

Development of a research project repository

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ABSTRACT

The advances of technology resulting in the proliferation of mobile devices have changed the way we live and have necessitated the restructuring of the educational system. This can be employed to aid student's participation in research studies. This study aims at promoting-research in universities amongst students by giving them the opportunity to exercise their scholarly abilities, easy access to research projects carried out by other students, collaboration with other students with similar research inclinations as well as gain visibility before the school management or companies interested in granting scholarships to outstanding works. This project is implemented using JavaScript, HTML and CSS for the front-end; Node.js, a JavaScript framework for the back-end and MongoDB for the database. It is a web application that enables the students to upload their research works, view the research of others and collaborate with peers. This system has a high potential to enhance student participation in universities' research studies.

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1. INTRODUCTION

Over the years, there has been a rapid increase in the use of mobile devices as users derive pleasure in them in various ways such as portability and adaptability [1, 2]. According to [3], availability of telecommunications services provide easy access to information, but in recent time, mobile devices like smartphones are used more frequently for various applications other than telecommunication [4]. Mobile device has unique and exceptional application in learning activities, although, conventional learning activities still play an important role in learning process, it suffers from limited use of time [5]. Hence, different sectors of society are adopting the use of mobile device technology for a wide range of services and this trend has necessitated the restructuring of the educational system.

Mobile learning is referred to as the use of mobile or handheld IT devices such as mobile telephones, laptops, etc. in teaching and learning [6, 7]. It is an evolution of distance learning which involves learning that takes place between student(s) and tutor without physical contact [8]. The first explicit record of distance learning is an advertisement featured in the Boston Gazette of 20th March, 1728. This advert was a call made by 'Caleb Phillips, Teacher of the new method of Short Hand' to people interested in learning short hand. Thereafter, some other attempts surfaced a century later from Isaac Pitman who incorporated feedback system. The system allows tutor to receive assignments from student(s), correct them and send the corrections back to them via correspondence [9, 10]. Early attempts at distance education involved the use of mails and postal services. However, in the present day and time and with the advent of the internet, distance learning

involves online education (e-learning), with the proliferation of mobile devices bringing on board the concept of mobile learning (m-learning).

It is very interesting to note that although University education dates as far back as AD 859 [11] and there were no educational programs using the internet before 1996 [12], it is strongly believed that mobile devices could contribute positively to the learning process [13] and is now a key interest of educational practitioners at different stages [1].

Mobile learning has been defined as the form of learning aided by the use of mobile devices [14] such as smart phones, tablets, etc. It supports learners within and outside of the formal education system, enabling them to be active participants and not just passive recipients of knowledge [6]. Via the platform created by mobile learning, students and researchers can obtain access to useful resources without being physically present at the geographical location where such materials are stored in libraries [15-17]. This platform breaks through the constraints which the classroom introduces in terms of its temporal and physical boundaries, thus making information available and not restricted by time or place of learning [1]. Due to its many benefits, mobile learning has been widely accepted.

2. REVIEW OF RELATED WORKS

2.1. ResearchGate

With the furtherance of technology, academics have been given the opportunity to publicise their scholarly works and collaborate with likeminded researchers over long distances. These two processes however have been separated to a large extent as the publications could be done via links on author home pages, whereas the communication and collaboration take place on social media platforms such as Facebook and LinkedIn. Platforms like ResearchGate have been able to remove the separation as researchers are given the opportunity to disseminate their work as well as collaborate with researchers of similar interests, all on one platform [18]. Like Academia.edu, ResearchGate is an “intersection between social media and scholarly publishing” [19].

ResearchGate is an academic social networking service for researchers that is designed to aid access to academic research as well as provide a platform for collaborations [20, 21]. ResearchGate is the incorporation of a research project repository within a social networking site for researchers [18]. It was founded in 2008 by the physicians Dr. Ijad Madisch and Dr. Sören Hofmayer, and a computer scientist named Horst Fickenscher. ResearchGate has the following features:

- It is free to join;
- It gives researchers the opportunity to share their publications, whilst giving them the opportunity to follow the projects of others;
- It enables researchers to connect and collaborate with their colleagues as well as researchers with common interests;
- It provides a platform to ask and answer research questions; and
- It has a job finding utility where recruiters can get applicants from specific research areas.

