International Journal of Multidisciplinary Research and Development
www.allsubjectjournal.com
ISSN Online: 2349-4182 ISSN Print: 2349-5979
Received: 15-10-2022, Accepted: 03-11-2022, Published: 19-11-2022
Volume 9, Issue 11, 2022, Page No. 31-39

Design and development of a web-based application for the allocation/selection of project supervisors for undergraduate research scholars in tertiary institutions in Nigeria

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Abstract
The challenge of transparent allocation of research resources in tertiary institutions has lingered for a very long time. Several Nigerian Universities/Polytechnics have adopted and continued with the inefficient manual system where students of choice are chosen by supervisors, based on some selfish or perverted reasons, this has led to poor management of the system leaving the undergraduate with little or no self-confidence to independently complete their research under constructive supervision. This manual approach has failed over and over again, and this has caught the interest of researchers in recent years. Several attempts have been made by researchers to automate this process and eliminate the errors of the manual method; however, their research has also been met with some drawbacks which make them inefficient to replace the manual method. In this work, we have designed and developed a web-based application for the allocation/selection of project supervisors to undergraduate research scholars in tertiary institutions in Nigeria. Our research aims to bring a web-based application for the efficiency of research coordinators in effectively selecting research supervisors for undergraduates, with its objectives to examine the existing model for undergraduate research supervisor allocation, create a user interface for eligible users, and identify stakeholders relating to the undergraduate research supervisor allocation system. The Agile methodology was adopted in this approach. The system was implemented using web-based tools such as PHP, HTML, CSS, MYSQL, and JavaScript. The results of the system demonstrate an increased efficiency in supervisor selection based on supervisors' area of specialization which will in turn bring out the best from the research student, project topic submission and approval, monitoring, and general management of the undergraduate research program. The proposed system could be beneficial to the undergraduates, the project supervisors, the research coordinators, and the research community interested in this field.

Keywords: undergraduates, final year project, project supervisors, web-based

Introduction

A thesis or "final year project" as it is referred to locally is one of the mandatory requirements for students who are in their final year in tertiary institutions across many institutions, especially for students in the science and engineering field. This exercise spans even the post-graduate sphere (Master, Doctorate, etc.). It can be considered the most substantial project undertaken by an undergraduate during their degree program, and it allows for the student to independently work on a project, contribute to knowledge, develop a new system or solve a problem, depending on the focus of the study. The students are expected to apply the scientific and theoretical knowledge gained in the course of their studies and also explore new paradigms of performing certain processes [1].

Usually, the students will be allocated supervisors who are well-learned in different fields (especially fields that are related to the topic allocated to the students), and this process of allocation is usually monitored and approved by the Head of Department (HOD), the sole role of these supervisors is to guide the students on the right format for information retrieval, analysis, development, and implementation (if necessary).

A research coordinator is in charge of coordinating the schedule, the issues, and the risks of the project. It's his job to make sure the project is well-organized and that it runs smoothly. This can include communicating with various supervisors in the institution to make sure everyone is on the same page.

According to the University of New South Wales [2], the position of the research coordinator is recognized by the University as a significant academic and administrative position. The role involves a substantial academic judgment and interpersonal relationships. The research coordinator acts on behalf of the Head of the Department in making academic, administrative, and in some cases, resource recommendations relating to undergraduate research candidatures across the range of disciplines covered by the institution.

Supervisor scheduling is done to ensure the smooth flow of academic activities, over the year supervisor scheduling has been done manually encountering so many constraints in the process such as allocation and preference of each of the supervisors to the number of students.

The university supervisor allocation problem increases with the size increase number of students. This makes this process more difficult and time-consuming. In most cases constructing a workable supervisor allocation system is very challenging due to resource constraints (time, place, people, etc.), which makes constructing an efficient supervisor allocation system a crucial problem in the educational sector. Therefore, optimization techniques are utilized to solve provide optimal or near-optimal feasible solutions using the genetic algorithmic approach for efficient tackling of this problem.

Ultimately, to solve this problem for the particular case of tertiary institutions, the allocation has to adopt the computer-based approach which enables the institution to automate a certain manual task and work efficiently.

1. Statement of the Problem

The manual system of allocation of supervisors has been in existence for several years, however, several drawbacks have been identified in this approach, some of which include: duplication of project topics among students by several supervisors, lack of transparency in the allocation process, difficulty in accessing supervisors, lack of proper monitoring and reporting of the supervisory process, and poor topic allocation process, which later results in plagiarism, outsourcing, difficulty in accessing softcopy of previously approved projects, difficulty in accessing project supervisors for approval of topic, etc. we hope to tackle these challenges by developing a system which will automate the allocation/selection or scheduling of project supervisors to undergraduate final year students. Our proposed system will be web-based to aid easy access and navigation.

