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Jamia Millia Islamia
A Central University
(NAAC Accredited A++ Grade)

A Project Report on

PRIORITIZING THE REQUIREMENTS OF AN INFORMATION SYSTEM USING FUZZY TOPSIS

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DIPLOMA IN COMPUTER ENGINEERING

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Date: 01/ 06/ 2024

CERTIFICATE

This is to certify that the project entitled **"Prioritizing The Requirements of an Information System using Fuzzy TOPSIS"** submitted by Mr. Abusad Alam (21DCS001), Mr. Adnan Khan (21DCS002), Mr. Asim Mustafa (21DCS009), Mr. Md Hatim (21DCS024) and Mr. Md Aman Maqsood (21DCS028) in the partial fulfilment of the requirements for the award of the Diploma in Computer Engineering embodies the work done by them under the supervision and the content of this report, in the full or in parts, have not been submitted to any other Institution and University for the award or any degree or diploma.

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LIST OF ABBREVIATIONS

Abbreviation: Definition

HTML: Hypertext Markup Language

CSS: Cascading Style Sheets

PHP: Hypertext Preprocessor

SQL: Structured Query Language

HR: Human Resources

API: Application Programming Interface

SRS: Software Requirements Specifications.

SRPS: Software Requirements Prioritization and Selection

SRs: Software Requirements

FRs: Functional Requirements

NFRs: Non-functional Requirements

AHP: Analytic Hierarchy Process

TOPSIS: Technique for Order of Preference by Similarity to Ideal Solution

MCDM: Multi Criteria Decision Making

CHAPTER 1: INTRODUCTION

The objective of this chapter is to discuss about peer-reviewed journals, software requirement selection and prioritization. The motivation behind the work and contribution is also included in the end of this chapter.

1.1 About peer review journal

Peer-reviewed journals are fundamental in engineering research, ensuring the credibility and quality of published work. They undergo rigorous evaluation by experts before publication, upholding academic standards and providing a trusted platform for scholarly communication. Its importance is that they uphold academic credibility and trustworthiness [1]. It is essential for professionals to access latest developments and best practices. It's selection criteria consider factors like impact factor, reputation, and ethical practices. In the engineering world, peerreviewed journals are a very useful way of spreading new ideas, techniques, and the best way of doing things with respect to information technology among others. Hence, for engineers to keep up with new developments at the same time confirm what they know from their recent researches and help in advancing knowledge collectively, they depend on them [1].

Peer-reviewed journals lay emphasis on the excellence and trustworthiness of published research by adhering to strict editorial rules and involving blind peer-review processes. The evaluation process is run by an editorial committee made up of professionals in different fields who warrant that only academic works of high quality and impact get to be published. When engineers choose peer-reviewed journals as outlets for their references or publications, they are influenced by impact factors, journal reputation within the field, and their reputation regarding ethical publishing. Thus, as they symbolize the literature review and peer review practices, engineers not only enrich the quality and visibility of their research, but also contribute to advancing knowledge and improving society at large scale [10].

1.2 Motivation

When developing software, the first step is to gather the software requirements using techniques like goal-oriented requirements engineering. After gathering these requirements, we often end up with hundreds, which is too many to implement due to limitations in cost, time, and resources. To

solve this problem, we need mathematical methods to select and prioritize the most important requirements. In this project, we use the TOPSIS methods to rank the software requirements. Different stakeholders have different opinions on the importance of each requirement. For example, people might say 'JMI is a very good university' or 'He/she is a very intelligent student,' where 'very good' and 'very intelligent' are fuzzy terms. This motivates us to use and apply fuzzy TOPSIS methods to prioritize software requirements.