ResearchGate allows researchers to track and follow the publications of other researchers in their field. It links them around specific topics. Researchers also have the ability to search and filter on a wide variety of topics [21]. A survey of 100 academics in an Indian institution showed that the common reasons researchers use ResearchGate are to find out about the research work of others, to be up to date, and to be involved in study groups [22]. Furthermore, when an online community is established, the members are encouraged to participate as they believe their peers or reference groups are interested in their participation [23].

ResearchGate also has a feature called RG score. This score is assigned based on the interactions which a user has with content and other factors such as views, downloads and citations [19]. Hence, ResearchGate is therefore, primarily a social networking site for academics [19] that has additional or supporting features. Limitations:

- There have been numerous complaints on email spamming; users receiving several unwanted updates in a day [21];
- Insufficient information is given as regards the age and discipline of the articles on the site. The usefulness of the publication statistics from the site as impact indicators is also unknown [24]; and
- Scholarly work is not all about sharing. It is also about competition and this would make researchers unwilling to release a great deal of their work [19].

2.2. Google Scholar

Google scholar was created in November, 2004 [25] by Anurag Acharya, [26] a distinguished engineer at Google with the aim of “making the world’s problem solvers 10% more efficient” [27] by providing quicker and easier access to scholarly articles. According to Acharya, “information had very strong geographical

boundaries” [27] and it is clear that Google Scholar is on the quest to solve this as much as it can. Google Scholar is a search service that was created exclusively for the search of scholarly documents [28]. It draws from university repositories, the publications of journals and websites which it has identified as scholarly [29, 30].

Before the advent of the online catalogue system, discovery of materials was a very tedious work. The rigor involved in accessing the needed data was not limited to the library system but as technology continued to advance, this challenge slowly began to become a thing of the past. Several attempts have been made to “decouple discovery and access” to the required information and according to Howland, Google Scholar did [31]. When Google was first made available to the public in 1998, it had over 25 million pages indexed and in 2005, it had well over 25 billion pages indexed and so, by the end of 2004, when Google Scholar was released, Google already had a lot of experience in discovery of data for users’ consumption [31]. Their prior experience in the successful management of Google’s Web search was pivotal to the establishment of Google Scholar. A study carried out by Howland and his colleagues on Google Scholar, comparing it with other databases based on the exclusivity of its content, the citation and a rubric popularly used to evaluate print materials, found Google Scholar 17.6% more scholarly [31].

Google Scholar, unlike many other search engines, exclusively delivers scientific documents [28] and so is very much convenient for researchers who already use Google in their quest for information. The convenience of Google Scholar is further enabled by its specific link resolution linking the search results directly to the researcher’s library [25]. Another advantage of Google Scholar is that it provides citation analysis [28] and has a wide coverage of open access scholarly work [25, 31]. Google Scholar is being challenged academically by at least two types of literature. One set is aimed at analysing the functionality, coverage and the frequency with which Google Scholar is updated with materials. On the other hand, there are research works carried out in a bid to ascertain if Google Scholar can be used as an alternative tool for citation analysis [28].

Irrespective of the differing opinions, Google Scholar is used as a bibliometric tool for the collection of information on the citation impact of articles or scholarly journals. According to Jasco, Google Scholar could also be used potentially as a citation search alternative to Web of Science and Scopus. This would be especially advantageous to libraries running on small budgets [25]. Also, more recent studies have shown an increase in the coverage of Google Scholar than in its early years [32]. Students prefer to use resources that are relatively accessible and easy to find. They also prefer products that would serve as a “one-stop” platform for them [33]. Perceived usefulness refers to the degree to which a user thinks of how a product would enhance his/her performance while perceived ease of use refers to the level of demand which a user thinks a product or process would make [34]. In the midst of these, the relationship between perceived usefulness and usage is significantly stronger than the relationship between ease of use and usage [33]. This is largely due to the fact that in the end, users would subscribe to the service that would increase their productivity; for researchers, faster publications due to increased access to research data and for students, better grades. Limitations:

- Google Scholar is susceptible to spamming. A demonstration carried out in 2010 with the pseudo personality, Ike Antkare by Cyril Labbe [35] shows that data can be manipulated to affect the performance indicators.
- Data redundancy. Redundancy exists in the system as Google Scholar has been unable to retrieve duplicates. This leads to stray citation [32].
- Matthew’s effect. A high weight is placed on citation counts by Google in its ranking algorithm. Hence, when searches are made, scholarly works with higher citation counts appear first. This causes them to get more citations while recent works with fewer citation counts remain with a less chance to get cited [36].
- The database does not cover the social sciences and humanities as much as it does for science and medical databases [25].
- Difficulty exists in assessing the accuracy of Google Scholar as a source for evaluation metrics because of the inability to make data exports for analysis [32].