2. Aim and Objectives

This study aims to design and develop a web-based application for the automated allocation/selection of project supervisors to undergraduate research scholars in tertiary institutions in Nigeria.

The specific objectives are to:

1. develop a web-based application that enables easy allocation/selection of research supervisors.
2. develop an enhanced web-based application for supervisor allocation/selection in tertiary institutions, which addresses the drawbacks of the existing system.
3. create a user-friendly interface that is easy to access and navigate.
4. implement the model using web-based tools such as Hypertext Markup Language (HTML), and JavaScript, for the front end, while MySQL and PHP are used for the database design and connection.

Literature Review

1. Conceptual Understanding of Undergraduate Research

Collins English Dictionary defined an undergraduate as a student at a university or college who is studying for his or her first degree. Undergraduates are students of universities and colleges: they've graduated from secondary school and have been accepted into university, but they haven't graduated yet.

There are several definitions of research, and each of the definitions captures a vital aspect of the concept which cannot be overlooked or overemphasized, as a result, there is no one concrete definition of the term. In this section, we will explore some definitions which capture the key features of the concept.

According to [3], research is an investigative process of finding a reliable solution to a problem through a systematic selection, collection, analysis, and interpretation of data relating to the problem. The researchers also added that research is all activities that make us discover new knowledge about things around us.

Stephenson and Slesinger [4] defined research as the manipulation of things, concepts, or symbols to generalize to extend, correct, or verify knowledge, whether that knowledge aids in the construction of theory or the practice of an art.

The undergraduate research project is a final-year course that requires students to conduct research individually and independently, under the supervision of one or more supervisors [5]. For undergraduate and postgraduate students in higher institutions of learning, research projects are a graduation requirement that usually has high credit units. According to Valderrama [5], the implementation of the research project for final-year students is a peak for the learning process of an undergraduate student in a university, whereby students need to apply all the knowledge that has been learned, including the scientific and engineering knowledge and even the generic and personal skills, and transform them into a research project. The research project implementation aims to expose and provide relevant experience to students in practical work where students' competency is assessed [6].

2. Conceptual Understanding of Undergraduate Research Coordination

The Position of research coordinator is recognized by tertiary institutions as a significant academic and administrative position. The role involves a substantial academic judgment and interpersonal relationships. According to [2] the Undergraduate Research Coordinator (URC) acts on behalf of the Head of the Department in making academic, administrative, and, in some cases, resource recommendations relating to undergraduate research candidatures across the range of disciplines covered by the department.

The URC should be a senior researcher with immense experience an undergraduate research supervisor who is a member of the academic staff of the institution and is adjudged competent to act on behalf of the Head of the Department in matters related to undergraduate research supervision candidatures. A research coordinator will coordinate the schedule, issues, and risks of the project. It's his job to make sure the project is well-organized and that it runs smoothly. This can include communicating with various supervisors in the institution to make sure that the best for all students is achieved and everyone is on the same page.

To ensure that the research project is enjoyable and fruitful for the students, there is a need to assign supervisors to students [7]. Lecturers do not usually have an input in the choice of students because they are most likely to select the bright students, causing the less-than-average students to be disadvantaged. When students are requested to rank potential supervisors, they are likely to favorably rank lecturers whose courses they enjoyed taking or whose areas of research interest they like. Thus, some popular lecturers may be oversubscribed. On the part of the lecturers, they may have a fixed number of slots for project students, based on their workloads. Ahead of the department/ departmental chair as well as professors having many graduate students may be required to supervise fewer undergraduates than other lecturers. However hard the research coordinator tries, it is difficult, if not impossible, to manually match supervisors to students such that all parties feel that they have been treated fairly.

3. Concept of Supervisor Allocation

The Encarta dictionary defines a 'Supervisor' as a teacher assigned to supervise the work of an individual student, especially research done by a graduate student.

According to [8] supervisor allocation is concerned with allocating project supervisors to students taking into account

the student's preferences for lecturers as well as lecturer supervision capacities. "Resource allocation is the assignment of available resources to various uses" [9]. Supervisor allocation is a resource allocation problem where the key constraints are to load the staff appropriately while matching projects to students' demands. Therefore, it becomes a matching problem and if solved mathematically under given constraints, the optimal solutions can be achieved [10].

Together with the allocation of students and supervisors, another important allocation is that of the examiners. Examiners will be the person in charge to assess the final year projects. One examiner is currently assigned to each undergraduate project. This is done transparently according to their area of expertise and experience in their respective fields.

3.1 Responsibilities of Academic Research Supervisor

According to [9], the supervisor(s) shall monitor, support, and direct the student's work and progress soon after the allocation of project/dissertation titles.

