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THE PATHWAY TO EDUCATIONAL TECHNOLOGY: THE DEVELOPMENT OF CONCEPT MAP BASED TOOL FOR STUDENT E-LEARNING

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ABSTRACT

In this contemporary time, the mode of receiving educational instruction is multifaceted. Prior to the onset of the Covid-19 pandemic, traditional offline classroom learning held greater prominence compared to online or electronic (E-learning) methods. Nevertheless, during and after the Covid-19 pandemic, E-learning has gained significant prominence and has established itself as one of the most effective mediums for delivering educational instruction and imparting knowledge to learners. Therefore, E-learning provides students with a new learning mode that is different from offline learning. Students can not only access the online platform anytime and anywhere, but also obtain various forms of learning resources and conduct diverse online and offline learning exchanges with teachers and classmates. However, existing online learning platforms do not provide strong support for revealing the inner relationship of learning content. For example, Tencent classroom, rain classroom and MOOC platforms such as Chinese University MOOCs and Coursera have not seen direct support in this regard. On the other hand, for learners, knowledge visualization technologies represented by mind maps, knowledge maps and concept maps can provide very useful information for personal knowledge management and assisted learning strong support and help. Aiming at the problem that the existing online learning platform lacks the support for knowledge visualization ability, this paper proposes a technical idea to provide online knowledge visualization support. The researchers collected and utilized learning behavior data based on E-learning platforms. Based on the data gathered, the following E-learning prototype system were designed, implemented and proposed by the study. First, the draw.io open-source visualization tool, it provides support for online knowledge visualization. Second, the concept map, it is a special type of knowledge map in the field of education, which can improve curriculum planning and learning effect evaluation, and is conducive to improving teaching quality. In addition, the use of concept map provides knowledge navigation for teachers and students, encourage learners to obtain content and information from various sources and share the process knowledge of learning, and form a better collaborative learning atmosphere. Additionally, the study design and implement a prototype software system that supports map education and learning assessment.

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INTRODUCTION

Learning is the primary step to success and with that is more important to acquire knowledge correctly. Good learners follow an understanding meticulously number of things may come straightforwardly to learners, but most of knowledge attains after work, so a good learner is eager to deposit in the time [1,2]. Good learners are analytic – They ask themselves all kinds of questions, often far beyond their jurisdiction. E-Learning technology is use to promote collaboration with peers, self-directed learning active engagement with the content and ultimately the creation of new knowledge [3]. E-Learning is not limited to one thing but it can involve a variety of different technologies used in different ways and its best part of it is that it provides multiple opportunities but ultimately, it's about integrating learning technologies.

It is not just limited to teaching and learning but to enhance existing approaches [4]. The system supports concept maps guided learning behavior collection and analysis student behavior towards their learning. How learners systematically activate and maintain cognition, motivation to achieve their learning goals. Concept mapping is an educational tool that can represent expressions of learner's knowledge structure. Concept maps link multiple concepts [5]. During the COVID-19 epidemic, e-learning has emerged as a critical option for overhauling the entire traditional education system. Teachers and students alike have had to modify their habits, teaching/learning styles, evaluation methodologies, and so on [7]. This reform has resulted in various benefits, but it has also produced conflicts and dissatisfaction among both teachers and educational actors. E-learning has demonstrated the need of modeling the behaviors of all parties involved. To streamline the educational process, particularly in the university setting, imaginative and

constructive interventions are required. These would address specific issues and could lead to the long-term viability of education [1,4]. On February 19 and 27, 2020, the National Engineering Laboratory for Cyber learning and Intelligent Technology hosted two national online seminars on "first-line demand and implementation of online and open education during the COVID-19 outbreak." More than 140 people attended these two seminars, including 40 experts and educators from various universities and schools (primary, middle, and high school) from various places and provinces, including remote areas and Wuhan, the city with the most COVID-19 cases. The purpose of these seminars was to bring together experts with a variety of educational experiences in various contexts (urban vs. remote, universities vs. schools, and totally closed areas like Wuhan vs. less closed areas) to discuss the new educational system reform toward open and distance education [2, 6]. Accordingly, a knowledge graph is a descriptive technique that uses a graphical model to define the relationship between knowledge and world modeling. Knowledge graph consist of nodes and edges. Nodes can be neutral entities or extract theoretical concepts. Edges can be features of entities or connections between entities. The first prototype of a graph founded on the Semantic Web [3,4]. Since then, many new semantic sources have been created. Like Freebase is behind of Google Knowledge Graph[3].DBpedia is working in the back of IBM Watson [6] and Yago[7], back of the Siri's Wolfarm Alpha of Apple working, aiming to emerge as the world's biggest improvement understanding base in Wikidata [8]. In 2010, Google settled and developed the early semantic corporation MetaWeb, which is based on Freebase and it can show people or places interrelated to an entity or concept described by some keywords. The education sector has a special kind of knowledge map —Concept Map [9, 11]. It is different from the usual knowledge graph type, Concept graph entities are not traditional entity forms for example, places, or organizations, but some concepts about the nature of the discipline, for instance "integration", "living animals "differential equation", "hardware" etc. Because of the different nature of object types, relationship types are not regular relationship types such as "and" and "include" in the usual knowledge graph, However, it usually appears as a relationship among some theoretical concepts [13, 15].

Furthermore, concept map is a technique the graphic representation of knowledge, the distribution of which forms a network in which nodes represent concepts and lines of hierarchy between these concepts [17]. American psychologist and educational psychologist David asobel in the mid-1960s, one of the theories of learning psychology, developed the tool. In the 1970s, researcher Joseph Novak, also from the United States, applied the concept map in his research on the use of learning tools in educational system [14,18]. In order for a conceptual map to meet its informative or learning objective, it must have some minimal features, which includes; visual effect, conceptual map structure must organize and generate theoretical effect that associate primary ideas with secondary ideas, which support the attachment of complex ideas [20]. Rating organization, generally, the most important concepts are present at the top of a concept map or those considered being a category. In general, these key ideas are into light within a framework to show their relevance and connect with each other using lines. Information is classified after compatibility patterns [23]. On this aspect, three types of concepts or ideas can be distinguished. These are; *superordinate*: central ideawith a high level of inclusion of concepts, *coordinates*: concepts of equal classification, and *subordinate*: these are the concepts that are included in the previous category [26]. Creation, in a conceptual map, the relationship between ideas and features are describe by keywords. It is not normal to explain these concepts because it is meant to connect ideas and not to memorize them [28]. Efficacy, concept maps are often use as a technique in the teaching and learning process to understand and summarize information. They are also a resource in the corporate area, as they allow key ideas about the project or topics of interest to the organization [30]. Additionally, symbol table is structured in order to integrate central ideas, secondary ideas and less relevant information by braces. They are often use to describe concepts that contain subcategories [32].Concept map's philosophies have an extensive history in the quest for intelligent education by

humans. Much research has been completed to demonstrate the positive effects of improving learning using conceptual maps [12,13]. Early research into the topic of recognizing knowledge graphs derived knowledge bases from a set of noisy facts [14]. Benjamin Bloom first officially proposed mastery learning in 1968. The study suggests that students need to reach a competent level of prerequisite knowledge ideas before they can acquire advanced knowledge. Subsequently, the prerequisite relationships between the concepts of knowledge have been the basis of the curriculum. Concept maps are a great way to link different concepts by estimated relationships, organize, and store the estimated relationships regarding concepts. In the current conceptual map, the structure of the knowledge group is extensively used in education and training of effective work evaluation [15]. Also,concept map ca n be used to improve lesson plan [16], create reading list automatically [17], contribute to improving the quality of education such as evaluating the effectiveness of education. The main goal and contributions of this study is to help deliver a learning tool that centers in deploying a meaningful and resourceful learning approach for different students. This is target at providing a better learning approach for all the concurrent proceeding future learners. It offers a better support for teachers in designing technology-enhanced learning scenarios. These help learners collect, organize, and present information. Also, to help learners build common concepts using self-assessment and cognitive communication. Due to the dual ability of concept maps to improve learning and manage knowledge, they are proposed for usage in the progress of digital e-content associated to the e- learning process.

LITERATURE REVIEW

E-Learning Theory and Tools: There are many ways through which teaching and learning take place. These are; *face-to-face*:it is very common way of teaching and learning.In this teaching and learning method, class content and learning materials are delivered individually to a group of students [2]. Face- to-face teaching is inherently teacher-centered and tends to vary broadly across cultures. Many current education methods deviate significantly from traditional forms of face- to-face education for the needs of individual students [3]. Furthermore, *blend learning* also known as *hybrid learning* is the same as traditional instructional method but it involves technologies like computers, mobile phones or laptops and high-speed internet [5]. Many universities throughout the world provide online face-to-face classes to students who do not have access to a physical classroom learning so as to provide equal opportunities to all learners [4]. Also, *distance learning*is another form of providing instruction for students. The primary purpose of distant learning is to overcome geographical and temporal limitations. This strategy frequently includes technological improvements such as online materials and videoconferencing [6]. Other learners might have easy access to a college, but that institution may not be offering the subject of study the learner requires. Accordingly, e-learning is a way of vesting the vision and spectrum of educational system using computer technology. As we have seen along the continuum from face-to-face teaching is more frequently used and many other technologies are used to replace the face-to-face features [2, 4]. Initially this has very low impact on teaching organization and learning process because the technology used primarily to enhance the face -to-face teaching but as move further along the continuum of the nature of the teaching and how it is organized is increasingly affected by the use of computer [26]. Somewhere around the middle of the continuum, we get into blended learning. When we reach at end of the continuum there is no longer any face-to-face teaching and we have a complete online learning, which all teaching technology mediated by e-learning is part of the continuum that begins with technology [25]. Moreso, the improvement of online education is to computerize teachingvia the means of structuring information, testing the learners' knowledge, and offering on the spot feedback to learners without human intervention [18]. Additionally, choosing and loading of content material and evaluation questions are part of enhancing the understanding of the learner. Constructivism is focused on a learner-centered approach [15]. It is a principle or idea concerning education

and understanding. Constructivism underlined that learning is just not passive acceptance or absorption, but instead the dynamic construction of information from individuals' self-cognitive abilities [33, 39]. Furthermore, it highlighted the significance of contextual for knowledge formation in which discussion (conversation) is at the core of the social design process. The study argued that if students do not have chance to converse with one another, learning would never occur [40]. As a result, knowledge building is concerned with students' not just an active activity within the learning experience, but also interactive teaching role within the social environment.

Moreover, collaborative learning complies of constructivism. It stimulates the mind and offers chances for students truly comprehend the essence of an issue through an interactive learning experience. Moreover, the instructor takes on the role of a facilitator. He/she not only gives learners with learning opportunities and materials but also motivates students to build a base of knowledge through joint effort through collaborations. Every individual must concentrate on collective responsibility and support each other in the learning process. With the expansion of the internet and the connection of communications systems, the usage of digital media, namely smartphones and tablets, has infiltrated different elements of learning. Thus, different online educational platforms such as; (i) Tencent Classroom [18] is an e-learning system that delivers digital language learning, programming, challenging tests, and activities. Teachers can utilize the QQsite system's teaching method to deliver online live classes to students. (ii) Rain Classroom [19] is a simple software that is installed as a component in WeChat, and all that is needed to obtain in Rain Classroom login is a smartphone. It supports self-learning everywhere on location worldwide, as well as teacher's response to the student in real-time. The teacher can upload relevant information to rain classroom during classes. Then after classes, learners only need to connect to the internet via their cellphones and laptops to access teaching materials and lessons tasks. (iii) Google Classroom [20] is a web-based tool that google has created. Its purpose is to turn the traditional education paperless, allowing for online production, delivery, and scoring its primary objective is to simplify data transfer between professors and students. Teachers may also keep track of their students' development and give comments on their work.

Current Teaching and Learning System: Instructors and students presently use a learning management system for group projects. For instance, a case study investigating interaction, collaboration, and knowledge construction [21]. Digitally learning management systems (LMS) enable instructors and students to collaborate online by sharing instructional materials, making class announcements, submitting and returning course assignments, and communicating with one another. The findings show that students utilized the LMS to engage and, to a lesser extent, cooperate well, although there was little evidence of knowledge creation utilizing the LMS technology. The educational value of integrating a LMS and a social networking platform is to enhanced teaching and learning collaboration between instructors and students [22]. This is because of the capabilities they provide that facilitate the management and distribution of course information to learners, LMSs are widely used at universities and other organizations. Regardless of their widespread use, their emphasis is on information delivery rather than on the learner. LMSs provide little or no possibilities for learners to communicate and cooperate on various projects, as well as publish material that can contribute to the information currently accessible in the systems. Academic and students use of a learning management system is an implication for quality teaching and learning [23]. Most universities have established a learning management system (LMS) to handle online classroom instruction, with different degrees of resources offered to students and faculty, although there is frequently no follow-up inquiry on the effectiveness of the web pages or how they are used. For instance, e-learning and its implications for New Zealand Schools as indicated in a literature review report to the Ministry of Education [24], this e-learning literature study looked at texts from a variety of nations during a very short period of time (the last five years). The report showed that e-learning significantly

enhanced teaching and learning. Thus, students can be motivated and engaged with e-learning technologies. This can be important variables in achieving better educational performance in various educational institutions across the globe.

Concept Map Related Work: The concept map (CM) guides learning, allows developers to articulate nuances, contexts, and dependencies between ideas in a very user-centered way. This is especially useful in education, whether used for instruction, research notes, or "back mapping" of units or unit evaluations [25]. They are powerful teaching learning visualization tools that can encourage macro thinking and close the gap with writers who are struggling to translate their thoughts into prose. The configuration used in CM is simple and places little cognitive load on the user regarding concepts, relationships and sentences. A CM is often a single word or a brief phrase that represents recognized uniformity or order in events and situations, or in recordings of events or objects [26]. Accordingly, there are two groups of ideas in information system that are extremely significant [25]. The first category consists of content ideas such as method, design, and information. The information process principles are based on the problem statement, a proposed challenge, evaluating, and generalization. The practical elements are content-oriented and correlate to process oriented modules in IS programs such as Database. The underlying theory of CMs is cognitive learning [26]. It is based on numerous principles. The main premise is development tool. To support effective education, the learner needs to integrate new information into his or her current cognitive framework. Also, the building of a CM allows creating the process of performing meaningful learning, making it an ideal option for this purpose. Once the CMs are finished, the quality of the CMs may be used to assess students' relevant learning. As result, we require an effective mechanism for assessing and analyze CM. The tool for evaluating CM often analyze the content and/or design of the CMs. The content evaluation of CM may measure CM component quality such as ideas, statements, and its created structures. The interconnection of the CM is often considered while evaluating the architecture of the CM [27, 28].

Moreso, the second category is the important current learning tools which collect student's information and help teacher-student in online education. These learning tools are; *Massive Open Online Course* (MOOCs) [29], is an online free course that encourages learning in a number of areas and is accessible to anybody with a computer and an internet connection. MOOCs seek to link learners from all around the world with instructors and with one another. The concerns or problems caused by MOOCs is if a learner does not comprehend a topic, he or she will not receive additional attention from the tutor. Students are often unable to concentrate in such classes since they only have to skim thru the course content [29]. The instructional materials contain no animation. In addition, there seems to be no introduction. Even though the class was advertised as free, there were expenditures paid in the form of necessary readings from books as recommended by the course creator. Furthermore, *Coursera* [30] is another web-based learning system that enables self-paced assignments as well as courses on a wide range of topics. To deliver courses, the system collaborates with colleges and corporations such as Amazon Web Services, Google, and IBM. Users can obtain digital certifications to include on their résumé or share within their LinkedIn networks. Peer grading is used to grade some tests. It performs well along average, although it might be difficult to obtain valuable advice at times. Students who have taken the classes have discovered that they really do not obtain honest answers from the program teachers on queries or assignments. This is most likely due to the enormous number of students enrolled in each class, making it impractical for teachers directly advise each student on such a wide scale [30]. Additionally, *Udemy* [31] is also a huge open web-based provider that organizes courses into a series of functions and lessons. Courses cannot be saved and viewed offline. Udemy does not offer accredited degrees or certifications, students enroll in programs mainly to improve their job-related abilities. Udemy does not offer features such as graded assignments, mentorship and specialized certificates. Since anybody can develop lessons, the quality of content

varies greatly amongst courses. Hence, Udemy provides better teaching approaches options for instructors and learners from various classes especially when seeking for theoretical concepts at the university level [31].