In summary, Google Scholar is a free web service that gives its users free access to the citations and the abstracts of millions of articles, it has a very simple interface, and it returns search results ranked by relevancy. While the reviewed works are very fantastic in their strength, this present study aims at promoting research in Covenant University amongst students by giving them the opportunity to exercise their scholarly abilities, easy access to research projects carried out by other students, collaboration with other students with similar research inclinations.

3. SYSTEM DESIGN

This section gives a general overview of the design of this work. Figure 1 shows the architecture of the system which gives the overall view of the system. This system consists of three major divisions namely:

- The front-end application;
- The back-end application; and
- The database.

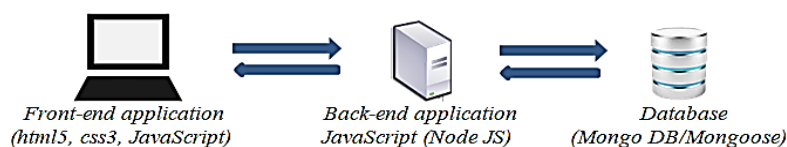


Figure 1. System architecture

3.1. Front-end development

The front-end of a web application refers to the main interface that the user interacts with. It is responsible for the look and feel of the website. Here, emphasis is placed on visual creativity [37]. It hosts hypertext mark-up language (HTML), cascading style sheets (CSS) and JavaScript services. Bootstrap is a front-end framework for designing responsive websites and web applications. It contains HTML and CSS-based templates for different interface components namely: buttons, forms, navigation components, etc. It supports the latest versions of Google Chrome, Safari, Internet Explorer, Firefox and Opera.

3.2. Back-end development

The back-end of a web application, i.e. the server-side, handles the functionality and business logic of the application. Back-end development is also responsible for the speed optimisation of the application. The server-side fetches data from the database as requested from the client side. It runs using server-side languages such as hypertext pre-processor (PHP), Ruby, Python, Node.js, etc.

The back-end framework used for this project is Node.js. Node.js is a JavaScript runtime built on Chrome's V8 JavaScript engine. It is essentially JavaScript running on a server. It uses an event-driven, non-blocking I/O model. This makes Node.js apps extremely fast and efficient.

3.3. Database

A database is a structured collection of related data. MongoDB was used in this project and it is a NoSQL database. NoSQL stands for "NOT ONLY Structured Query Language". It is a non-relational database i.e. it does not make use of tables. These databases work well with big data and real-time web apps. Advantages of NoSQL over Relational Database Management System (RDBMS) include its scalability and its ability to handle unstructured data. MongoDB is a document database and is used in this work with an object relational mapper (ORM), Mongoose. In order to understand the system's functionality, Figure 2 gives a simplified flowchart of different stages in the repository platform which are sign up process, login process, and upload process. Unified modelling language (UML) which comprises use case, activity, etc. is often used to describe the system.

Use case diagram: in software engineering, a use case is a list of event steps that define the interactions between an actor and a system, in order to achieve a certain goal. A use case diagram, therefore, is a graphical representation of the interaction which an actor has with a system. An actor could either be a person, organisation, another system or an external system. The actors to be defined in the use cases include the following:

- The students;
- The administrator;
- Authenticated external users; and
- Non-authenticated external users.

Activity diagrams: the activity diagram is one of the standard UML diagrams. It is used to describe the dynamic aspects of the system and it represents the flow from one operation to another. The activity diagram is however different from the flow chart as it has additional features such as showing not just single but also the parallel, branched and concurrent flows of the system. They also describe the sequence of activities. The elements of an activity diagram include the following:

- The action;
- The start node;
- The end node;

- The control flows; and
- Decision node.