The responsibilities of the supervisor are expounded as follows:

1. Proposing/supervising projects/dissertations in their subject area.
2. Briefing the students and apprising them of the regulations about the final year projects/dissertations.
3. Setting a framework for regularly scheduled progress meetings between supervisor (s) and student.
4. Giving frequent feedback/comments on progress achieved by the student.
5. Giving guidance about relevant literature on the topic under study and appropriate literature sources.
6. Providing advice on issues of plagiarism, in line with the University Regulations.
7. Assisting in the identification of a research methodology, planning, and execution of the research project (if applicable).
8. Giving guidance on the approach for appropriate analysis of data obtained, interpretation, and presentation of results (if applicable).
9. Giving guidance about the formulation of an appropriate hypothesis-driven research project and focusing on the objectives of the research (if applicable).

4. Techniques for Project Allocation

Undergraduate final-year projects offer opportunities for students to undertake independent project work and to develop subject-specific and generic skills. It also provides an opportunity for staff to work closely with the student and strengthen individual students' skills, which are not visible from a standard course assessment. However, the success of achieving some of these underlined objectives also depends on the project allocation scheme used at the beginning.

In this section, we will discuss a few of the most common and popular student project allocation (SPA) methods.

4.1 Project Allocation Based on the Preferences

This is one of the most common SPA methods, where both students and supervisors have their preferences. Typically, the available projects are advertised to the students and having browsed through the descriptions, each student (either explicitly or implicitly) forms a preference list over the projects that they find acceptable. Supervisors may also have preferences over the students and/or the projects that they offer. [11] studied the problems of allocating projects, in this scenario, and proposed different algorithms for establishing a more stable allocation process but could not strongly propose one single method without having some approximation. Later, [12] built upon the algorithms presented by Manlove *et al*. and proposed an improved stability index for SPA. Furthermore, [13] mentioned several complexities after analyzing two different approaches applied in two consecutive academic sessions, where both the students and supervisors have preferences over projects. [13] identified several problems with those methods and proposed a new method having three phases, which saved time for both students and supervisors and reduced the number of randomly allocated projects. A project is allocated to a student if both parties agree and confirm the same project number. The concept of first come, first served is applied and the process is usually conducted via email.

4.2 Project Selection by Students Based on Project Titles

This is another popular SPA system, where students choose their projects by themselves based on the project titles provided by the supervisors. Many higher education institutions worldwide have adopted this system to allocate final-year projects to students. [14] proposed an algorithm, which was intended to find an optimal allocation scheme that best matches a student's preference to the student's eligibility for the corresponding project, subject to the constraints in the student's ranking, their prioritized project selections, and available project spaces. This allocation scheme ensured that everyone got a project that best matches the student's personal preference with their ranking.

[15] carried out a case study to compare the factors that influence students' choice of project in the two allocation systems, namely the choice of specific title and choice of the subject area followed by negotiation, and to determine whether different factors were relevant. This case study demonstrated that there is no significant difference in the factors affecting student project choices between allocation by project title and allocation by subject area followed by individual negotiation. However, SPA by project titles has benefits, such as it saves the supervisors' time spent on negotiations with students regarding any project. It also ensures that the higher-ranked students get their desired projects to work with.

4.3 Project Selection by Students Based on Supervisors and/or Project Category

[16] stated that no allocation system can guarantee that every student gets their first choice when the number of students is significantly greater than the number of available supervisors. They proposed a novel method based on a ranked list of supervisors, as well as categories provided to students, where a category corresponds to a general research area. A student's satisfaction may therefore correspond to getting a project either with a highly-ranked supervisor and/or in a highly-ranked category. Although they claimed to have an improved level of satisfaction in students and academics, this method could be more time-consuming as students have to negotiate the project title with their preferred supervisor or in their preferred area of research even after the allocation. A similar problem will occur in the

method proposed by [17] where they proposed assigning supervisors to students rather than assigning project titles by using their algorithm. According to them, the advantages of this method are that the projects are not required to be available at the time of allocation, and students and supervisors can discuss their project ideas/topics with each other after the allocation.

4.4 Project Allocation Based on Students' Proposals

Another common and popular way of SPA is a "student-led" allocation system. In this system, students design their project and approach a member of staff to be their supervisor. Students contact supervisors directly via e-mail or in person, and it is up to that member of staff to agree to supervise the student or refer them to someone else. The topic and content of the project are established entirely between the supervisor and the student. Thus, a minimum of admin staff support is needed until after the topic and supervisor have been identified. There are some positive aspects of running a student-led model as [15] stated that projects suggested/proposed by students promote active student participation. Despite having these advantages, the student-led model also raises several issues for the undergraduate cohort as a whole. First, most undergraduates find choosing a research topic difficult as undergraduate students rarely have deep knowledge of any particular area to identify a research rationale. Students often identify a very general topic area for research, and usually produce research questions that are too broad to be tenable. This can end up with the supervisor suggesting a very different topic afterward in negotiations, where students can feel disenfranchised as their ideas are set aside and they are channeled into a project for which they have less interest, enthusiasm, and ownership. [18] suggested that asking students to create their projects from scratch presents a few difficulties and takes considerable time. Analysis of the literature and informal feedback from those involved suggests that the student-led system is unsatisfactory for the majority of staff and students.