Concept Map Tools Overview: Concept mapping is a learning approach that includes showing relationships between concepts and ideas through graphical representations. A CM is a type of graphic organizer that contains of several circles or boxes (called nodes) that individually represent an idea and are all inter connected by connecting words. The purpose of these connecting keywords is to 'determine the relationship between neighboring concepts [32]. CM first originally used as a learning aid by Novak and his associates at Cornell University in the 1970s. Thus, Asubel's idea of effective teaching holds that "learning is valuable when the learner understands the link of what is being learnt to other information [33]. Meaningful learning, in other words, "occurs when a person deliberately and openly relates new information to key aspects that already possess" [34]. CMs are used in various ways and for various purposes including to: (1) draw attention to the matches and/or contrasts between concepts, (2) show all of a concept's sub-concepts, (3) demonstrate the stages involved in the creation of an action or event, (4) ideas for certain topics should be brainstormed, (5) during the education process, learners' information is formatively assessed, and (6) in summative evaluations at the completion of a class or program unit, utilize concepts.

distinct entity and a vital stakeholder in digital learning [42]. Although the industry is a stakeholder that can be seen as a separate of the three major stakeholders centered on academia, it can be comprehended as a supply and demand factor for online education. Throughout having a successful online education, the goals are expectations and requirements of separately of these stakeholders must be clearly established [41].

Teacher Stakeholder: It is the obligation of teachers to maintain and enhance students' involvement levels on a constant basis [42]. It is worth mentioning, from a teacher's viewpoint, that theoretically and practically research findings do not always agree. According to the Sloan Survey [43], there seems to be little growth in teachers' interest for digital learning from 2002. Perhaps this is because certain professors' teaching strategy and approach may be even more suited in a face-to-face distribution mode, whereas others could be more confident and adopt in online delivery. Robinson and Hullinger [42] investigated the relationship between teachers and students; their survey study on student involvement in online learning found that, due to technological developments, teacher-student contact was particularly successful in online courses. Figure 2 depicts teacher's requirements, needs, and expectations for creating, implementing, and delivering online education. Figure 2: Teacher Requirements are the first stakeholder. Up-to-date technologies for designing, developing and delivering for creating online education.

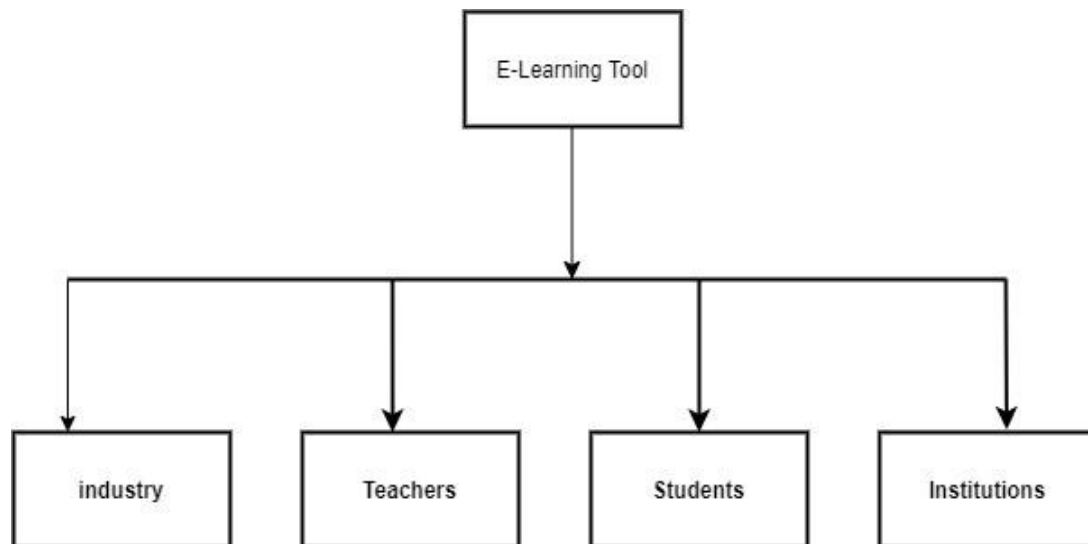


Figure 1. Major Stakeholder of Online Education

Moreso, the following is a collection of some concept map tools: Mind Map [35], XMind [36], Bubbl.us [37], and Popplet [38]. However, these tools are mainly used for drawing or designing of CMs and do not depict and capture the student learning behavior such as teacher-student feedback, no student group work, no sharing of experiences, and suggestions, etc. Teachers cannot share their knowledge visually. These tools are just different drawing CMs tools and do not support students' learning behaviors. In conclusion, the researchers argue that based on the description of 2.3 and 2.4, online platforms like Moocs do not support online CM based learning for students.

MATERIAL AND DISCUSSION

Stakeholder use cases: There are four major stakeholders as shown in Figure 1. Teachers seem to be in charge of designing, developing, and delivering online education. Students are the later part of this online education; consequently, variables influencing student performance and morale must be considered. Institutions are universities that offer web-based education to students through teachers. Even though these universities appear to be a collective of students and professors, they generally have their own set of criteria and demands, making them a

Student Stakeholder: The interaction with their teacher and classmates in a "real" classroom is definitely preferable for some students, whereas others choose the secrecy and flexibility provided by an online education program. Using various tools to support distance education motivates students to participate in classroom discussions and meetings, as Menchaca and Bekele found in a study they conducted [44]. Among undergraduate students surveyed by Wilkes [41], the following five points were most important when considering taking online classes: fast response to queries, institution certification, information availability, well-organized and structured arrangement of contents, and scheduling flexibility to fulfill work duties. A further characteristic of online learning is electronic submission of assignments, as well as meeting social activities on a flexible schedule [45]. We have seen this disparity in learners in my encounters teaching various student profiles. Students' perceptions of a course are influenced by a variety of factors, including their experience, gender, and region. Senior students who have already returned to school to pursue another degree may find it more challenging to acclimatize to online modes of delivery [46]. Adult students, on the other hand, gain the most from these mediums, as they are generally full-time working adults with families. As a result, it is critical to recognize that diverse student demographics will have

distinct demands in order of course design and delivery. This Figure 3 depicts the interests, objectives, and ambitions of learners.

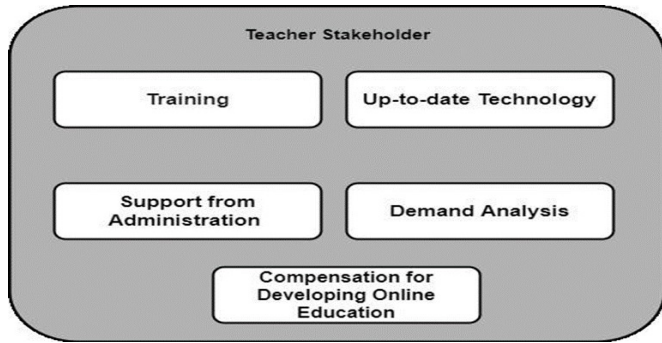


Figure 2. Teacher Requirements

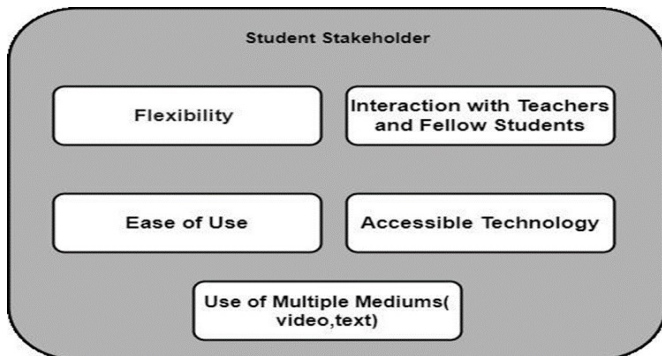


Figure 3. Student Requirements

Institution Stakeholder: The analyses have been carried out at a higher graduate level. According to the Sloan Survey [43], the tendency for colleges and universities to integrate online learning as part of its long vision and strategy has nearly reached a halt, with 73.6 percent of public academic institutions admitting that it is vital to their big plan. For private non-profit organizations, the percentage reduces to 49.5 percent. This is intriguing, because research suggests that e-learning has a considerable impact on financial concerns in the institution's favor. Smith and Mitry [45] addressed the problem of quality, concluding that if academic institutions do not remain dedicated to outstanding educational standards, e-learning would never realize its full potential. Stakeholder gives two prerequisites for student's flexibility and user-friendliness technology as the accessible contact with professors and classmates have the potential to be used [46]. With the growing number of profit-making institutions offering online degrees with the help of part-time educators who may or may not have the required terminal degrees from accredited universities, it is critical that absolute education systems pay special attention to highlighting the expertise of digital learning while combating the difficulties of digital learning. Figure 4 depicts the expectations and objectives of institutions of higher learning.

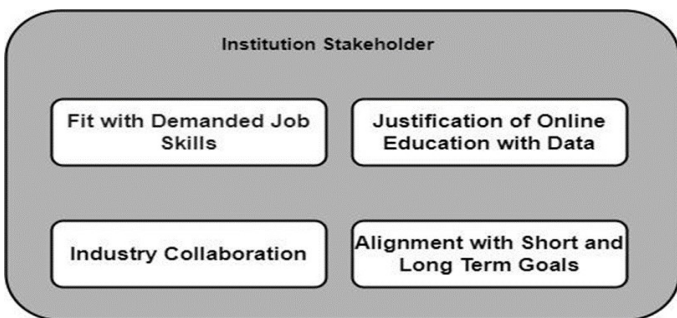


Figure 4. Institution Requirements

Industry Stakeholder: Most companies and organizations want their employees to receive higher degrees so they can operate more

effectively. As such, working professionals who are employees are potential students for academic institutions organizations support them while they are working, or because employees want to be more competitive and have more skills organizations support them although they are working [46]. Online program removes schedule issues and provide working students with the flexibility they demand. Some other aspect here is that fresh graduates become prospective employees for enterprises in the industry. When implementing new courses or giving online courses, institutions of higher learning frequently undertake a market study and research the industry in the surrounding area to determine what the organizations demand. Therefore, here is a supply-demand circle amongst industry and institution. Figure 5 shows the industry requirements and expectations.

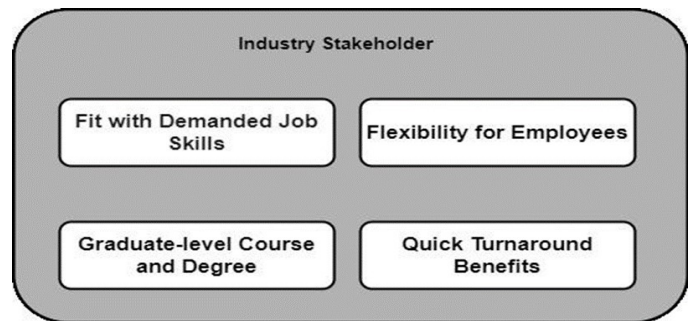


Figure 5. Industry Requirements

System Architecture: The architecture could be outline of concurrent intuitive between components, databases, client interfaces, and servers within the framework. It is additionally portrayed as a format that coherently characterizes the association between the server and client side for distant an improved web encounter. There are two major parts of this system; User-side: the front end is the part of the website in which the information is encode in HTML, CSS, and JavaScript and save in the web page. It is where users engage with each other. Server-side: server-side is recognized as backside, so it is in responsible of business logic and HTTP requests. The server-side code is developed in a variety of languages, including Java Script, Python. Aside this, there is also an extra component known as the database server, that transfers the required information to the server Architecture functions which are shown in, figure 6. When users enter their Id and password and clicks login, they are taken to a page where they may submit their information. The website will submit a request to the web server, which will authenticate the internet address and forward it to the controller that stores user information. The server then intercepts the information and transmits it to the information storage to retrieve the page and make requests for data to show on the screen. The page containing the required data is then show on browser.

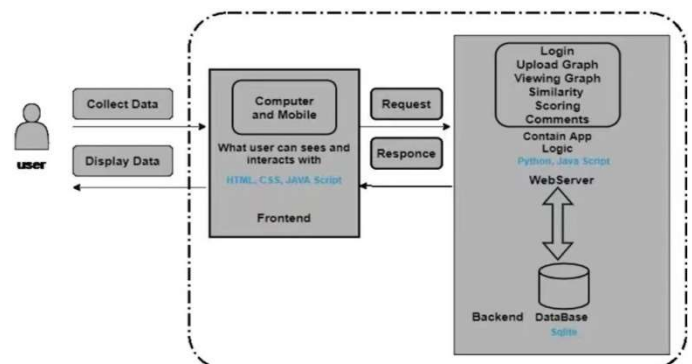


Figure 6. System Architecture

System Architecture's Layers: Responsive design apps are designed with a layered architecture that includes presentation, business, persistence, and database layers [44]. Presentation Layer: the presentation layer, which is develops with HTML, CSS and JavaScript, allows interaction between the interface and browser to

improve user engagement. The information can be access via the Web page while using a computer. Any common internet browser that supports HTML, JavaScript, CSS, and other web technologies can access the system with using generated web pages.

Business Layer: the business layer defines the application logic and regulations. It handles web queries, implements the application logic connected with them, and then transmits them to the presentation layer. It is also acknowledged as application layer and data processing layer is maintain the interaction between user and database. When user send request business layer process that request and fetch information from the database if it necessary, also create a client reaction and save information in database. The business layer gives network and data flowing facilities.

Persistence Layer: the persistence layer also called data access layer; it is in charge of data persistence. It is tightly link to the business layer and contains a server that repossesses information from associated servers.

Database Layer: all data store in database layer the database server is in charge of giving a variety of functions to the application layer (server), including building, accessing, and updating information as needed. The server also ensures security of data, as well as preventing illegal access. Various data gateways, visualizations, and analyses have been developed, as well as synchronization, backups, and restoration. By dividing the application logic from the user, the database layer, also called the data service layer, contains all of the information and gives data security.

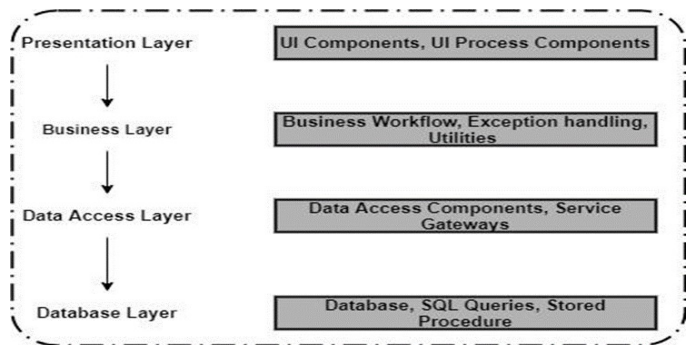


Figure 7. System Architecture's Layers

System Design

Login/ Registration: This is a flowchart of our users accessing our educational tool. The functional system combines manual entry (i.e. username, password) and computerized processing to handle Registration and Login of users. The function starts by receiving user credentials, which are check if they exist in our database if yes then it will stay on login page message, will come from database that these details are not find. If database did not find any information of student and teacher user need to create new account to get access of resources. If new user is teacher, they will select that I am a teacher and create new account and if user is new a student, will just enter student id name and password and enter information to register and save it to database. Teacher and student will be able to login afterwards.