1.3 Objective

The main goal for prioritizing requirements of an information system using fuzzy logic is to create a structured and adaptive strategy that uses fuzzy logic principles to weight different system requirements phases. The above model aims to ensure that funds are allocated sufficiently to address the most important and essential needs, bearing in mind that real-world decision-making is often uncertain and vague. A strategy to efficiently manage inaccurate or arbitrary ideas using fuzzy logic methods is the main purpose. In this way stakeholders will be in a position to choose issues that they consider most relevant when it comes to allocating resources and prioritizing the development of a system. In the end, the aim is to improve the overall efficiency and flexibility of the information system by giving priority to requirements that agree with organizational goals and stakeholder preferences.

1.4 Software Requirement Selection and Prioritization

Requirements elicitation is the process of determining software requirements from stakeholders. It involves collecting potential requirements, refining them, and analyzing them to form a preliminary model of the system. There are several activities in this sub-process, i.e., identification of stakeholders and their requirements, software requirements prioritization, and analysis. It is important to note that the requirements elicitation process focuses on "what" is expected to be achieved by the predicted system irrespective of "how" it is to be achieved. There are various methods for the requirements elicitation process as Traditional methods: like interviews, questionnaire, brain storming session, analysis of existing documents and survey. Goal Oriented method: decompose and refine the goal of stakeholders into sub-goals and Group Requirement Elicitation like multi-criteria decision (MCDM), Fuzzy environment [3].

The software requirements are description of functionalities and features of the system. Requirements convey the expectations of users from software product [10]. These requirements are gathered by the various requirement elicitation methods such as traditional method, goaloriented method, group-requirements elicitation etc. the goal of requirements elicitation is to understand what the users and stakeholders need from the system to solve a problem or achieve an objective. There are two types of software requirement i.e. functional and non-functional requirements. The functional requirements define the functionality of software product whereas non-functional requirements define the software quality attribute like security, performance, accessibility, usability etc.

Software Requirements Prioritization and Selection (SRPS) is the process that involves multiple decision makers to rank software requirements based on criteria like cost, quality and usability. SRPS is multi-criteria decision-making process in which different decision makers are involved to compute ranking values of the SRs. So selected set of SRs can be implemented in different release of software. Different SRPS method has been developed to prioritize and select the SRs for different release of software [3].

There are two categories of SRPS methods [12]:

i. Manual SRPS
ii. Automated SRPS

1.4.1 Requirement Prioritization Technique

A number of prioritization methods have been found to be useful in traditional requirements engineering and could potentially use for requirements [11]. Efficient and trustworthy methods for prioritizing requirements are therefore strongly demanded by practitioners. There are several methods of requirements prioritization.

1. Analytic Hierarchy Process (AHP)
   AHP prioritization technique based on ratio scale results is called analytic hierarchy process. The idea of AHP is that it compares all possible pairs of hierarchical requirements to determine the priority.

2. B-Tree

It is an algorithm that typically used in search for information and can easily be scaled to be used in prioritizing many requirements. It has a root node which determines the priority of requirements which need to be implemented in first release.

1.5 Contribution

This application is important because journal submission process could be difficult especially if the paper is long, making it tough. It makes work easier by looking into the needs of both users and administration, it's secure such that any information you have entered will be stored there for future reference. With its simple interface, all one needs is to sign in and therefore accessible either as a user on their own behalf or else an administrator himself thus registering becomes very easy to prevent you to consider being either a writer who may want some advice at times from other people in form of remarks made in this application.

1.5.1 Goal Oriented Method

Having goals means focusing clearly on certain aims or results that one wants to achieve. It includes fixing certain targets or goals before starting on them and pursuing them energetically and with determination. Planning and organizing one's actions towards the set objectives shows how goal-oriented a person is, he should remain committed to them for him to be successful.

1.5.2 Fuzzy TOPSIS

Fuzzy TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) is a multi-criteria decision-making method that combines fuzzy logic and the TOPSIS approach. In this method, criteria and alternatives are evaluated using fuzzy numbers to handle uncertainty and imprecision. The process involves defining an ideal and a negative-ideal solution, then calculating the distance of each alternative from these ideal points. The alternative closest to the ideal solution and farthest from the negative-ideal solution is considered the best choice. Fuzzy TOPSIS is widely used for complex decision-making problems where subjective judgments are involved.