4.5 Challenges of University Research Supervisor Allocation

Allocation of final-year undergraduates to projects is also a key challenge for university programs. The global growth of transnational education is rapidly increasing and becoming an integral part of the internationalization strategy of most universities. It is generally challenging, particularly to sustain high standards with all the other constraints and to meet the requirements of accreditation organizations [19]. This becomes substantial when students enter their final year of studies. For example, the allocation of the final-year-year projects to students should be conducted considering all the constraints associated with the university. Simultaneously, it is critical to ensure that student learning and engagement during the project sustain at the highest level, and should demonstrate the effectiveness of the selected project allocation mechanism.

For instance, in some university programs, the staff working model is fly-in-fly-out (FIFO) where some of the staff members only fly for a particular number of days or weeks in a semester to teach and supervise the students on the non-local campus. While some of the staff members are permanently placed in such locations and thus there arises a mismatch in the physical availability of the staff.

Now, the participation of local staff in the project supervision brings an additional constraint while the projects are allocated to the students. This additional constraint has to be taken into consideration while the projects are allocated (Dimitar, 2001) [19]. One of the solutions is to fix a ratio of the projects that the students could choose from local supervisors to the FIFO supervisors. This should normally result in a trade-off between quality of supervision, staff workload, and student satisfaction. However, the complexity of the problem increases as the balance between the number of proposed projects and/or available supervisors from both sides may not be appropriate.

Further, there is a possibility that students may tend to prefer the staff from a specific group of supervisors (local or non-local) while making their selections due to several reasons. For instance, the global visibility of the foreign staff, on-campus availability of the staff, or presence (or absence) of the drive to communicate in the non-native language, etc. The allocation algorithm then needs not only to keep the student preferences into account but also to keep the pre-agreed balance between the staff supervisions from both sides. There should be solutions that could take care of student preferences while balancing the staff load, not only between the two sides but also among the staff members of each side. This makes the problem more challenging.

5. Technological Integration for Project Management

At present, technology/computers are widely used for varied purposes. Educational, commercial, industrial, administrative, transport, medical, social financial and several other organizations are increasingly depending upon computers to some degree or the other.

Computers can facilitate research work. Innumerable data can be processed and analyzed with greater ease and speed. Moreover, the results obtained are generally correct and reliable. Not only this, even the design, pictorial graphing, and report are being developed with the help of computers. Hence, researchers should be given computer education and be trained in the line so that they can use computers for their research work.

The application of technology/computer and its uses are depicted below in the table;

Table 1: Application of technology/computer

Application	Some of the various uses
Education	1. Provides a large data bank of information 2. Aid to time-tabling 3. Provide the student's profile 4. Carry out the lengthy or complex calculation
Research	1. Model Process 2. Performing computation 3. Research and data analysis
Management	1. Useful in the scheduling of project 2. Finding the best solution from several options. 3. Helpful in inventory management, sales forecasting, and production planning

6. Web-based Application for supervisor Allocation

As the number of students requiring projects doubled in the institution, a step was taken to move from the old paper-based (manual) system of project allocation to web-based technology.

Web-based applications are applications that are used either over the Internet or Intranet. In other words, web applications are used over a network. Sometimes, the term can also be used for applications that are hosted on a web browser-controlled environment. Web applications run through web browsers like Google Chrome. The program runs on a web server. Web-based applications also may be client-based, where a small part of the program is downloaded to a user's desktop, but processing is done over the internet on an external server.

1. **Administrators Login/Dashboard**: This is the section of the platform which coordinates the entire process of the system. It can be said to be a client that manages the process following a clayed-down function assigning supervisors' area of specialization: this section shows a dashboard to see a list of supervisors and students assigned to supervisors.

2. **Supervisor's Login/Dashboard**: this section handles the supervisor's concern which involves the students, topics approval, and arrangements This section creates how supervisors can monitor and supervise the activities of their student's project and allocation.

3. **Student's Login/Dashboard**: this is where a student selects a supervisor based on his specialization, submits topics for approval, sends a message to the supervisor, and submits chapter by chapter to the supervisor to ease the process concerning the projects.

6.1 Benefits of Web-based Application

Paul (2018) further highlighted the following benefits attributed to web-based applications:

1. Zero install - all PCs have a browser.
2. Reduce business costs - less time spent talking to customers over the phone; eliminate printed materials; allow users to update their details.
3. Centralized data is secure and easy to back up.
4. Quick and easy updates.
5. Reach anybody, anywhere in the world.
6. Available 24 hours a day, 7 days a week.
7. Low PCs or smartphones can be used.
8. Online training can be completed at the user's own time and pace.
9. Direct access to the latest information - for Employees where ever they are located.
10. Always up-to-date.