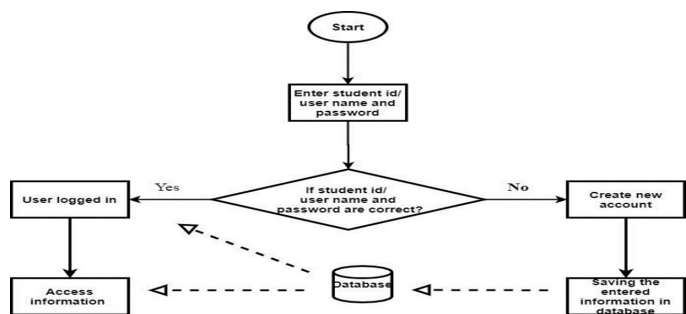


Figure 8. Login and Registration

Add Book: After login on teacher dashboard, teacher will be able to upload books with chapters; those chapters will draw in draw.io and save in to xml file to upload in system. The functional implementation is depicted in Figure 9. The teacher will add a book, which has details: book name, chapter name and xml file, if the concept map file is not xml file type, the system will not allow the teacher to upload the file, because the system support xml file type. The system will convert xml file into JSON file and store in a folder on our server with book name, chapter name, and file name. The book name and chapter name will be saved in database, after which students will be able to access and view.

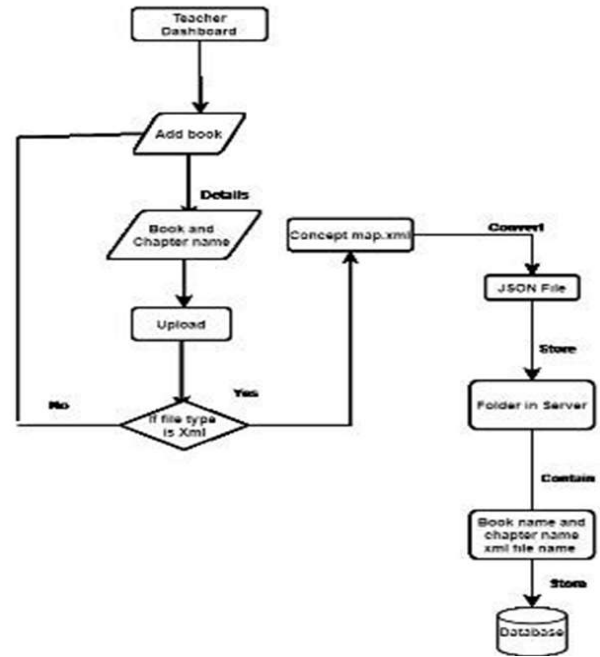


Figure 9. Add book

View Graph: Teacher will add book's chapter for students to learn, student can view that chapter's concept map. That JSON file will store on database and students can access that file by book id, chapter id, and teacher id. Graph will display in browser, it contains nodes, and every node have topic, which linked with subtopics. Student will get knowledge by clicking node's name (topic name) which is connected with Wikipedia API so, basically clicking on node will send request to Wikipedia API by topic name and will get response with Wikipedia article of specific node name in JSON format and display on screen. Process of this function shows in Figure 10.

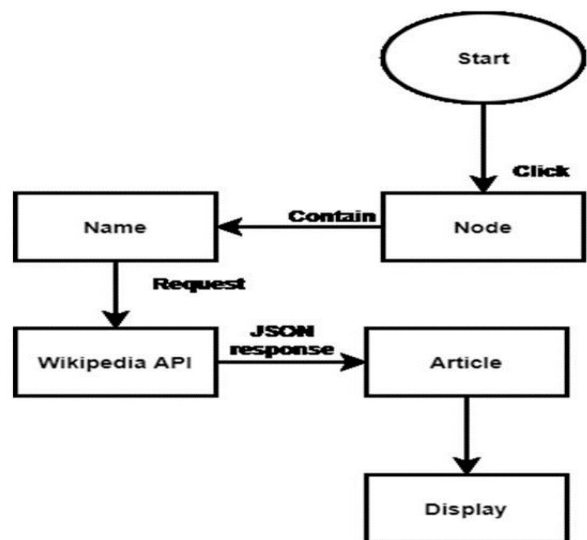


Figure 10. View graph

Submit Graph and Status: The implementation of the function submitting graph and status is show in Figure 11. After reading from the teacher’s graph, teacher will assess the student knowledge, so students will upload their own graph to the system. Student will add book id, chapter id and file upload it to system if that file type is xml, and file will be upload but if file is not xml system will take back student to add submission part. If the file isxml, student’s xml file will upload successful. Then that student file will convert to JSON file and save in folder on server that contain the information of user id, submission id, chapter id, teacher id, and file name and store into database. After storing to database, it will show the status of pending automatically. After the teacher checks the submission, it will change from pending to checked submission.

Similarity: In text similarity, when students upload their graphs on teacher dashboard, it will show submission with book name, chapter name, and file. Teacher will click on check similarity that contain two graphs; one student and one teacher graph. For the student graph, it contains submission id which is store in database to get the name of requested submission fetch of the file from the submission folder and extract all nodes and text. For the teacher graph is contain chapter id which is already stored in database and will get name of the chapter as well as book name. The extract nodes and text also request for those articles from Wikipedia API which are linked to extracted nodes at last check the cosine similarity using twinword API and show the results on screen.

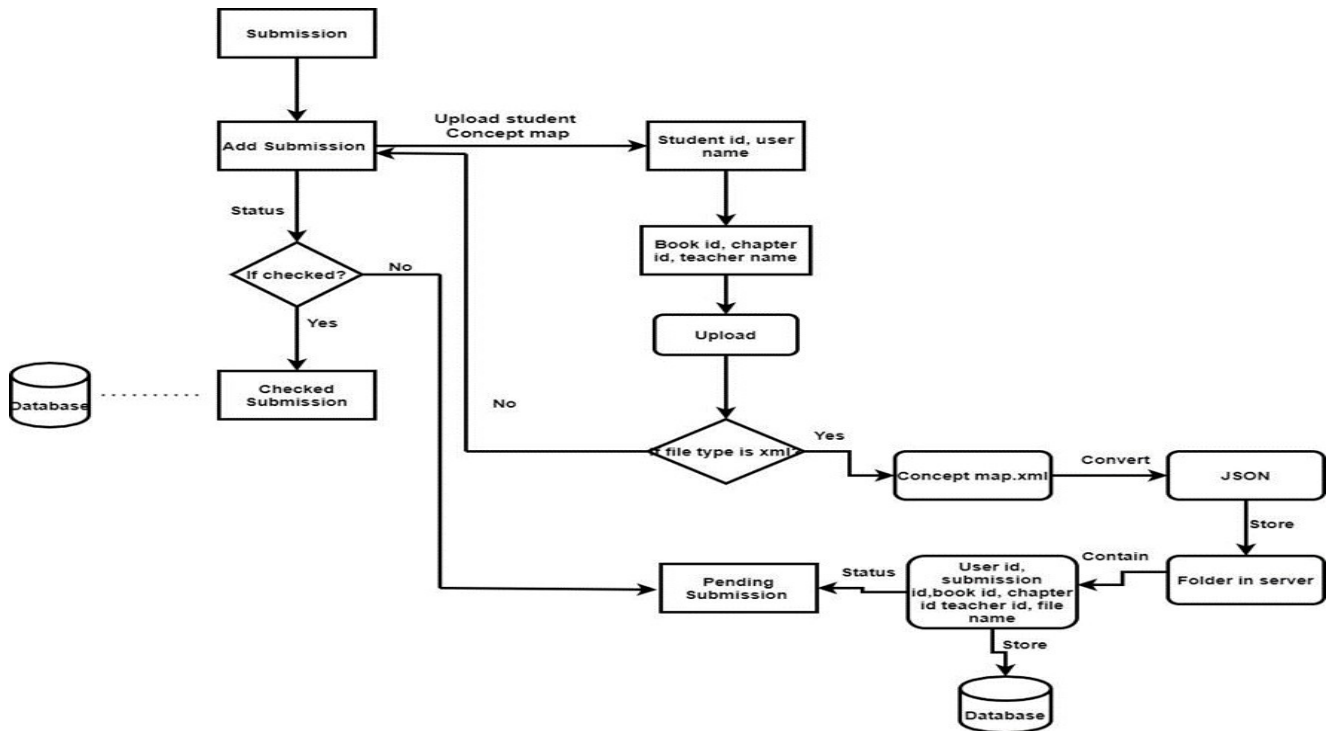


Figure 11. Submit Graph and Status

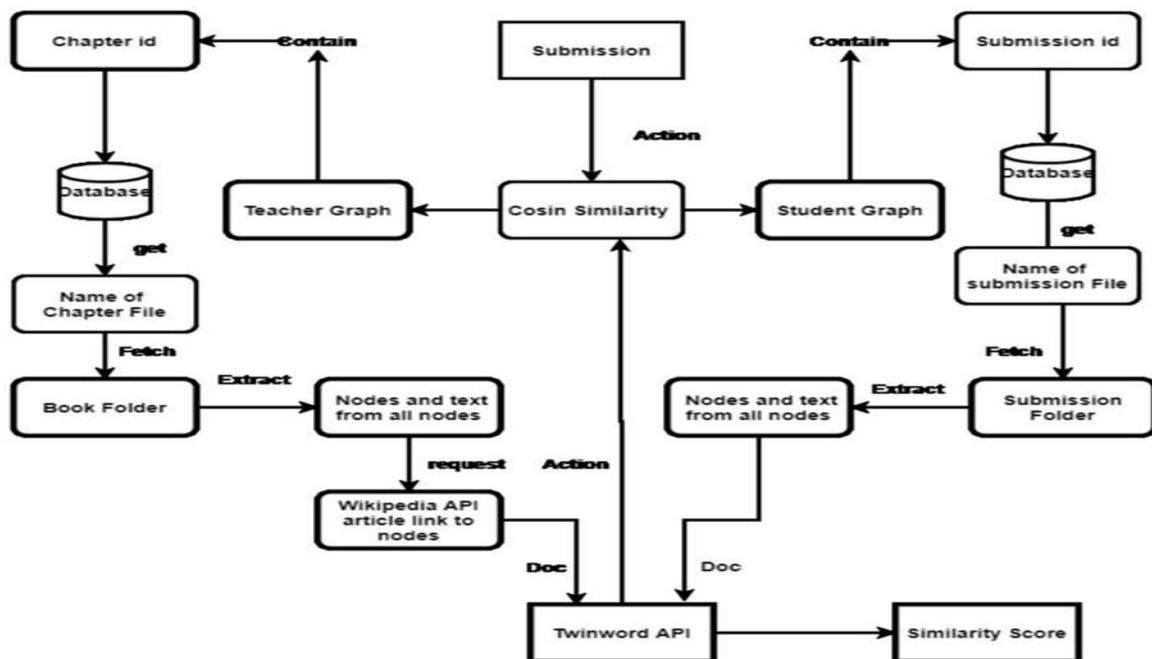


Figure 12. Similarity

Add Resource: User will be able to add resource those resources can be pdf file, word, video, image. This function user will add user id description, file name, resources file and that all information will store in database. All user will be able to access those resources and also can download and view.

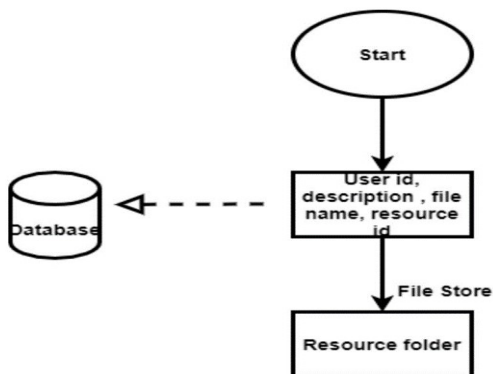


Figure 13. Add Resources

Post Comment: Online learning user can share their knowledge or view on specific node they will be able to comment and other user can response on these comments. In the comments, section if user comment it will be user id and post and that will be store in database if some user will response it will save all the information of post id, user id response id and date and store to database.

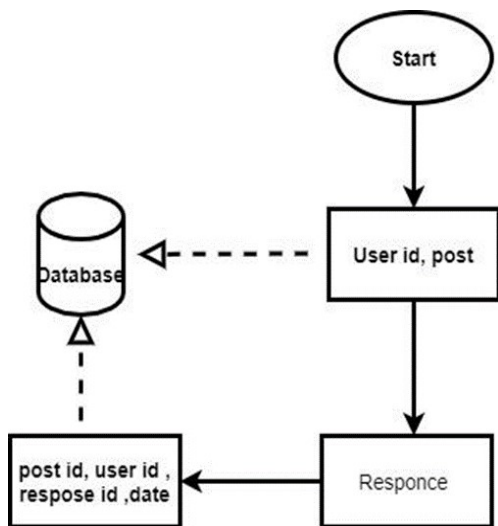


Figure 14. Post Comment

Design Pattern: The Model-View-Controller (MVC) layered architecture divides a framework consists of three main functional units: Model, View, and Controller. Each function of the architecture is developed to accommodate a particular aspect of software development. The presentation layer and the business logic layer are separate by MVC. It was previously only use for virtual environments on desktop computers (GUIs). MVC pattern it became common in World Wide Web for developing web applications. Trygve Reenskaug proposed the MVC architecture in 1979. The MVC framework was first use in the Smalltalk programming language in 1987. In a 1988 article, MVC had been accept as a basic idea. In past few years, the Design pattern has become increasingly popular in modern web apps. The features of MVC are in many kinds. Testability is simple and straightforward. The structure is extremely verifiable, versatile, and pluggable. The Design pattern provides greater control over the HTML and URLs when designing a web development platform. Utilize existing features such as ASP.NET, JSP, Django, and others. Model, View, and Controller are clearly separate in terms of logic. Application tasks, such as business logic, UI logic, and input logic, are separate, routing URLs for SEO-

Friendly URLs for understandable and trackable URLs, powerful URL mapping is available. MVC Architecture.

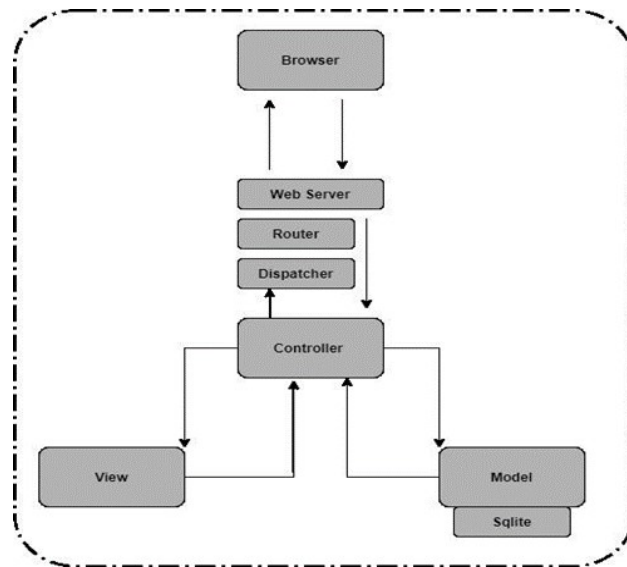


Figure 15. MVC Framework

The three critical MVC principles are *model*; it contains all of the data as well as the logic that correlates with it. The *view* displays information here to user or manages interactivity. The *controller* serves as a link between the Model as well as View elements. The MVC implementation comprise of the following; *View*: view is the component of an interface that provides data presentation. The data obtained out from model data is used to construct views. A view seeks information from the model in order to deliver the output presentation to the viewer. The information from graphs, maps, and figures is also shown in the view. For example, the teachers and students view will comprise all of the UI components such as the login portion, the dashboard, the view graph, and so on. *The Controller*: the Controller is the component of the system in charge of user interaction. The controller evaluates the user's inputs, instructing the framework and the display to modify as needed. A Controller gives orders to the model in order to change its state, such as Teacher can view all student's details, students cannot edit other students work. The controller also provides orders to its associated view to modify the display of the view. Also, *Model*: the process model holds data as well as the logic associated with it. It depicts data being moved between control system elements or any other functionality. A Controller object, for example, will get student information from the database. It manipulates data before returning it to the database or using it to produce the same data for example checking similarity and gives score. It reacts to requests from the views as well as controller directives to update itself. It is also the lowest level of the pattern and is in charge of data maintenance [47]. *The Database Design* is defined as all entities, which are used in the system and the relationship between different entities. The system contains the following entities User, Role, Submission, Chapter, Book, Chat Room, Resources, the system design contains 5 entities and these all entities are tables in our designed database and also execution of our designed system schema.