The activity diagrams are provided in Figure 3.

System specifications: The proposed system would be deployed to the cloud via a cloud-hosting service known as Heroku. Heroku is an application-oriented architecture that ensures system availability. It is a software that can be accessed as a web application by any browser-enabled device. Examples of browsers that can be used to access this service include but are not limited to Mozilla Firefox, Google Chrome, Apple's Safari, and Opera Mini.

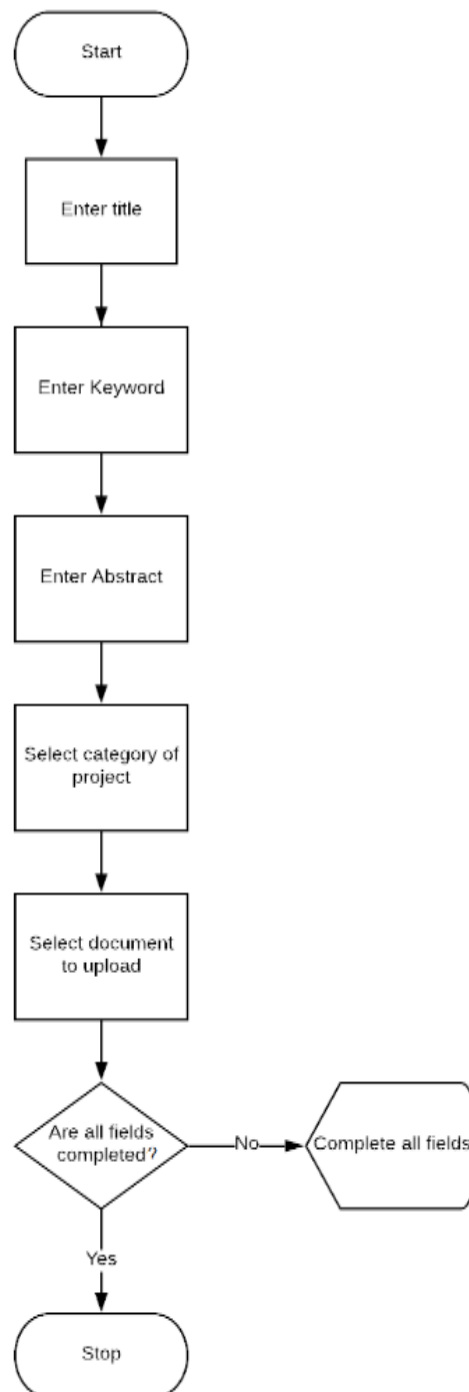


Figure 2. Simplified flow chart for the repository platform

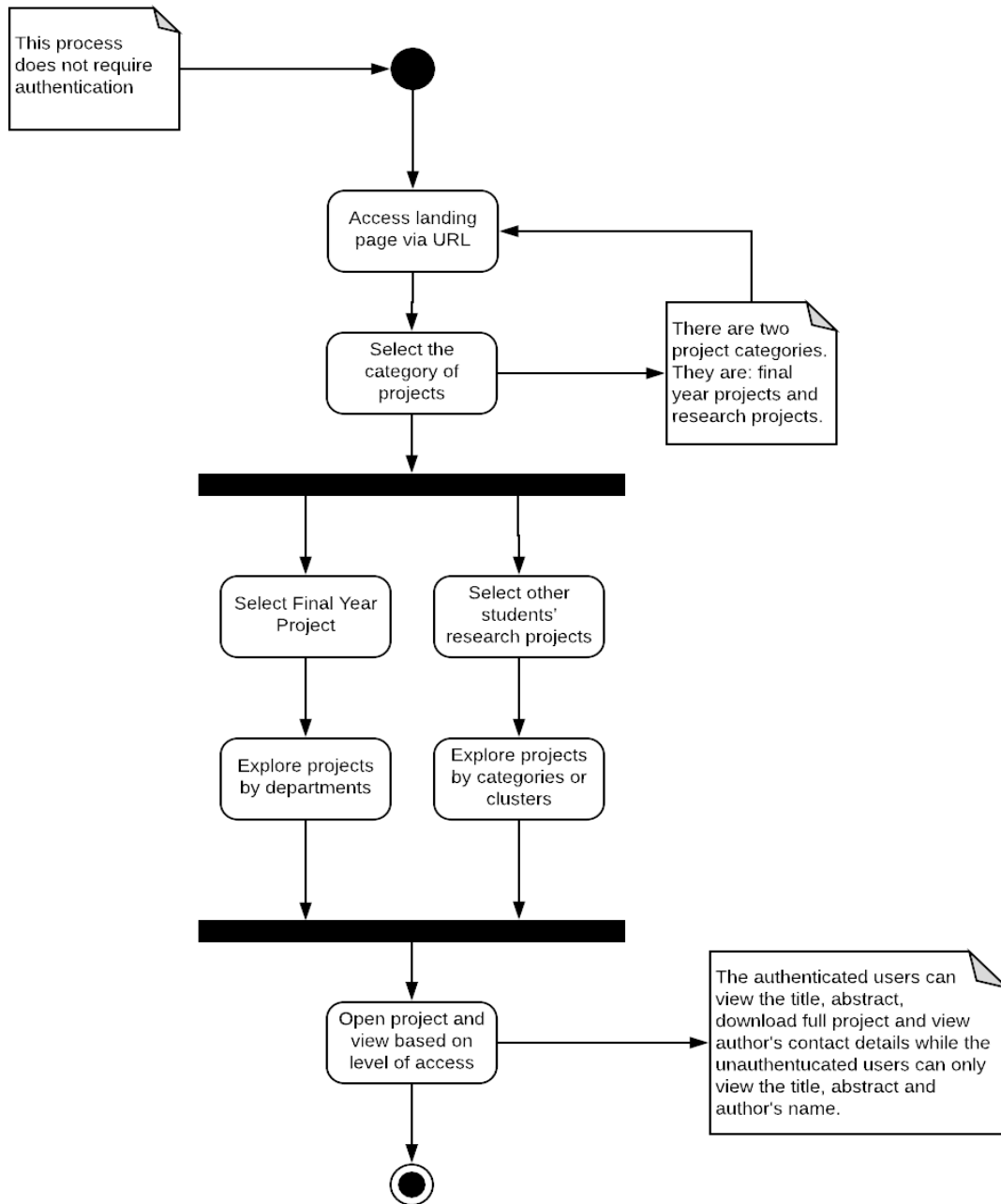


Figure 3. Activity diagram

Functional Requirements: The functional requirements of a system refer to the behaviour or functionality of the system. In other words, how the system would work. It explains the service offered by the system to the user which include following:

- The admins must be able to log in with their Covenant University email and password;
- The admins must be able to manage the students and their information;
- The admins must be able to manage the clusters;
- The admins must be able to manage the upload of projects;
- The admins must be able to search for projects;
- The admins must be able to manage the learning resources available for research methodology;
- The students must be able to log in with their Covenant University email and password;
- The students must be able to view the projects of others;
- The students must be able to upload their own projects;
- The students must be able to view, join and create clusters;

- The students must be able to search for projects;
- The authenticated external users such as organisations that are granted access must be able to login with the OTP provided;
- The authenticated external users must be able to view the titles, abstract and reports of the projects;
- The authenticated external users must be able to search for projects;
- The authenticated external users must be able to view clusters;
- The authenticated external users must be able to view the contact details of the authors;
- Non-authenticated users must be able to view the titles and abstracts of projects;
- Non-authenticated users must be able to view clusters;
- Non-authenticated users must be able to view the names of the authors;
- Non-authenticated users must be able to search for projects; and
- All users must be able to logout and end their sessions.

Non-functional Requirements: The non-functional requirements of the system refer to the qualities that are not functional yet to evaluate system performance. They are implicit expectations from the system and so are not specifically documented. They can also be referred to as attributes. The non-functional requirements of the proposed system include the following:

- The authors must be able to get registered on the system;
- This system should be able to grant outstanding students visibility;
- The user interface should be easy to navigate;
- All users should be able to view content based on their level of rights and privileges;
- The application shall have a quick loading/response time; and
- The authenticated external users must be able to contact the author of the project if interested in the research work.