7. Related Work

Vial, *et al*. [20] proposed a Java program for automatic team allocation in project-based coursework. The proposed system aided quick allocation of students into optimal or suboptimal teams based on prearranged standards. The major use of team allocation software demonstrates that it can find, in a short time, the solutions highly compliant with the team allocation criteria selected using a simple algorithm. The software reduces the time needed for allocation. On estimation, the software saves at least 8 hours of the coordinator's time. However, a drawback of this software is that mobility is difficult and requires moving installed devices from place to place.

Hussain *et al*. [21] proposed a systematic review of project allocation methods in undergraduate transnational engineering education. The proposed system uses an algorithm to allocate titles to students based on students' submissions of their top ten preferred titles in order of preference. They developed three allocation algorithms which were evaluated by calculating and comparing the costs of their selection. The algorithm guaranteed that each pupil got one of their ten preferred titles, and the utmost of the scholars got largely ranked titles. However, several perpetration issues also need to be cleared out, particularly the ideal number of titles to be ranked by every pupil during the selection process, which posed a disadvantage to this system.

Tayal *et al*. [22] proposed a student project management system for the faculty of engineering and technology. They developed SPAM (Student Project Allocation and Management) a Web Application that automates the whole project management system through which the documentation related to the project tasks could be viewed. The system provided a platform where the guide could allot tasks to their respective group, and students could choose their group and choose their project guide. The project guide could allot Project-related tasks, and other faculties could only give reviews on it. Students could directly upload their proposed work and the documentation on this system to evaluate it.

A. Adamu [23] proposed a final-year student project allocation archiving and management system. they implemented their system using PHP ASP.NET to develop GUI and XAMPP for the database. The system was aimed at replacing the manual supervising final-year students in tertiary institutions. The system was aimed at reducing energy challenges and the time required to monitor and manage final-year student projects.

Srinivasan and Rachmawati [24] proposed an efficient fuzzy evolutionary algorithm-based approach for solving the student project allocation problem. They adopted an effective fuzzy evolutionary algorithm for designing the allocation model. They also presented a result frame for the pupil design allocation (Gym) problem grounded on evolutionary algorithms (EAs). The EA-based project allocation system was implemented in a large university department to automate this process and enhance scholars' matching to their desired projects.

Gerasimos [25] Proposed an online project allocation system. Their proposed model was web-based and allowed the allocation to take place securely over the internet, irrespective of the location and the device used to access it. A security mechanism was integrated into the system to restrict access and allow only authorized parties (the people responsible are allowed to perform the allocation and view the sensitive data).

Methodology

The agile methodology was adopted in this approach. The Agile model provides development teams with an experience of a lightweight process that supports a focus on the rapid delivery of the business process. In the Agile model, working models are delivered in little iterations, and then an update is carried out on the project based on customer feedback. This will help in meeting user requirements to the fullest. In our design, this methodology will help in producing images that are of the perfect size for transmission and storage after several iterative compressions.