System Running Environment: Technical specifications are the basic conditions for instructors and students to setup this tool on their computers and utilize it without any difficulty. The goal is to assist them and ensure that they have all of the necessary technology and materials. With evaluation, some goals for hardware, software, and anything else would be consider in the system's minimal needs. This system runs on the following hardware and software specification as shown in Table 1.

Teacher Sequence Diagram: All the teacher roles used for evaluation are all illustrated as functions in Figure 4. 1 below:

Table 1. System environment

Ram	12GBRAM but 1 Gig		
Network	Internet access at 56k or above		
Display	Screen resolution min1024x768		
Web browser	Internet Explorer 7.0+,		
	Safari	3.0+,	Firefox
3.0+(Browser must be enabled)			
	Java	And JavaScript	
OS	Windows 10,	Vista, or 7; Mac	
OSX	10.4+		
System development software	PyCharm, Html, CSS, JavaScript		

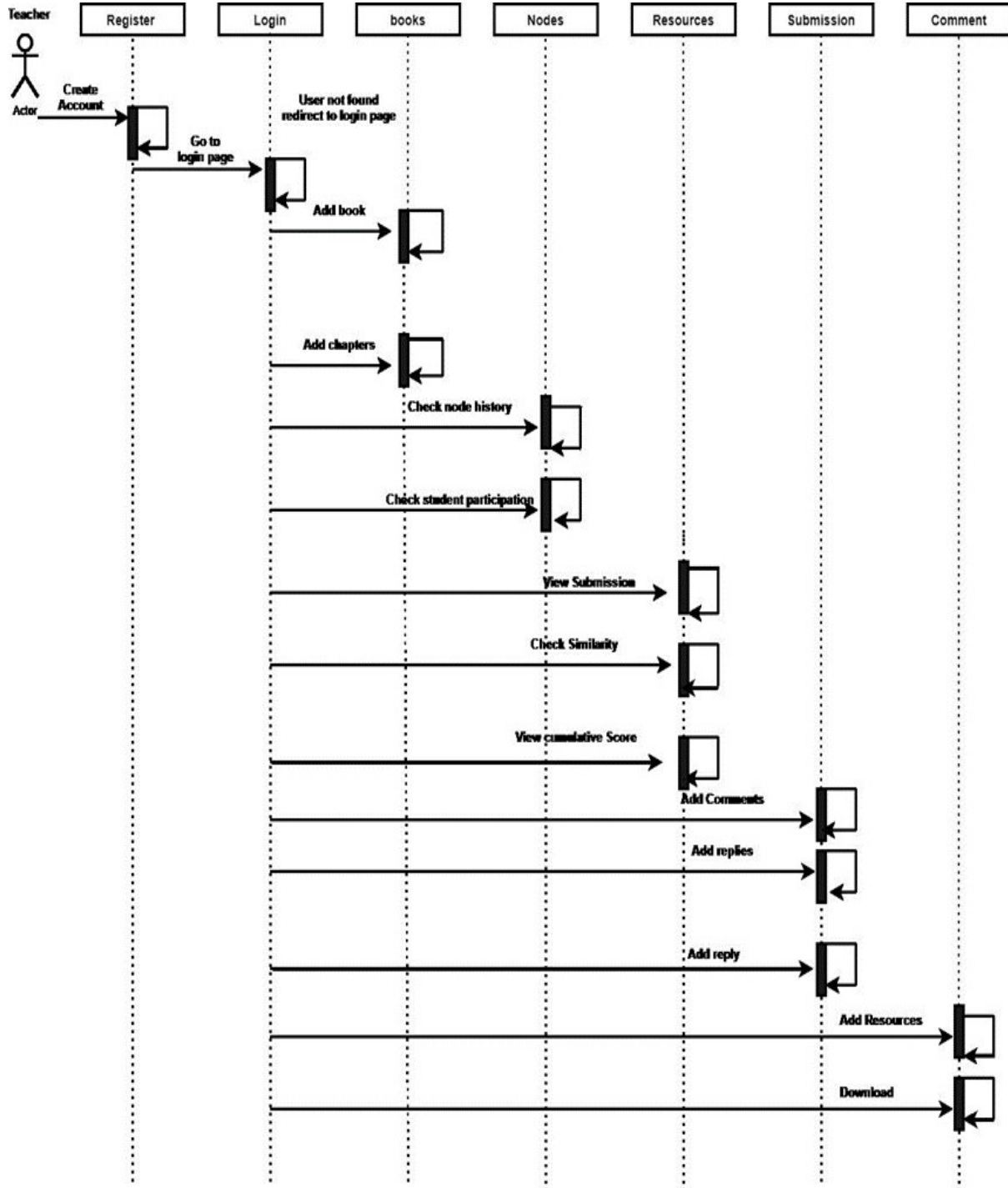


Figure 16. Teacher Sequence Diagram

Student Sequence Diagram: The following are the student roles captured to illustrate the evaluation process of all the functions that enable the student module as shown in Figure 4.2 below.

Backend Logical Design: In system access, users can access system; users can be teachers and students. They enter id or user name and password post to database, using SQLAlchemy library, which connect system to database check information, is there of specific user if yes it

returns row if not than user need to register his information and store it to database. User password will be confirming while using flask_bcrypt library if password is correct it will take to next teacher or user dashboard but if not, then database will return the message with "Invalid login credentials".

Module Selection: The teacher dashboard gives teachers the functionality to upload concept maps of a book. Each book consists of different concept maps of each chapter of the book given in XML format. Each concept map is parse into the JSON file and both files are stored in a folder on the web server.

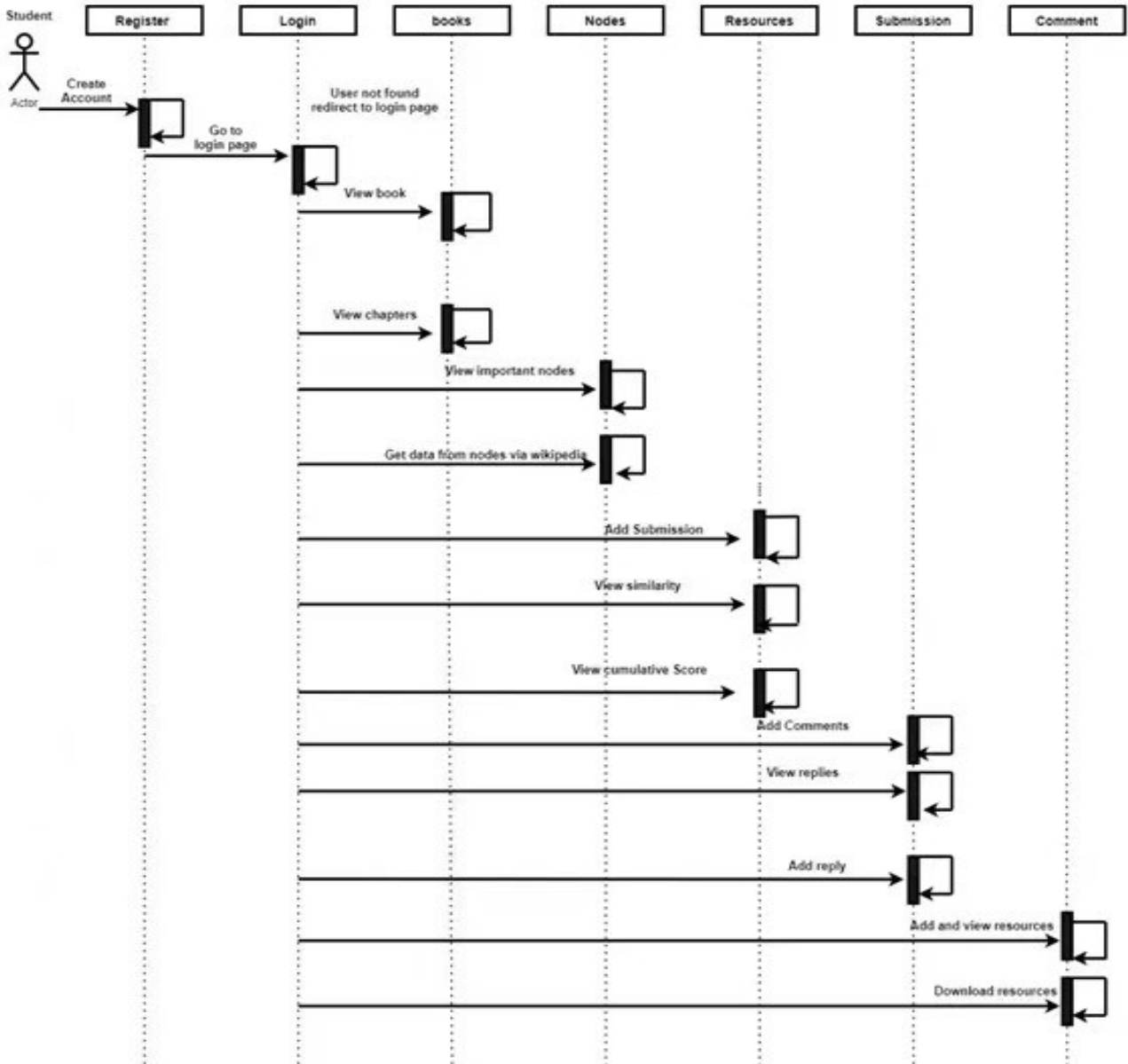


Figure 17. Student Sequence Diagram

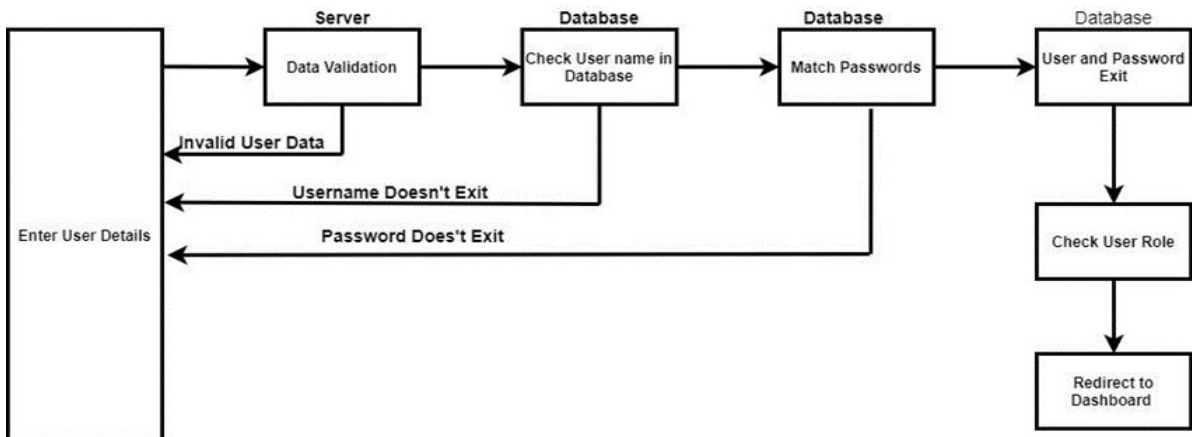


Figure 18. System Access

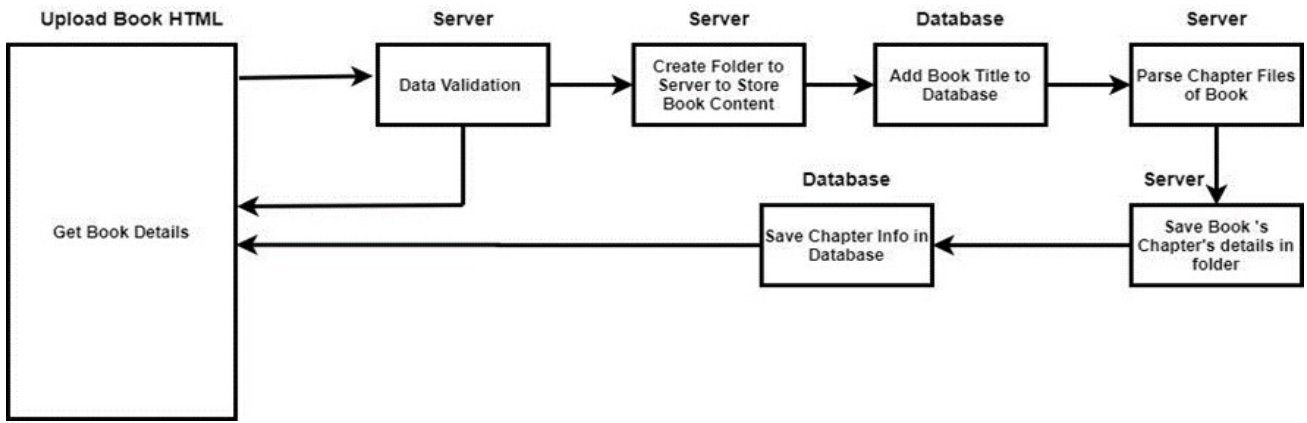


Figure 19. Upload Book

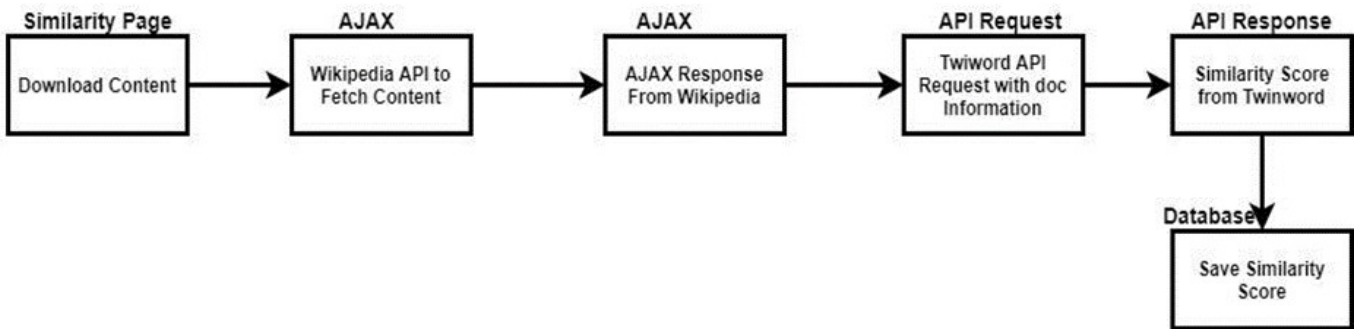


Figure 20. Check Similarity

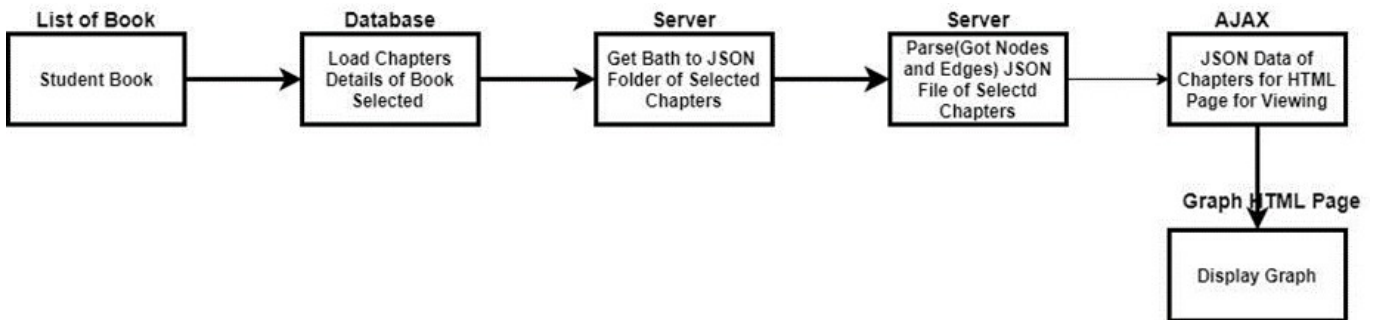


Figure 21. Student Dashboard

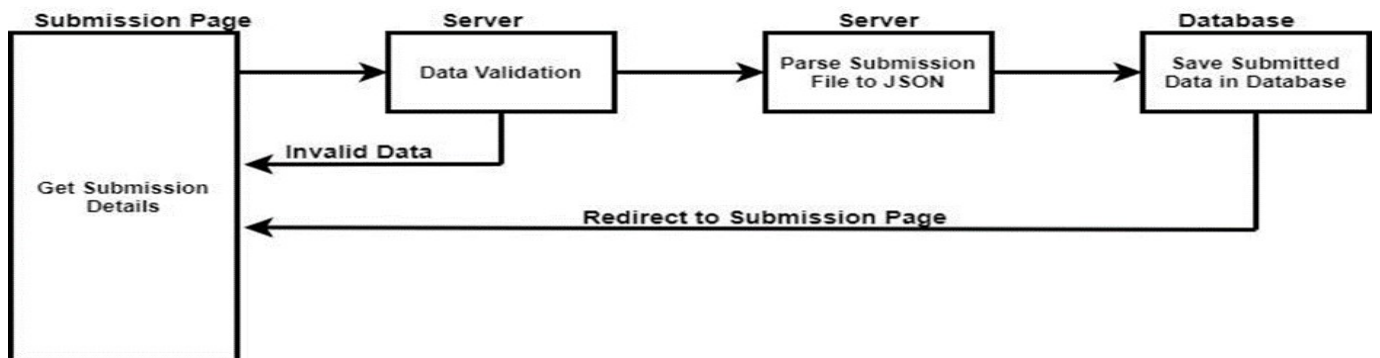


Figure 22. Add Submission

The Networkx and Pyvis libraries take in the generated JSON file of the chapter as input and displays the graph as a concept map on the frontend for students to view and interact.