4. RESULT AND DISCUSSION

Various sections of this work have been taken through a number of tests in order to verify the functionality of the system application. It also checks the performance of the system against the functional and non-functional requirements in order to discover limitations and to ascertain that the system meets specified requirements. Figures 2 to 5 give the pictorial representations of the system interface. Figure 2 displays the home page interface where the user can easily carry out the following task: get to know more about the application through get started link; contact the admin via contact us link; and login to his or her page via login link. However, with a click on the login button at the system home page, the dialog box will appear as shown in Figure 3. A user who is a bona fide member of Covenant University will simply supply his or her details easily login to the research repository network. But an outside from another University will click on Create new account button to register first before login access would be granted. Figure 4 displays the user home page (in this case, charlotte is the user), where she can easily upload her project work and other research works. Figure 5 displays the upload interface after upload button has been clicked.

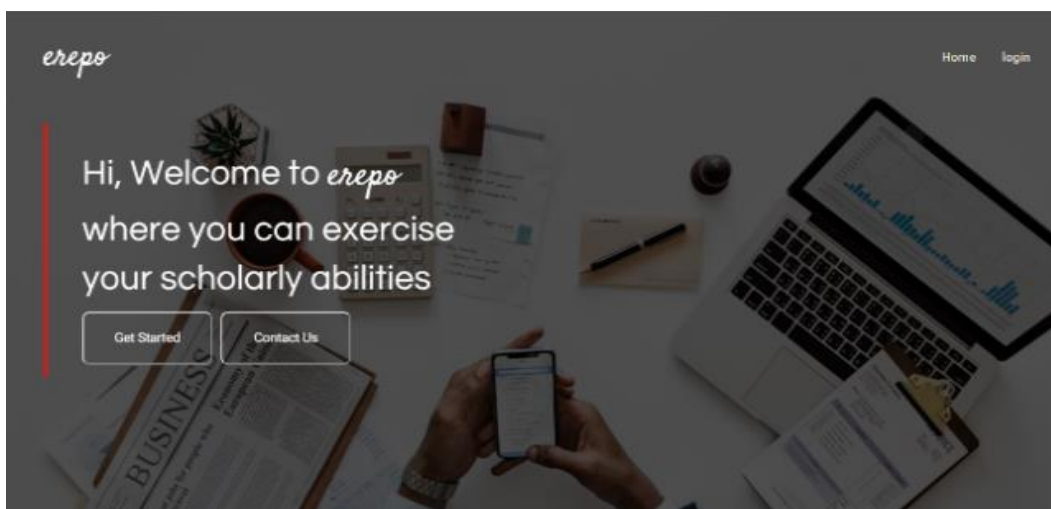


Figure 2. System home page

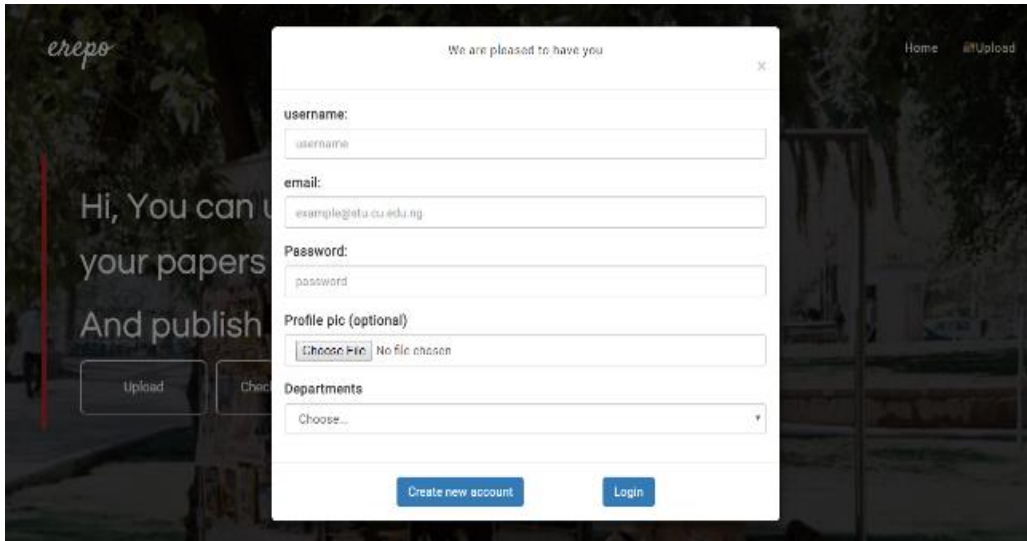


Figure 3. Sign-up page

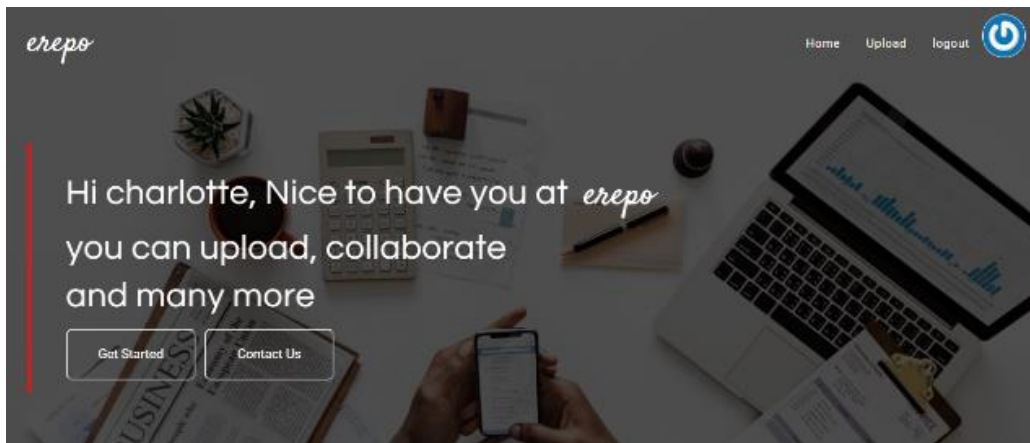


Figure 4. User home page

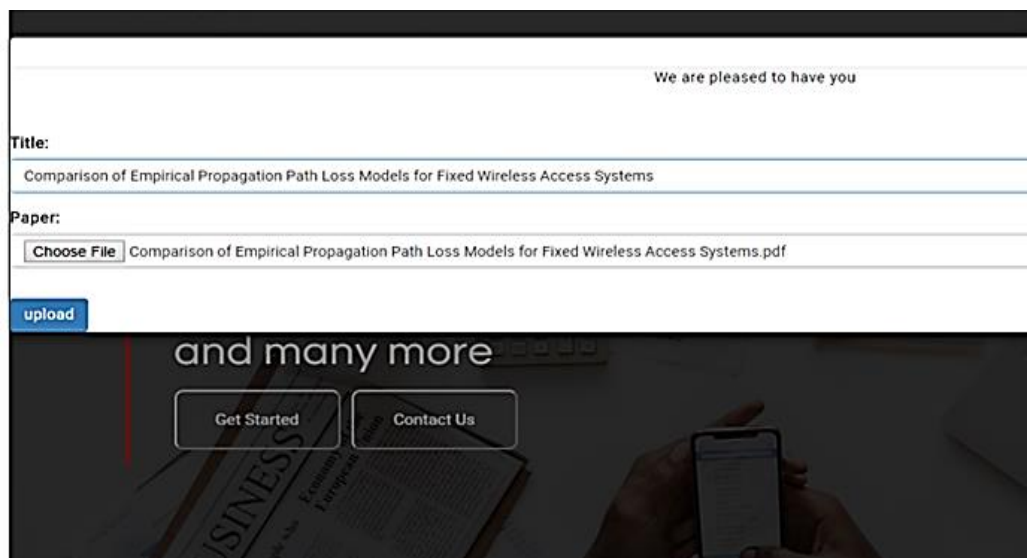


Figure 5. Upload page

5. CONCLUSION

This work is aimed at promoting research among undergraduate students by giving them easy access to final year projects and other research projects worked on by their peers. An opportunity for collaboration is also created on this platform. Generally, the software can perform the following tasks: (1) display final year projects of past students; (2) display students' personal research work; (3) provide a platform for collaboration amongst students; and (4) provide additional learning materials for students interested in building their scholarly abilities. Further work can be carried out to improve on this work in the following areas: (1) system security; (2) protection of intellectual rights of the authors; and (3) plagiarism check pass before upload is allowed.

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