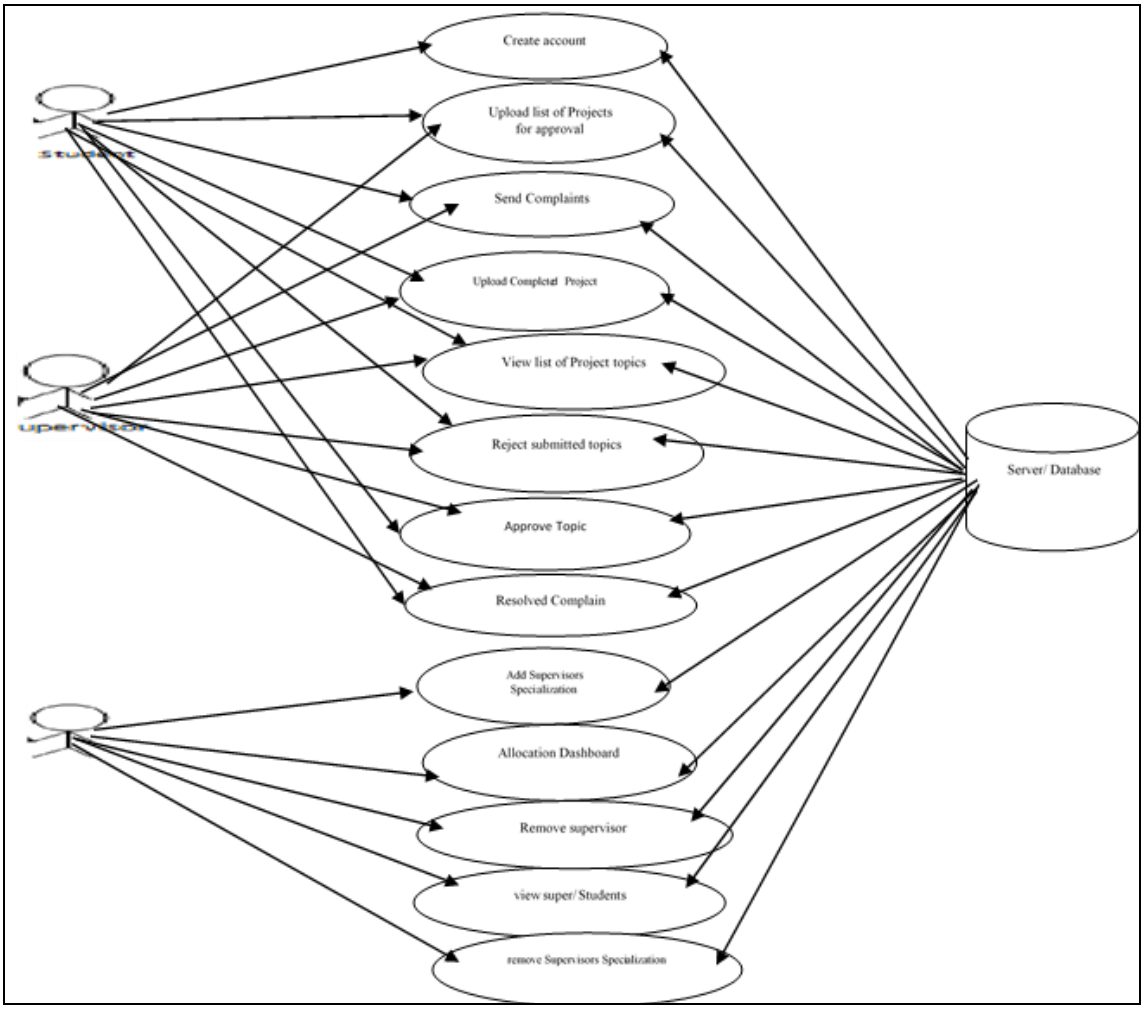

Fig 1: Use-case Diagram of the Proposed System.

1. Our Proposed system

The proposed model is an enhancement of the existing system developed by researchers over the years. After a careful review, one common problem kept reoccurring in the proposed model, the problem of accessibility, even after the process of scheduling and allocation had been supposedly automated. Our proposed model aims at tackling the drawback by developing a system that can be easily accessible and doesn't require need installation on a particular device. Also, data duplication is eliminated in this system and no two students can be allocated/select the same supervisors.

There are four main stakeholders in the proposed system: the Students, Supervisors, Coordinators, and Departmental heads. The proposed model is made up of five major modules: the user registration module, the login module, the submission module, the add supervisor's module, and the monitoring /Submission module.

Login to Information Page

This page requires the users (students, supervisors, and HOD/coordinators) to input their login details to be authenticated by clicking the sign-in button, users who have not signed up we not have access to the system.

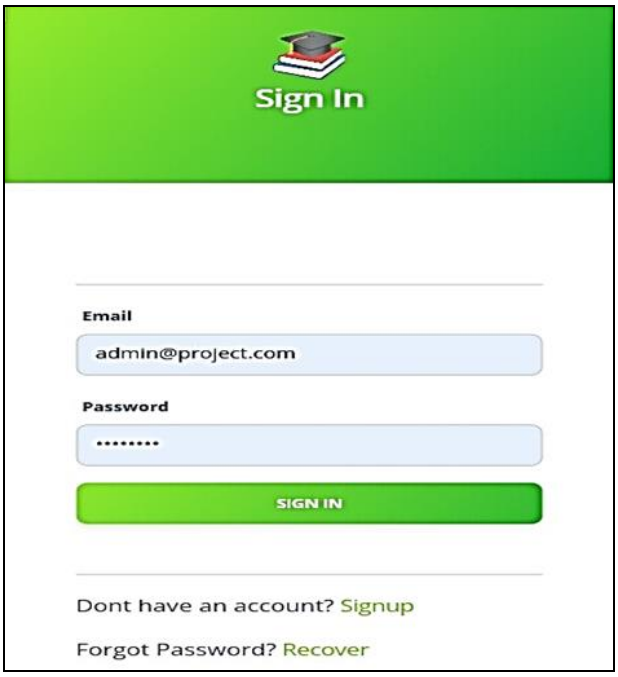

Fig 2: Login Page

Users' Registration Page This page is strictly for supervisors' and student's registration with