Pending Submission: Teacher will be able to see student submission with their student's name, book name, chapter's name and submission date. Student submission function is the same for a teacher, they draw the graph in draw.io, import xml file format and upload onto the system. The system will convert this file to JSON and the teacher online will be able to review that graph. Submitting graphs can be check by teachers using text similarity method.

For checking similarity, we collaborate with twinword and use API to check teacher and student's graph text similarity and score them on the bases of text analysis.

Student Dashboard: In student's dashboard, students can view concepts maps of books and their chapters as well. Every node of map will have concept that concept will have Wikipedia link which will show the short summary of that concept and video link as well. Student will be able to learn from these concept maps. After learning from those concepts, students will upload their graphs, for adding submission student needs to add teacher name, book name, and

chapter name, upload Xml file, and submit it to teacher after submitting that file teacher will be able to check that student's graph.

Pending submission: In this section those students who submitted their graph and the teacher did not check will show pending in the submission list. The pending section contain information of teacher name, book name, and chapter name and submission date all information will store in database.

Checked Submission: When teacher will check student-pending submission those checked submission would show the score in checked submission. That checked submission contains teacher of that subject, book name, chapter name and score with submission date and it will store in database.

The User: We use teacher and student as a user, our system mainly developed for education system to help them. Student have different way different learning styles and levels of understanding. This learning tool show how relationship between different ideas so student can work through them. User will upload graph that graph will be draw in Draw.io.

Draw.io file format: Draw.io documents contain vector picture files that are save in the industry-standard XML file format. Diagrams.net created it, and it allows you to save schematic information in a manner comparable to Microsoft Visual studio. Draw.io is an online program that allows you to create, edit, and import and export diagrams in a variety of formats.

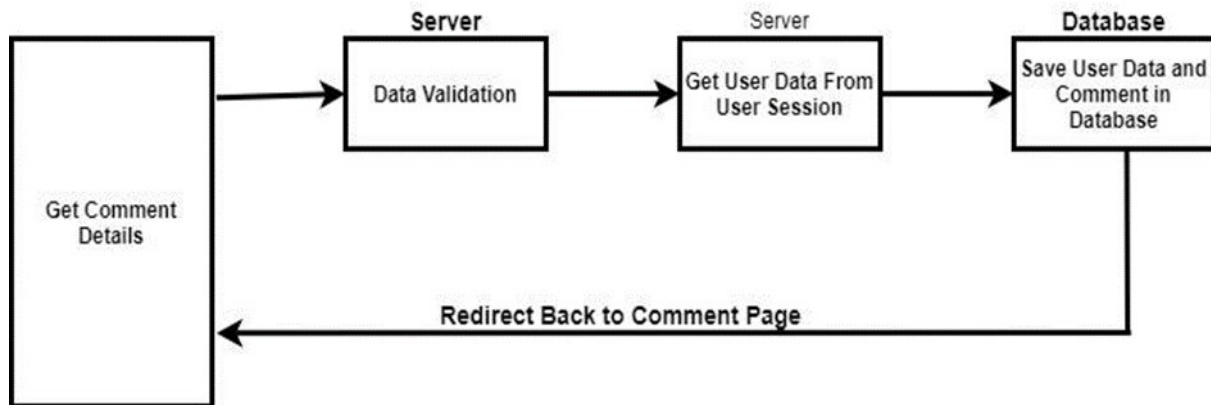


Figure 23. Post-Comment

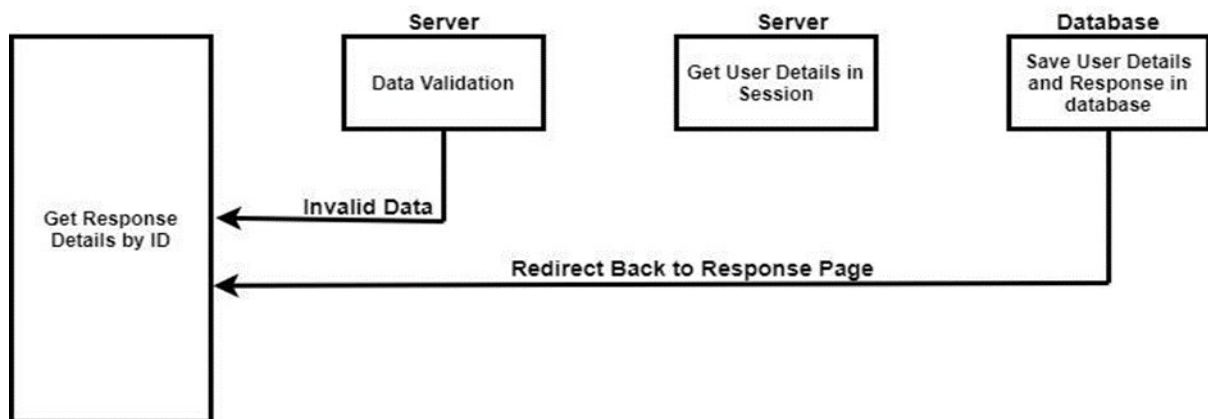


Figure 24. Response to Post

Cumulative Score: Students are submitting each chapter graph and getting each chapter score individually so, book's chapter in cumulative score student can see total score of book's score by adding up all chapter's score.

Extra Resources: After learning from the teacher's resources, students can upload extra resources, which will related to their study, and they can share with other students. Students will be able to download and view those resources and can get more knowledge that can help them to draw informative and readable concept map and get good score. Students can post their comments and everyone can see those comments and can response back. If student have some information to share regarding any node text or topic, they can poston comments it will help other students to learn more knowledge. They can chat with their class mates ask help if they are not able to understand some topic.

Front-end Logical Design: This is model design of the entire system; in this section, the researchers explain how all components interact with each other;

The program built on the mxGraph drawing library, which offers dynamic graph and plotting apps that work in every popular browser. The following is a basic diagram generated by the Draw.io.

Graph Description Language: Graph description language in XML can be used as an interchange format for graph drawing and visualization packages. The generality and rich features of XML make it possible to define an interchange format that not only supports the pure, mathematical description of a graph, but also the needs of information visualization applications that use graph-based data structures. The following code segment shows the simplest possible use of draw.io. It describes a graph with a parent node with two other nodes and simple edges: This example shows the basic style of a graph description in draw.io. It resembles the way HTML document is written using different tags. The first line is required in all XML files. An XML application based on the draw.io.3rd and the last lines enclose the real content of the files. The real content begins with line number 4, which defines a full graph. We delineate graph definitions with the <mxGraphModel> tag so that a file can contain several graph definitions. The body of the graph description is straightforward: two nodes and a connecting edge are defined; all the nodes are defined by the <mxCell> tag.

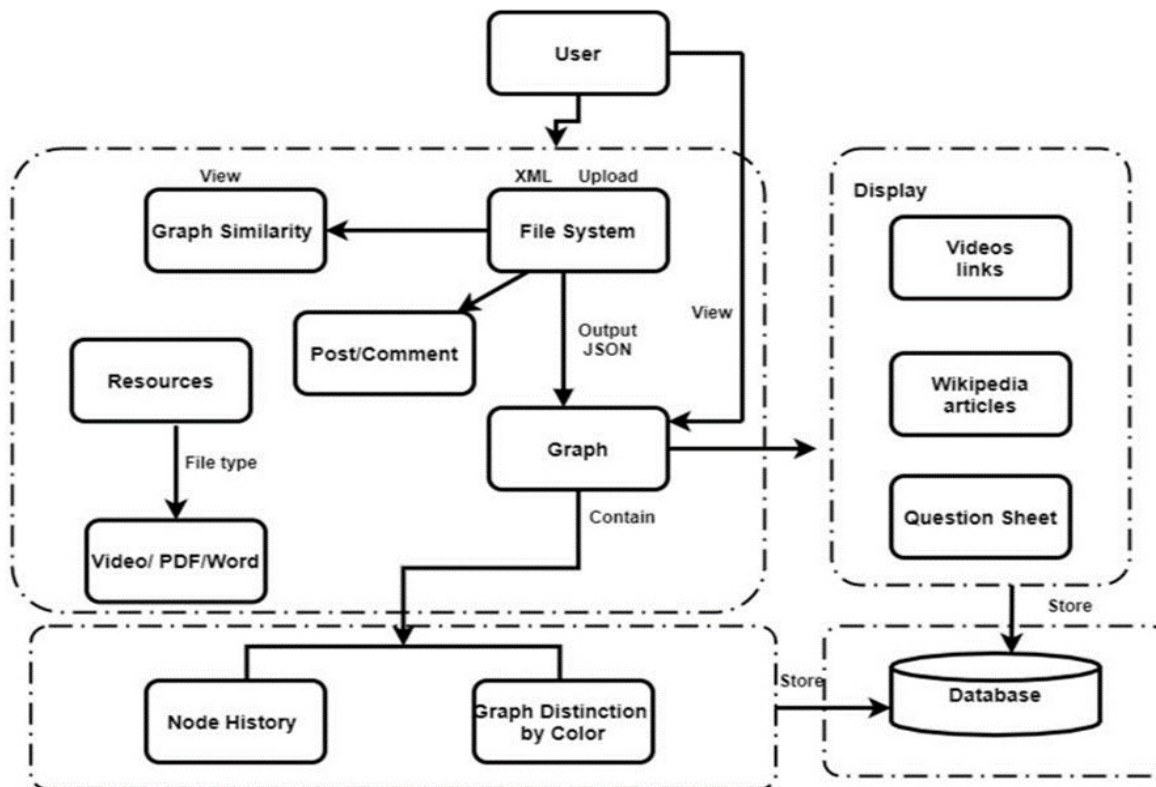


Figure 25. System design

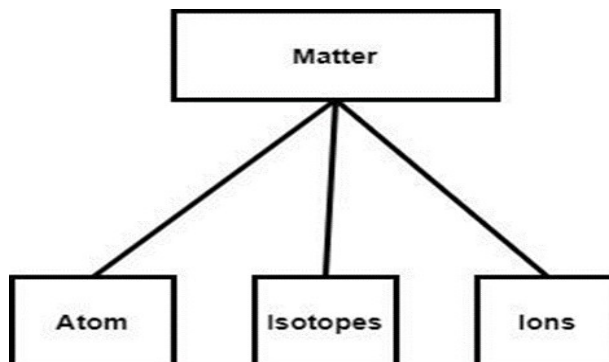


Figure 26. Simple diagram generated by draw.io

```

1  <?xml version="13.9.9"?>
2  <!DOCTYPE MxGraphModel SYSTEM "file:draw.io">
3  <diagram id="" name="Page-1">
4  < mxGraphModel >
5    < root >
6      <mxCell id="1" parent="1" value="<b>Matter</b>"> </mxCell>
7      <mxCell id="" parent="1" value="<b>Atom</b>" target=""> </mxCell>
      <mxCell id="" parent="1" value="<b>Isotopes</b>" target=""> </mxCell>
      <edge source="first" target="second"/>
8    </ root >
9  </
mxGraphModel>
10</diagram>
    
```

Figure 27. Graph Description Language

Also, define attributes for each of the elements: these are key-value pairs. The MxGraphModel defines the set of allowable attributes for each element and a validating parser will check those. It is partly through those attributes that additional information about nodes, edges, or graphs be convey to the application. For example, the <mxCell> tag can use keys such as id, parent, value, style, target to capture further features that present the structure of the graph.

This example shows the basic style of a graph description in draw.io. It resembles the way HTML document is written using different tags. The first line is required in all XML files. An XML application based on the draw.io.3rd and the last lines enclose the real content of the files. The real content begins with line number 4, which defines a full graph. We delineate graph definitions with the <mxGraphModel> tag so that a file can contain several graph definitions. The body of the graph description is straightforward: two nodes and a connecting edge are defined; all the nodes are defined by the <mxCell> tag. Also, define attributes for each of the elements: these are key-value pairs. The MxGraphModel defines the set of allowable attributes for each element and a validating parser will check those. It is partly through those attributes that additional information about nodes, edges, or graphs be convey to the application. For example, the <mxCell> tag can use keys such as id, parent, value, style, target to capture further features that present the structure of the graph.

```

1<mxCell    ellid="0"/>
2    <mxCellid="1"parent="0"/>
3    <mxCellid="sEyHIZOREUxzUX1yMMed-2"value="&lt;fontstyle="&quot;font-
size:14px&
quap;html
4    ot;&gt;&lt;b&gt;Matter&lt;/b&gt;&lt;/font&gt;"style="rounded=0;whiteSpace=w
5    =1;strokeWidth=3;"parent="1"vertex="1">
6    <mxGeometryx="340" y="170"width="160"height="60"as="geometry"/>
    </mxCell>
mxCell14px& ell    id="sEyHIZOREUxzUX1yMMed-3"    value="&lt;font
quap;html= size:ot;&gt;&lt;b&gt;Atom&lt;/b&gt;&lt;/font&gt;"style="rounded=0;whiteSpace=w
1    ;strokeWidth=3;"parent="1"vertex="1">
7
    <mxGeometryx="260" y="350"width="80"height="60"as="geometry"
/>
8    </mxCell>

```

Note that the attribute parent="0" present the parent node and the child-node are present by parent="1". The id uniquely identifies each node and all nodes with the same parent value "1" indicates that they are connected to the same parent node. Further feature that give a clear graph presentation have attributes such as font, vertex that capture the edges and the <mxGeometry> tag gives the position of a node.

File System: In file system, all uploaded files will be stored with their name and file type, it will help user to store and retrieve graphs easily. A file system, often known as file management or FS, is a method of controlling what and how information is secure on a disk drive. A logical storage part encodes data that are divide into groups called directories. It is conceptual to a user and computer-related; as a result, it handles the internal activities of a disk. The folders can contain files and extra directories, without file system, stored graphs would not be isolated into individual files and would be difficult to identify and retrieve.

Graph: User will upload their file in XML format in the system and the system will convert XML to JSON. The conversion is done in order to display our graph in the browser and the browser easily supports JSON file type. JSON documents are small, text-based, and understandable by humans, and they can modify with a text editor. The JSON file type is used to send data between a sender and a receiver. JSON's terse semantics result in code that is easier to follow. XML is slower, because it is design for a lot more than just data interchange, cross-browser XML parsing can be tricky.

