backups, parsing, even biology and medicine. So you can use Ruby to do a lot of things.

 Ruby is an interpreted, high-level, dynamic, general-purpose, open source programming language which focuses on simplicity and productivity.

 1. Ruby's libraries and packages are managed through central library management system called Rubygems.

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Type here to search

28°C 23:21 31-10-2022 ENG

The screenshot shows a web browser window with multiple tabs open. The active tab displays a course page for 'Ruby Course' on the edureka! platform. The page includes a video thumbnail for 'Ruby Programming Language', a rating of 4.5 stars from 87k+ learners, and a section titled 'Why should you take ?' with two bullet points. The browser's taskbar at the bottom shows various pinned icons and system status.

The screenshot shows a web browser window displaying a grid of course cards on the edureka! website. The cards include:

- Cloud Architect Masters Program
- DevOps Engineer Masters Program
- Data Science Masters Program
- Java Certification Training Course
- Python Django Training and Certification
- Machine Learning Certification Training using Python
- Data Analytics Masters Program
- AWS Development Certification Training

Each card features a small thumbnail image, the course name, a star rating (4.4 or 4.5), and the number of learners (e.g., 5500). The browser's taskbar at the bottom shows various pinned icons and system status.

The screenshot shows a grid of course cards on a website:

- C language Certificate**: 4.4 (5500) stars
- Rust Certificate**: 4.4 (5500) stars
- Ruby Course**: 4.4 (5500) stars
- AJAX Course**: 4.4 (5500) stars
- Mastering Google Analytics**: 4.4 (5500) stars
- iOS App Development Certification Training**: 4.4 (5500) stars

Below the cards are buttons for "Browse All Courses" and "Explore our wide range of courses".

The screenshot shows the homepage of edureka!:

- Latest Offers. Hurry offers end soon! Click Here**
- Enter Course, Category or keyword** search bar
- Courses**, **Blog**, **Log In**, **Sign Up** buttons
- Browse Categories**: AWS, Ember Js, JSON, AJAX, JAVA, Ruby, Rust, Devops
- All Courses** link
- Trending Courses** section:
  - Cloud Architect Masters Program**: Cloud Architect Masters Program makes you proficient in designing, planning, and scaling cloud implementation. It includes training in Python, Clo... [Read More](#)
  - DevOps Engineer Masters Program**: Devops Engineer Masters Program will make you proficient in DevOps principles like CI/CD, Containerization, Monitoring, Log Collection, and more. [Read More](#)

The screenshot shows a web browser window with four tabs open. The active tab displays three training course sections:

- Python Django Training and Certification**: Designed to meet the industry benchmarks, Edureka's Python Django Training and Certification course is curated by top industry experts. This... [Read More](#)
- AWS Development Certification Training**: Edureka's AWS Development Training is designed to help you pass the AWS Certified Developer – Associate Exam. You will gain expertise on... [Read More](#)
- Pentaho BI Certification Training**: A self-paced online training designed for both technical and non-technical BI practitioners to develop their skills and knowledge for the most eff... [Read More](#)

At the bottom of the browser window, there is a Windows taskbar with various pinned icons and system status information.

The screenshot shows a web browser window with two tabs open. The active tab displays the Java Certification Training Course page:

**LATEST OFFERS. Hurry offers end soon! Click Here ▾**

**edureka!** | Enter Course, Category or keyword | [Search](#)

Courses Blog Log In Sign Up

Browse Categories ▾ AWS Ember Js JSON AJAX JAVA Ruby Rust Devops

**JAVA CERTIFICATION TRAINING COURSE**

Designed to meet the industry benchmarks, Edureka's Java Certification Training is curated by top industry experts. This course is designed for both technical and non-technical practitioners to develop their skills and knowledge for the most efficient way to pass the Oracle Certified Professional Java SE 8 Programmer exam.

★★★★★ 4.4 (5500)

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**WORK WITH US**

- Careers
- Become an Instructor
- Become an Affiliate
- Become a Partner
- Hire from Edureka

**DOWNLOAD APP**

At the bottom of the browser window, there is a Windows taskbar with various pinned icons and system status information.

The screenshot shows the homepage of an E-learning portal. At the top, there's a header bar with a search icon and a user profile icon. Below the header, a section titled "Recent Additions" displays four items: "C LANGUAGE CERTIFICATE", "RUST CERTIFICATE", "RUBY COURSE", and "AJAX COURSE", each with a brief description and a 4.4 rating out of 5 stars. Below this is a section titled "Discover Top Categories" featuring five categories: Python, Javascript, Cloud Computing, Aws, and Ember Js, each represented by a graduation cap icon. A "VIEW MORE" button is located below these categories. Further down, there's a "Reviews" section with a "Drop us a Query" button and a "Chat now" button. The bottom of the page shows a Windows taskbar with various pinned icons and system status indicators.

This screenshot shows a specialized version of the E-learning portal for business. The top features a banner with two men in suits working together at a desk. Below the banner is a section for "Our Corporate Clients" featuring logos for Coca-Cola, VISA, Cisco, Wipro, Dell, Citi, and Honeywell. The main navigation menu includes sections for "PYTHON", "JAVASCRIPT", "COMPANY", and "WORK WITH US". Under "COMPANY", there are links to "About us", "News & Media", "Reviews", "Contact us", "Webinars", "Blog", and "Community". Under "WORK WITH US", there are links to "Careers", "Become an Instructor", "Become an Affiliate", "Become a Partner", and "Hire from Edureka". A "DOWNLOAD APP" button is also present. The bottom of the page shows a Windows taskbar with various pinned icons and system status indicators.

## CONCLUSION

E-learning is not just a change of technology. It is part of a redefinition of how we as a species transmit knowledge, skills, and values to younger generations of workers and students. In this project, we have developed E-learning portal which has features like sign-up, login, browsing courses and course registration.