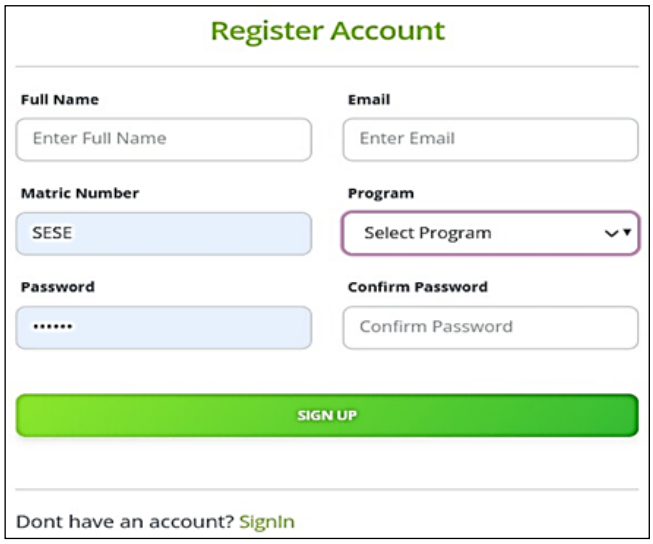

Fig 3: Users' Registration Page

of the system. A form is presented which must be filled by the user for efficient allocation of project supervisor.

Admin Allocation Page

The administrator of this system happens to be the Dean/Head of the Department. The admin dashboard is accessed through the login details supplied on the login page. This module handles

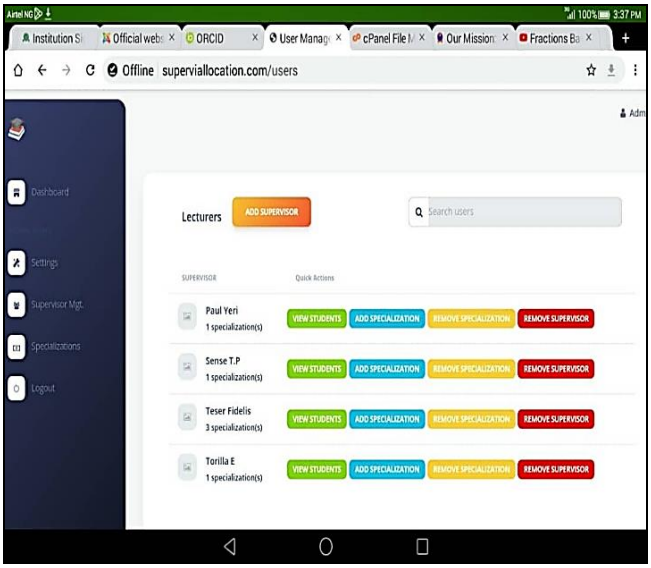

Fig 4: Admin Allocation page

the automatic allocation/selection of project supervisors based on certain considerations such as the supervisor's area of specialization. This step is aimed at promoting transparency in the allocation process, and also to ensuring that the students are allocated supervisors who can make meaningful contributions and offer constructive assistance during the course of the research.

The monitoring module/Submission: this module is in charge of tracking student progress and performance by the supervisors. The supervisor can also utilize this platform to monitor or check and track each document submitted by a student, schedule appointments with the student, create a task, and edit tasks. If the supervisor needs a one-on-one session with the student, the student is notified on this platform, and details of the meeting, discussions, deliberations, and consensus reached are stored on this platform. The research coordinator can access this platform for cross-reference on the active participation of both parties during the course of the research. A plagiarism checker can also be integrated into the system to detect unreferenced content, and help boost the originality of research work carried out in the institution.

Fig 5: Monitoring/Submission Page

The algorithm for this allocation is quite simple, the supervisors are selected based on their specialization. This process eliminates any human intervention in the process of selection and it will improve the quality of students' research work.

1. Advantages of our Proposed Model

The present system that is been used has no or little computer help or application. Most Tertiary institution's project works are done on paper, which involves more human physical capabilities on supervisor to the student. The present system involves a student's login portal, student-supervisor selection based on their area of specialization portal, supervisor's account/login, and administrator/dean/ coordinator portal. The proposed model has the following advantages over the existing system:

a. Fully automated supervisor and project allocation procedure without any human input.
b. Data duplication in terms of supervisors is eliminated.
c. The proposed system guarantees proper planning, monitoring, and transparent system, such that the students are satisfied.
d. The archiving system provides a guide for the execution of future projects for the students and therefore simplifies their research program.
e. The proposed system can be accessed from anywhere, on any device, and at any time by the authorized parties, conveniently.
f. The proposed system will allow the students to select their supervisors based on their area of specialty.

Conclusion

We have successfully developed an enhanced project supervisor selection using a web-based platform, in which a student can accurately and automatically select a supervisor based on his area of specialization and submit topics for approval. Proper scheduling, allocation, and monitoring of research resources are very useful in the proper coordination of the research scheme for undergraduate students in tertiary institutions. This attempt has eliminated manipulation in the allocation and has also provided an easily accessible platform for proper guidance and monitoring by the supervisor. Our results show that our system is more accurate than the manual system used.

1. Contribution to Knowledge

A web-based application for automated allocation of project supervisors to undergraduate research scholars in tertiary institutions in Nigeria has been designed and implemented in this study which outperforms the existing models.