Video Link: Each node on the graph will contain video information related the topic, which will be displayed in our tool when any

particular node is clicked. We use Baidu cloud storage system where the teacher uploads a list of all videos on the storage system. Students can access and watch video according to the chapter and based on the node clicked.

Wikipedia Article: Each node contains the information in text form, which we use to retrieve Wikipedia articles in a concept map. Each node in the Concept map can be linked to a Wikipedia article linked. This is the code snippet for retrieving data using the Wikipedia articles.

Question Sheet: Each graph is attached with a question sheet, which teachers prepared for students based on the graph. After a student learns based on the graph and watching videos, the student will fill this sheet and the teacher will assess the student's learning behavior. The teacher can make a list of students who are having difficulty with specific topics and then work with them individually as a group. This enhances the student's focus on their weak spots.

Graph Similarity: Teacher graph will already store in database and when student will upload their graph teacher will be check the similarity between his graph and student graph using twinword text similarity. Cosine similarity is one of the metric to measure the text-similarity between two documents irrespective of their size in Natural

language. Cosine similarity is a statistic that measures how similar texts are regardless of size. It computes the cosine of the angle formed by two variables displayed in a three-dimensional space. The cosine similarity is helpful because, even if two comparable documents are separate by the Distance measure (due to the size of the document), they may still be orientated closer together. The greater the cosine similarity, the shorter the angle.

The cosine of two non-zero vectors can be derived by using the Euclidean dot product formula:

$$A \cdot B = \|A\| \|B\| \cos(\theta)$$

Given two vectors of attributes, A and B , the cosine similarity, $\cos(\theta)$, is represented using dot product and magnitude as

$$\text{cosine similarity} = S_C(A, B) := \cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\| \|\mathbf{B}\|} = \frac{\sum_{i=1}^n A_i B_i}{\sqrt{\sum_{i=1}^n A_i^2} \sqrt{\sum_{i=1}^n B_i^2}}$$

As we include more words from the document, it is harder to visualize a higher dimensional space. However, we can directly compute the cosine similarity using this math formula.

Resources: Students will learn from teacher's resource (Wikipedia articles, videos). In the end they will upload and share their knowledge with other students by uploading their own resources in their accounts. Other students can access that knowledge and download that and can read later. It will upload by student name students and teachers can

see those resources and can also assess which student is sharing those students can get extra point in their final scores.

Chat: Students and teachers can share their views on concept maps by commenting on those graphs and have some discussion in comment section. If one student does not understand some point or he/she want to share more information regarding to specific topic they can share in comment section. Student can communicate at the spot with teacher and student if they do not understand some point or they need help, will get immediate response.

Testing and Evaluation: In test section, we will focus on the test results and feedback received from testing by both the developer and the users. No developed system is flawless; thus, testing is critical to the success of every system development. Testing is often divided into two phases. The first step is system engineering, which occurs during module development. After the system is completed, the second process is system testing, which confirms that the entire collection of system is working properly.

and development phase, a test was carried. A technique, function, process, or structure can be considered a component in unit testing. Each experiment scene was developed separately and tested individually for feedback before the whole system was merged together. We focus on that all functions of system, and internal structure or code of our system is working properly. Unit testing is important because we can find more defects at the unit test level and fix those all bugs before heading to next phase. There were no automated testing tools used throughout the testing of the script. First, we make the code run to accept XML file and convert into JSON because the file needs to show on webpage at first. Next stage of system was to test that Wikipedia articles if they are properly linked to concept map. We did not face so much big problem while doing other functions after unit testing. Hence, we were able to move on to the text phase which is system testing.

System Testing: After the first unit test of the system, many changes were made to improve its performance. The system testing was performed after all the scenes, which consists of the login,

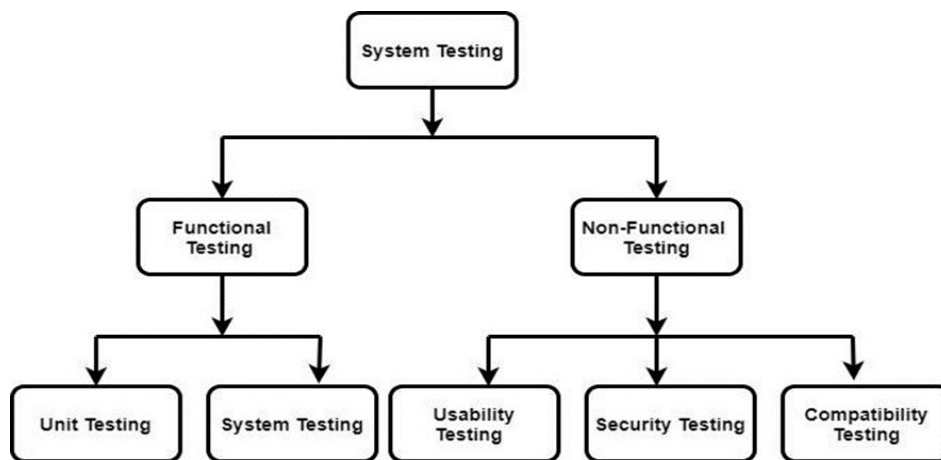


Figure 28. System Testing Types

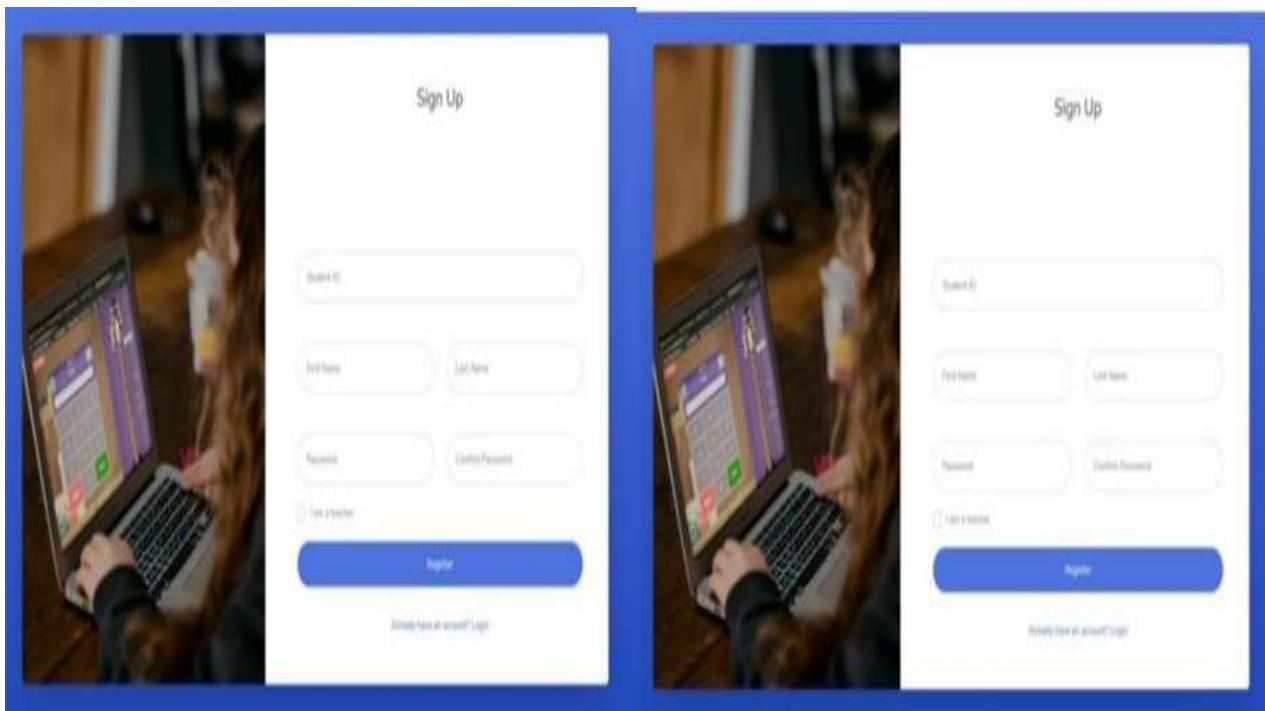


Figure 29. User registration page

Functional Testing

Unit Testing: We verify software testing that is done on each specific unit or component to test and fix in unit testing. During the design

registration, upload book, checking similarity, fetching Wikipedia articles, post comments, upload resources, upload question sheets. All scenes were merged successfully and could be accessed from each other. However, there were few problems noted during the system

test. Student could upload their graphs but teachers were not able to see for this bug,thus, we managed to solve and make it work as normal.

Registration: user needs to register before using the system. If the user is a teacher, he/shewill enter his/her user information according to his/her details and if the user is a student, he/she will enter the details according to his/her information.

- Teacher's registration pageb. Student's registration page

Login Page: Afterregistration, the user can enter registered information and login the system. If he is a teacher, he will check button and enter username and password and if user is student, he will enter student Id and password.

- a. Teacher's login pageb. Student's login page



Figure 30. User login page

Student Submitted Graph: Student's submitted graph will show on teacher dashboard as seen the figure below.

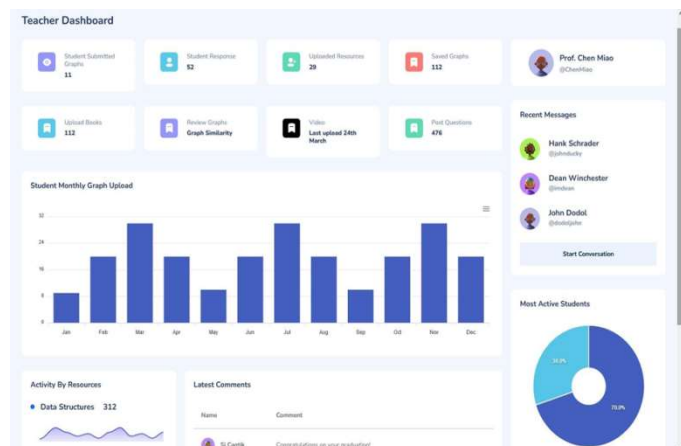


Figure 31. Teacher dashboard with student name book name and chapter name teacher can view student concept map

Pending Submissions				
Student	Book	Chapter	Submission Date	Action
Sam agyemang	Bio	Biology	20-04-2022	View Graph

View Graph: Teacher can view student graph by click view graph.

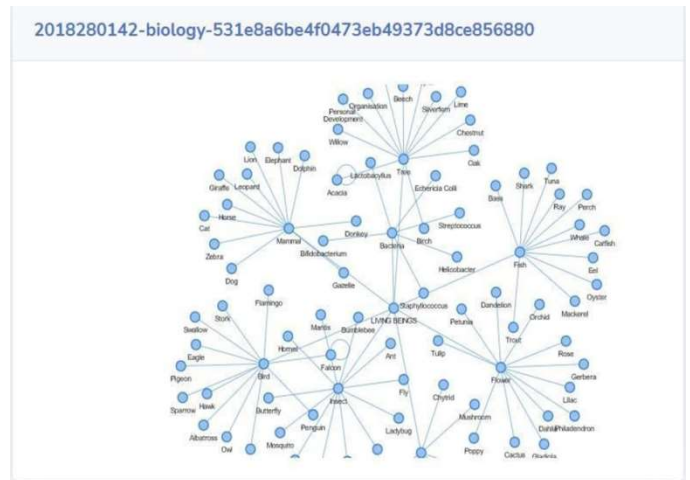


Figure 32. Student's concept map

Upload Resources: Teacher and student can upload resources with their captions it can be video, word file, pdf file.

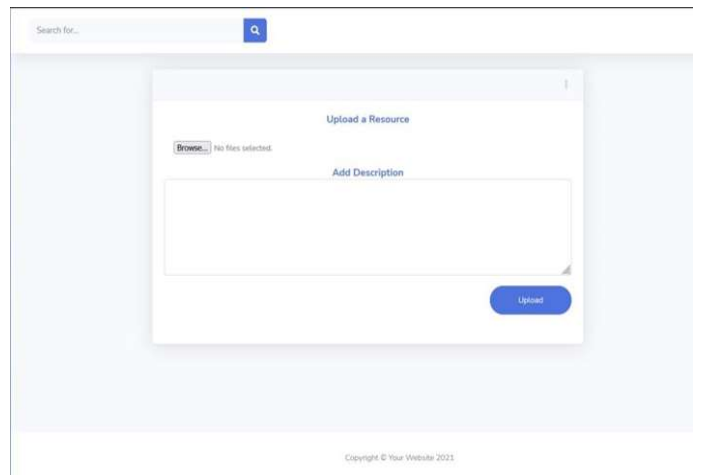


Figure 33. Page for uploading resources

View Other Resources and Download: Users can also view and download other users' resources which they think it will help them in study.

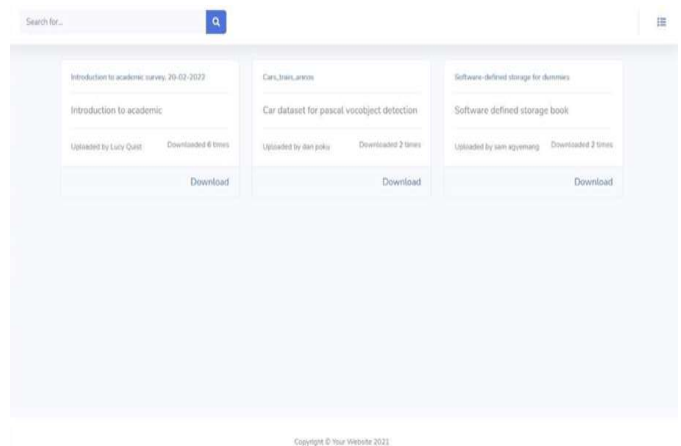


Figure 33. Other user accessible and downloadable resources

Saved Graph: All uploaded chapters will show under saved graph.

Teachers can upload books with chapters name and xml file and upload in system as shown in Figure 35: (a) and they can equally view books as shown in Figure 35: (b) below:

When student will upload their concept maps teacher will see with student name book chapter name date and in action teacher will check similarity of his concept map and student map and it will show the score. Teacher text will extract and student graph text will extract and compare their similarity and score can be seen.