2. Future Work

Having achieved huge success in the present system, our future work will be directed towards integrating a plagiarism checker into our system and blockchain technology (preferably Ethereum) to further enhance the security of the system and ensure a more tamper-proof architecture.

References

1. Hussain S, Gamage KAA, Sagor H, Tariq F, Ma L, Imran MA. "A Systematic Review of Project Allocation Methods in Undergraduate Transnational Engineering Education". *Education Science*,2019:9(248):1-14.
2. The University of North-South Wales Roles and responsibilities of postgraduate research coordinators guideline, 2019. Retrieved from https://www.gs.unsw.edu.au/policy/documents/pcgrguideline.pdf
3. Ruth TK, Rumble JN, Gay KD, Rodriguez MT. "The Importance of Source: A Mixed Methods Analysis of Undergraduate Students' Attitudes Toward Genetically Modified Food". Journal of Agricultural Education,2016:57(3):145-161. Https://doi:10.5032/jae.2016.03145
4. Slesinger D, Stephenson M. "Social Research-Encyclopedia of Social Sciences". *MacMillan Company*,2006:09:78.
5. Ebardo R, Valderama AMC. "The Effect of Web-Based Learning Management System on Knowledge Acquisition of Information Technology Students", 2009, 17-18.
6. Karzai S, Brabazon D, Smyth P, Molloy D. "An analysis of final year student project performance in mechanical engineering". *International Symposium for Engineering Education*, ISEE-08, Dublin City University, Ireland, 2008.
7. Pearson M. "Flexible postgraduate research supervision in an open system" Proceedings of the 2000 Quality in Postgraduate Research Conference Adelaide, SA, 2000, 103-118.
8. Salami OH, Esther YM. A genetic algorithm for allocating project supervisors to students. *I. J. Intelligent Models and Applications*, 2016, 10.
9. Fabiyi A, Ramoni T, Amosa, Adetutu AO. "Development of student project allocation model using the matching algorithm". International Conference of Science, Engineering & Environmental Technology (ICONSEET),2016:1(22).
10. Kelum G, Sajjad H, Qammer HA. "Final Year Project Allocations for Undergraduate Engineering Students in TNE Programs". 6th Teaching & Education Conference, Vienna, 2018, 17-21.
11. Manlove DF, G. Mally G. "Student-project allocation with preferences over projects". Journal of Discrete Algorithms,2008:6(4).
12. Iwama K. "Improved approximation bounds for the student-Project Allocation problem with preferences over projects*" J. Discret. Algorithms*, 2012.
13. Kazakov D. "Coordination of Student Project Allocation", 2001.
14. Cheung Y, Hong GM, Ang KK. "A dynamic project allocation algorithm for a distributed expert system." Expert Syst. Appl. 2004, 26.
15. Harland J, Pitt S, Venetia S. "Factors affecting student choice of the undergraduate research project: Staff and student perceptions." Biosci. Educ.,2005:5:1-19.
16. Sameerchand P, Munish B, Vishika B. "A multi-objective approach for the project allocation problem". International Journal of Computer Applications, 69(20).
17. Salami HO, Mamman EY. "A Genetic Algorithm for Allocating Project Supervisors to Students." *Int. J. Intell. Syst. Appl*.,10, 51-59.
18. Volkema RJ. "Designing effective projects: Decision options for maximizing learning and project success". *J. Manag. Educ*.,2010:34:527-550.
19. Dimitar K. Coordination of student project allocation, 2001.
20. Vial PJ, Russell TJ, Montserrat DS, Ros P. Premaratne, Nikolic S. "A Java Program for Automatic Team Allocation in Project-Based Coursework." In IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE), IEEE, 2018, 185-192.
21. Hussain SK, Sajjad KAA, Sagor GH, Tariq F, Ma L, Imran MA. "A systematic review of project allocation methods in undergraduate transnational engineering education." *Education Sciences*,2019:9(4):258.
22. Tayal A, Gadge S, Chawhan S, Suryawanshi S, Pahire R, Wakode A. "Student's Project Management System for Faculty of Engineering and Technology", International Journal Of Trend in Research and Development,2017:4(01).

23. Adamu A. “Final Year Student Project Allocation Archiving and Management System.”
24. Srinivasan D, Rachmawati L. “Efficient fuzzy evolutionary algorithm-based approach for solving the student project allocation problem.” IEEE Transactions on Education,2008:51(4):439-447.
25. Gerasimos R. “Online project allocation system”, A dissertation submitted to the University of Manchester for the degree of Master of Science in the Faculty of Engineering and Physical Sciences, 2012. https://studentnet.cs.manchester.ac.uk/resources
26. Ugboaja C, Eziechina M. “Web-Based Student Project Management System”: A Tetfund Institution-Based Research Report International Journal of Current Science Research and Review,2021:04(12). ISSN: 2581-8341.