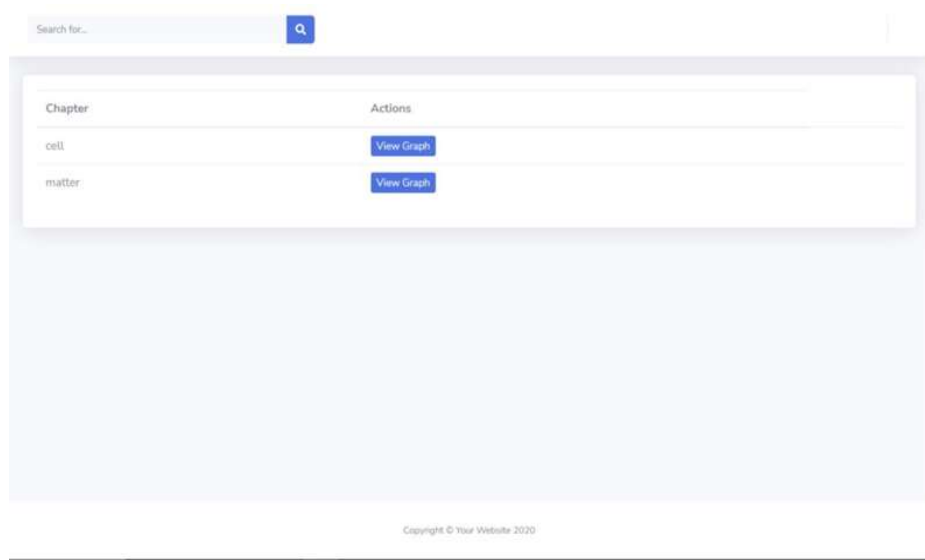


Figure 34. List of all available graphs

Upload book

View all uploaded books

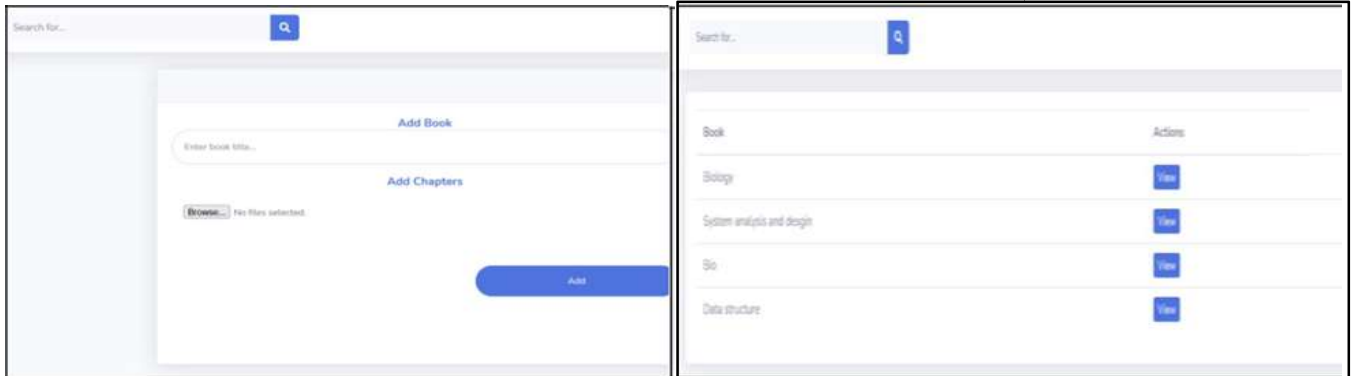


Figure 35. Upload & View Book

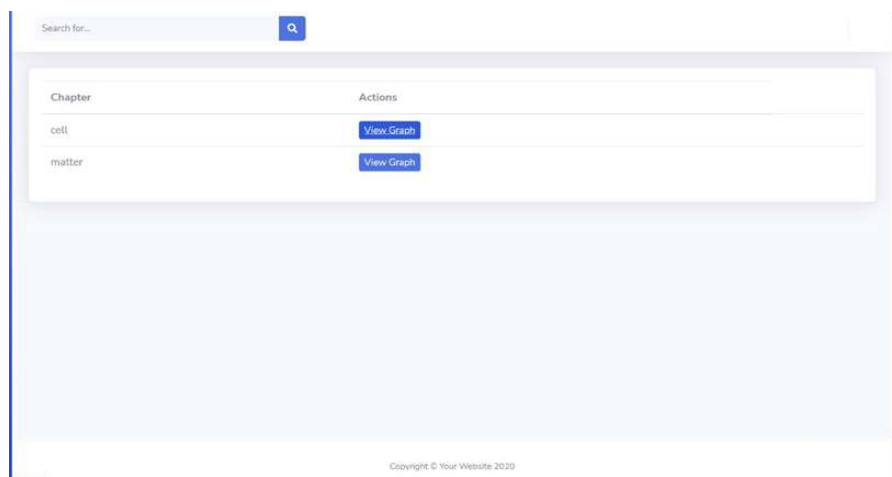


Figure 36. Book chapters

Books will have chapters inside it so they can click on view graph and view concept map. This is example of teacher upload concept map and when user will click on node it will show the Wikipedia article on the bases of node text. They can also share more information in comment section and other users can view and comment and also reply those comments.

Upload video: Teacher can add link of Baidu cloud where he already added all videos and attach link for student to view.

Student Monthly Graph upload: It shows the number of students who submitted in each month and overall class progress. In student's chat what they are discussing teacher will be able to see on side of his window and can answer by student.

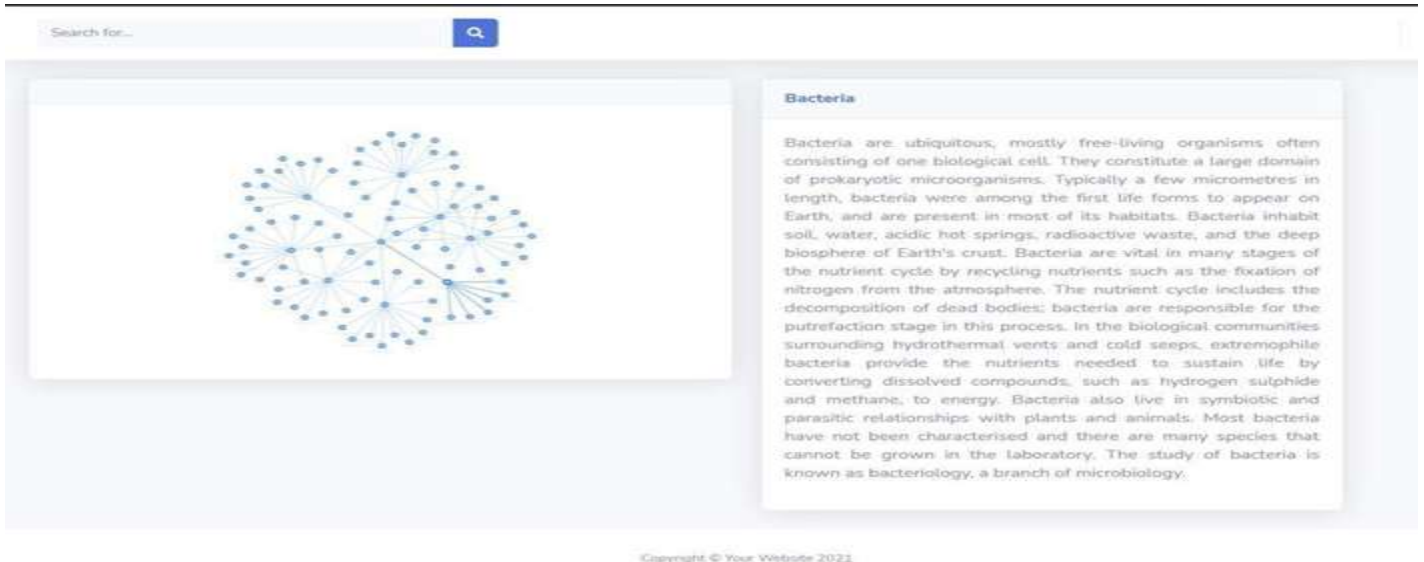


Figure 37. Concept map

Pending Submissions				
Student	Book	Chapter	Submission Date	Action
Sam agyemang	Bio	Biology	20-04-2022	View Graph Check Similarity

Figure 38. Student Submission

[Back](#)

Similarity Score for Cell Dan paku

0.78%

Original Graph Data

emerged in the Archaea or as a sister of the Asgard archaea. Eukaryotes represent a small minority of the number of organisms; however, due to their generally much larger size, their collective global biomass is estimated to be about equal to that of prokaryotes. Eukaryotes emerged approximately 2.1–1.7 billion years ago, during the Proterozoic eon, likely as flagellated phagotrophs. A prokaryote is a single-celled organism that lacks a nucleus, and other membrane-bound organelles. The word prokaryote comes from the Greek πρό and κόρυον. In the two-empire system arising from the work of Édouard Chatton, prokaryotes were classified within the empire Prokaryota. But in the three-domain system, based upon molecular analysis, prokaryotes are divided into two domains: Bacteria and Archaea. Organisms with nuclei are placed in a third domain, Eukaryota. In the study of the origins of life, prokaryotes are thought to have arisen before eukaryotes.

Student Graph Data

Mammal Insect Bird Fish Tree Bacteria Fungi Flower Gazelle Lion Dolphin Elephant Cat Giraffe Dog Donkey Leopard Horse Zebra Ant Bee Hornet Fly Termite Mantis Ladybug Butterfly Flea Mosquito Spider Bumblebee Eagle Hawk Falcon Sparrow Stork Flamingo Penguin Owl Pigeon Swallow Pelican Albatross Perch Mackerel Tuna Shark Whale Bass Oyster Eel Ray Trout Catfish Helicobacter Bifidobacterium Echericia Colli Staphylococcus Streptococcus Chytrid Zygomycota Script Writing Ascomycota Basidiomycota Mushroom Lichen Bread Mold Yeast Zygosporangium Truffle Rose Philadendron Dahlia Petunia Cactus Tulip Lilac Dandelion Poppy Gerbera Orchid Gladiola Falcon Organisation Oak Birch Silverfern Personal Development Pine Lime Chestnut Beech Poplar Willow

Figure 39. Checking Similarity

Enter video link...

[Add Video](#)

[Add](#)

Figure 40. Attach video

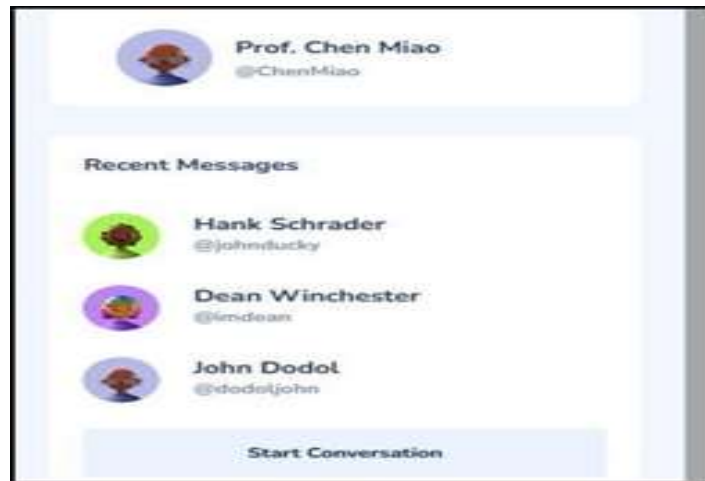


Figure 41. Check messages

It also shows on teacher dashboard students who submitted the graph most in percentage.

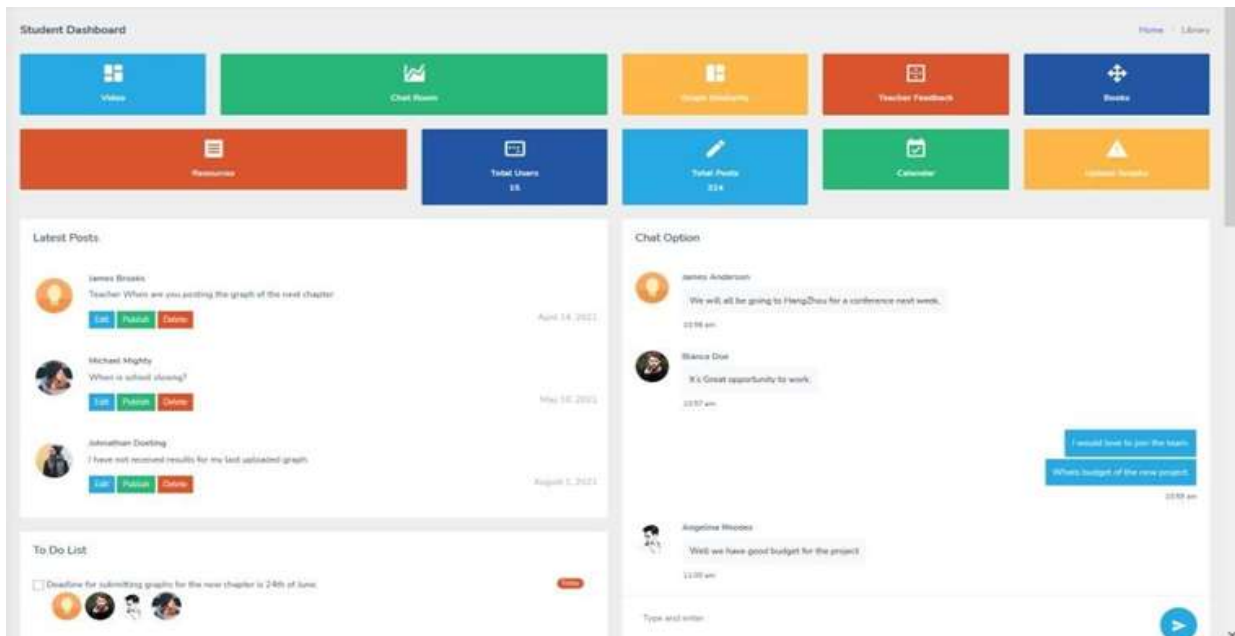


Figure 42. Student Dashboard

When student click on video it will take them to teacher cloud and they can enter the code which teacher already provide in class.



Figure 43. Video access



Figure 44. Student can login can choose book and can view videos

Student can also view book and graph of the teacher’s uploaded chapters.

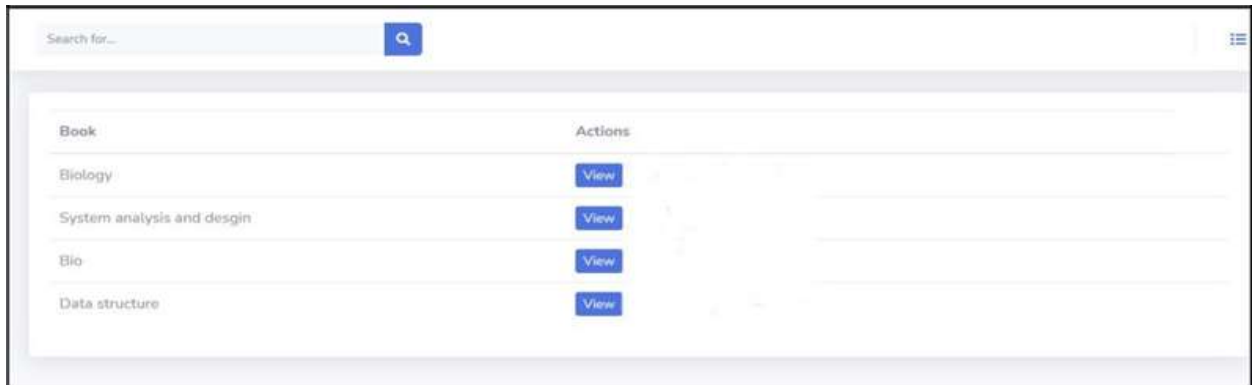


Figure 45. View Books

Student can also check that book’s chapters cumulative score.

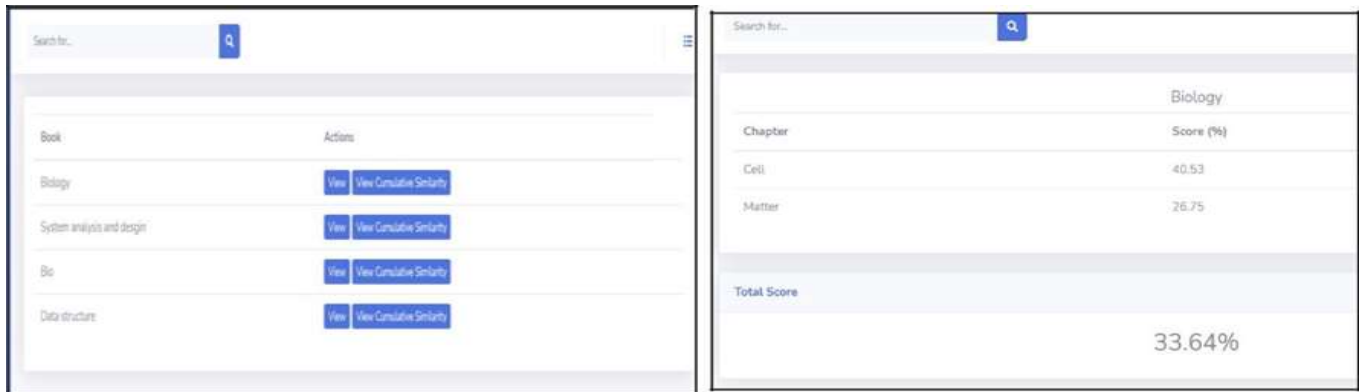


Figure 46. Results/ Score

Student can also view book chapters with their graphs.

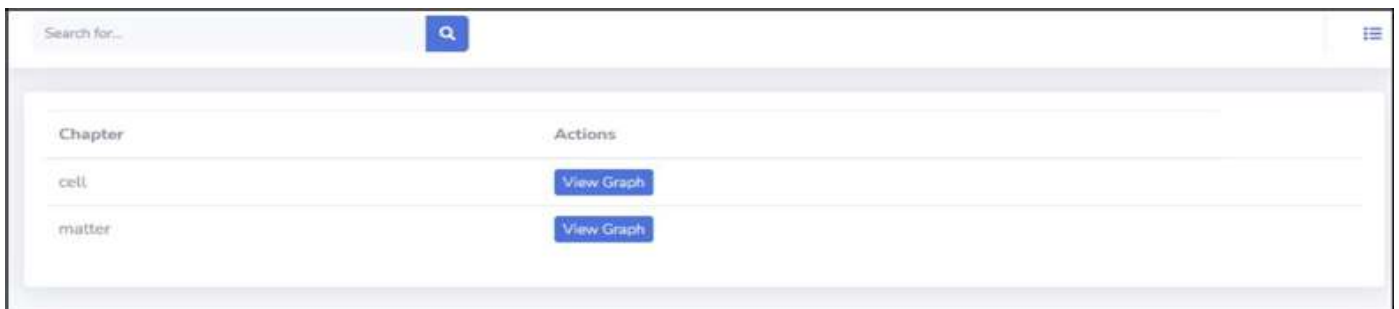


Figure 47. View Chapters

Student can also view graphs click on nodes and Wikipedia articles will show on side of graph, also comments if he wants to know more about some nodes so other students and teachers can answer.

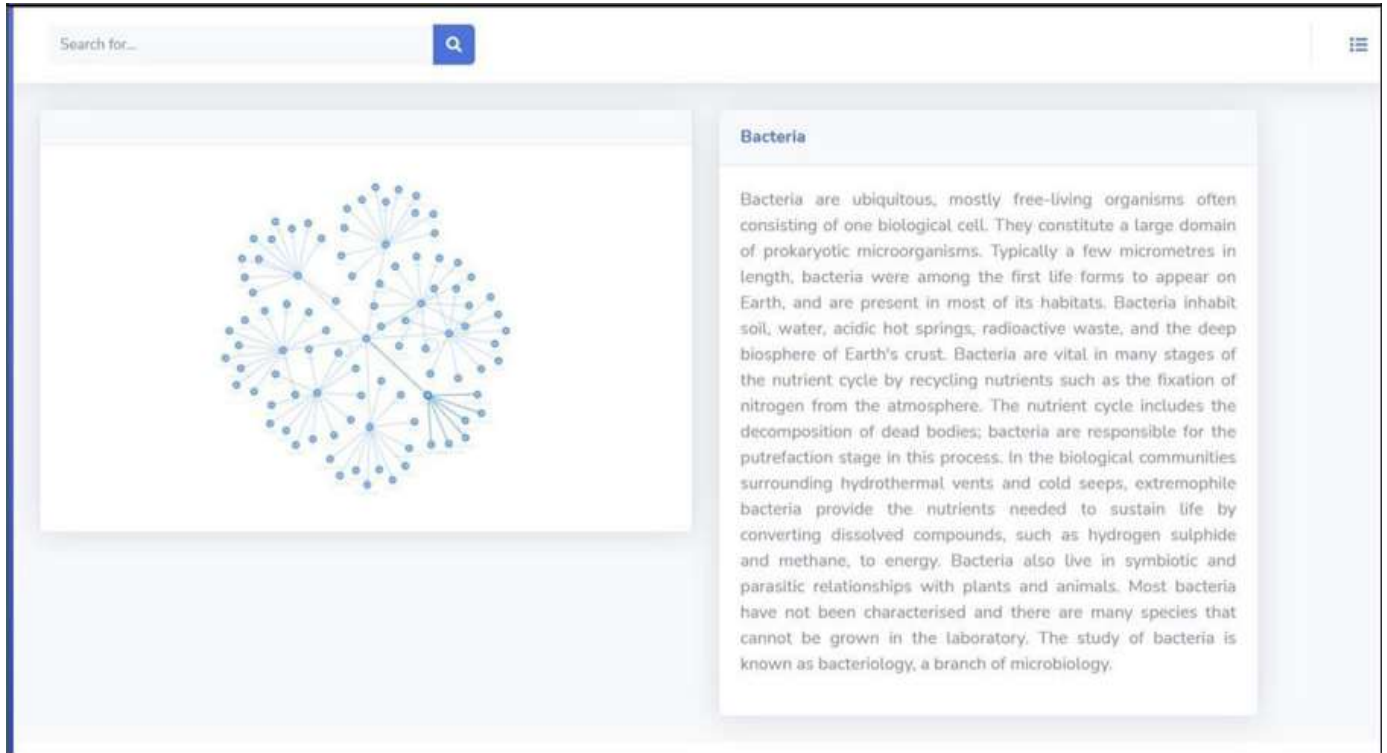


Figure 48. View Graph

Student can add submission with teacher name book name, chapter name and upload draw graph in system.

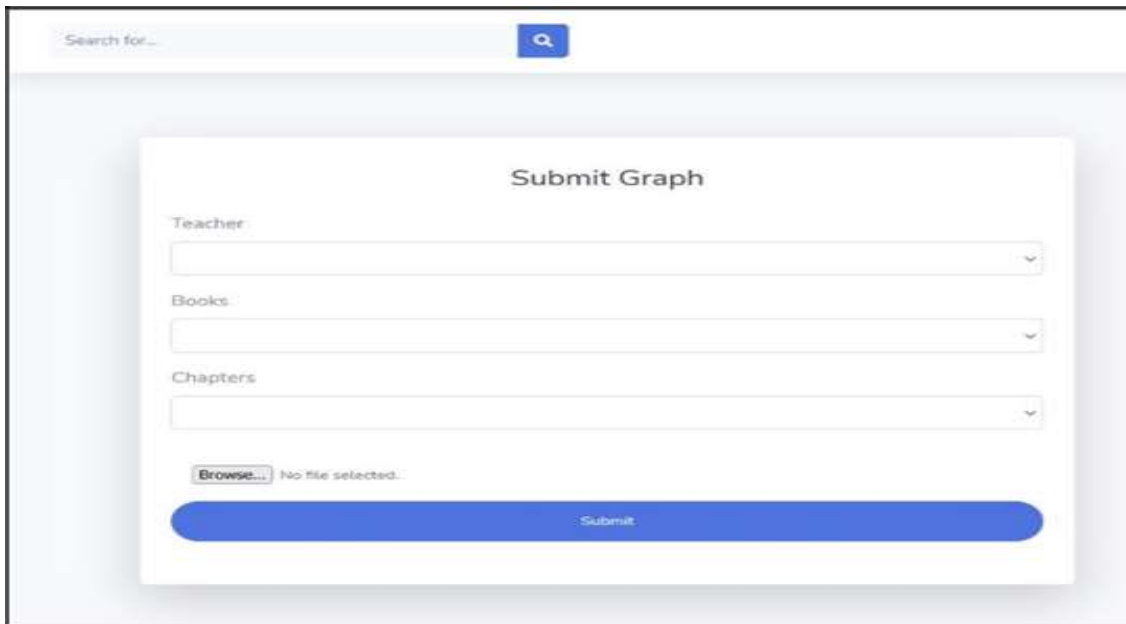


Figure 49. Upload Graph

After submitting, it will automatically show in pending submission.

Pending Submissions				
Student	Book	Chapter	Submission Date	Action
Sam agyemang	Bio	Biology	20-04-2022	View Graph

Figure 50. Pending Submission

When teachers will check student's graphs similarity it will show score name of teachers book name with chapters name and submission date.

Checked Submissions				
Teacher	Book	Chapter	Score (%)	Submission Date
Jack ma	Biology	Cell	40.53	12-10-2021
Jack ma	Biology	Matter	26.75	12-10-2021

Figure 51. Checked Submission

Teachers and students can also add post and comments on that they want to talk about so topics and can also share information.

By Sam agyemang

In the dark hours of our countries history, lingus provides the warmth and sunshine to see through this storm. Snarky Puppy for president 2020.

Replies

Sam agyemang
ola la

2022-03-17 16:42:20

Write Something

Reply

Figure 52. Chat Room

User can also view other user's comments and reply.

Posted by Dan poku 2022-03-16 15:36:10
Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularized in the 1960s with the release of Letteraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like Aldus PageMaker including versions of Lorem Ipsum.
View replies

Posted by Dan poku 2022-03-17 16:37:30
Snarky Puppy is an interesting band
View replies

Posted by Lucy quist 2022-03-17 16:38:35
Gbaegbae is not good
View replies

Posted by Sam agyemang 2022-03-17 16:42:08
In the dark hours of our countries history, lingus provides the warmth and sunshine to see through this storm. Snarky Puppy for president 2020.
View replies

Figure 53. View Comments

If any user has some extra resources, which they want to share with other users, they can upload it here.

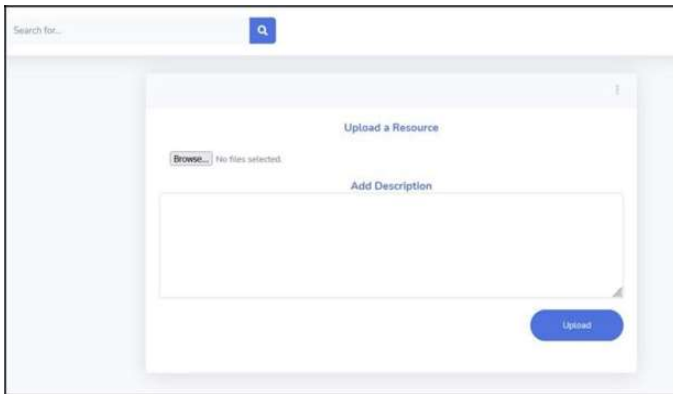
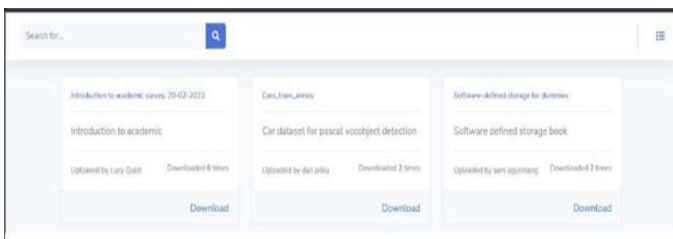


Figure 54. Upload Resources

Users can view other users' resources and download them.



Non-functional Testing: Testing that is not functional It helps to decrease production risk and expense related with non-functional components of the system by increasing usability, efficiency, maintainability, and portability of our system. Optimize the installation, setup, execution, management, and monitoring of the system. Improve and expand overall understanding of the system's behavior and technology.

Usability: Testing also known as User Experience (UX) Testing, is a testing method for measuring how easy and user-friendly a software application is. A small set of target end-users, use system to expose usability defects. Usability testing mainly focuses on user's ease of using application, flexibility of application to handle controls and ability of application to meet its objectives. Minimize unnecessary learning-related frustration so learners can learn and deal with unavoidable frustration. Teachers and students can interact easily and naturally with the system. Minimize system-related frustration and allow learners to use them for their intended purposes without unnecessary hassle, delay, or extra steps. No prior training is required to use our system. Learners can benefit from and use all the tools provided by the system. Interaction with the system causes positive emotions. Students can download extra resources easily by only one click and can save for later study. In the chat section teacher can answer by mentioning student and communicate when student need help. Teacher can keep an eye on students to check the discussion in group must be some educational purpose.

Security: Security Testing is a type of Software Testing that uncovers vulnerabilities, threats, risks in a system and prevents malicious attacks from intruders. The purpose of security Tests is to identify all possible loopholes and weaknesses of the software system, which might result in a loss of information. Here is no network and system weaknesses no one can hack our system; it is surely secure system. Here are some security measures that makes our system more secure. Detecting unauthorized entry no one can login on teachers account and student account only the owner of the account can login account using id/username and password. All code is saved on secure server only developer have access to it both teacher and students have no control over it. It has session timeout of 5 minutes; this prevents an attacker from accessing the system from a computer that has been logged on unattended for some time.

Compatibility Testing: While testing a system, we test its compatibility factors. We make sure that the system works perfectly with each device and browser it is supposed to work with. Therefore, compatibility testing is a long process, but it has to be followed aptly to make a successful system. Here are some compatibility to run this system

Ram 12 GB RAM but 1 Gig

Network Internet access at 56k or above

Display Screen resolution min 1024 x 768

Web browser Internet Explorer 7.0+, Safari 3.0+, Firefox 3.0+ (Browser must be Java and JavaScript enabled)

OS Windows 10, Vista, or 7; Mac OSX 10.4+

CONCLUSION

The study's results and conclusion are presented in this chapter. The study's findings are based on the results and discussion of the data gathered during the implementation. The recommendations are given to the teachers, students and also the future researcher in discussion. The main research direction of this thesis is concept map-based tools for student e-learning. among many types of maps which has been used in education system but we use concept map. Concept map is a network of interconnected concepts, good for knowledge and content gap analysis and more logical map. The system handles analysis, design, development, implementation and evaluation of concept map-based tools for student e-learning, with a user- friendly knowledge acquisition environment at all levels of education for potential students and between them. Provides a bridging gap between teachers and students. We explain the background of research and the meaning of the knowledge map, focusing on the introduction of the concept map, which is a special knowledge map for education. We analyze the importance of e-learning and the background and importance of concept map technology research in Japan and overseas, and introduce the growth and results of concept map structural technology research in detail. E-Learning theory and technologies that explain various forms of learning and demonstrate how student learn from those tools. We additionally talk about how the technologies let students acquire knowledge and instruction from certified teachers while seated anywhere else in the globe. Following that, discuss concept map-related tasks and resources that facilitate concept map-based learning. A concept map is a novel type of learning in which students may design their own maps to demonstrate their grasp of various topics and the connections between them. It also describes the goal of this study and the many Python library approaches utilized to complete it. The key purpose and emphasis of this research is to figure out what will help in the creation and design of this instrument, to begin, we explore concept map-based learning aid students and teachers in revision, reinforcement learning, and identifying misunderstandings. Learning via Wikipedia articles, video tutorials, and assessing student learning by comparing student and teacher graph similarity are all options. Teachers will be able to examine students' node histories in order to measure their learning behavior. The services that the program must deliver are functional requirements (FR). Following is a representation of a software system and its components. Functions are simply inputs to a software system, as well as their behavior and outputs. Non-functional requirements (NFRs) system security, reliability, performance, maintainability, scalability, and simplicity of use.

Through the numerous backlogs, these operate as limits on the system's approach. Stakeholders who will utilize this tool and refer those groups of individuals who will be affected by the tool's progress. Teachers, students, institutions, and business are among our stakeholders. We show the system architecture of our system, which is the theoretical framework that illustrates a system's structure, performance, and other aspects. An architecturally specification is a concise overview and representation of information that is arranged in such a manner that it can be used to explain about the platform's components and functions We use Model View Controller (MVC) to explain design pattern of our system it divides user interface three

consistent elements, which are logic of our system. In the end, we explain design constraint. We also depict the system's deployment foundation in a system design. Each system user can use the interface is very easy. The user can begin by logging in and progress through the system's functions (upload concept map of book's chapters, teachers and student concept maps similarity, students' comments, cumulative score, upload extra resources, map distribution by color, assessing student behavior form comments) before logging out. All functions are linked to one another, and they all work together. There are some technical terms to run this system; if teachers and students want to run a system, they must have these specifications in their systems. Backend logic design of our system, we use various libraries, packages PyCharm, Html, CSS, JavaScript, and tools to implement our system user must full fill these requirements 12 GB RAM but 1 Gig, internet access at 56k or above, screen resolution min 1024 x 768, Internet Explorer 7.0+, Safari 3.0+, Firefox 3.0+ (Browser must be Java and JavaScript enabled), Internet access at 56k or above Windows 10, Vista, or 7; Mac OSX 10.4+. In the end did testing of our work and show results when also teachers and students evaluations.

Limitation and Future Studies: In future work developer can also develop a drawing tool for users to draw concept map and upload automatically. Second suggestion for future work instead of using one by one student's map similarity teacher can also check all students CM altogether and rate which CM was more related to teacher's CM. In end uploading CM by chapters teacher can also combine these all chapter's CM and upload whole book CM.

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