1.5.3 Prototype Development of Journal submission portal

The Journal Submission Portal prototype was developed using a combination of HTML, CSS, JavaScript, PHP, and SQL. HTML provides the structure of the web pages, while CSS ensures they are styled and visually appealing. JavaScript adds interactivity and client-side validation. PHP

handles server-side scripting, processing form submissions, and interacting with the SQL database, which stores submission data securely. Together, these technologies create a seamless and functional user experience.

CHAPTER 2: IDENTIFICATION OF STAKEHOLDERS OF PEER REVIEWED JOURNAL

The objective of this chapter is to discuss about the stakeholder's identification and types of stakeholders. The list of stakeholders of journal portal are given at the end of this chapter.

2.1 Stakeholders Identification

It is the process of identifying a person, group, or company that can affect or get affected by a decision, activity, or the outcome of the software project. It is important in order to identify the exact requirements of the project and what various stakeholders are expecting from the project outcome.

2.2 Types of Stakeholders

Internal Stakeholder - An internal stakeholder is a person, group or a company that is directly involved in the project. For example, Project Manager, Company, Partners, Investors.

External Stakeholder - An external stakeholder is the one who is linked indirectly to the project but has a significant contribution to the successful completion of the project. For example, Customers, Suppliers, Government.

2.2.1 Stakeholders of Journal Portal

STACK HOLDERS	ROLES	RESPONSIBILITIES
S1	Authors	Ensure the quality and accuracy of their work, comply with submission guidelines, and respond to peer review feedback.
S2	Readers	Use the portal for research, learning, and staying updated in their field.
S3	Editors	Ensure the quality and integrity of published content, and make publication decisions.
S4	Reviewers	Provide constructive feedback, assess the quality and suitability of the work, and maintain confidentiality.
S5	Publishers	Ensure the sustainability and profitability of the portal, and handle financial and administrative aspects.

S6	Advertisers	Ad creation, targeting, and payment for advertising space.
S7	Funding Agencies	Allocate funding, and monitor compliance with grant requirements.
S8	Professional Societies	Publish content, support research initiatives, and promote the portal.
S9	Academic Institutions	Provide access, support research, and uphold academic standards.
S10	Data Providers	Ensure data accuracy, availability, and proper citation.
S11	Technology Providers	Ensure the portal's functionality, security, and usability.
S12	Language Editors	Ensure the quality and readability of published content.
S13	Translation Services	Ensure accurate and high-quality translations of published content.
S14	Indexing Services	Enhance discoverability and accessibility of content.
S15	User Community	Participate in community activities, provide feedback, and share knowledge.
S16	User Data Privacy Officers	Develop and enforce data protection policies and handle privacy-related issues.
S17	Ethical Committees	Review and approve research involving human subjects, animals, or sensitive data.
S18	Editorial Board	Provide expert peer reviews, make recommendations regarding acceptance, revisions, or rejection, and contribute to journal policy decisions.

S19	Translation Services	Translate articles to broaden the journal's international readership and accessibility.
S20	Corporate Partners	Companies and industry partners with interests in specific research areas may collaborate with journals to sponsor special issues, advertise products or services, or support research initiatives.
S21	Technology Standards Bodies:	Organizations that develop and maintain standards for data formats, and interoperability may influence the technical specifications of the submission portal.
S22	International Bodies	Organizations like the Scientific and Cultural Organization (UNESCO) may promote global cooperation in scientific publishing and support initiatives for open access to research.
S23	Educational Institutions	Educational organizations outside of traditional academia, such as online learning platforms may have an interest in accessing research publications to support their programs and initiatives.
S24	Students	Students at all levels benefit from access to scholarly research through journals for their academic studies and research projects.
S25	Research Collaborators	Collaborators involved in the research process, may have an interest in the publication outcome and use of the submission portal.
S26	Parents and Guardians	Parents and guardians may indirectly benefit from research published in journals through its influence on educational materials, healthcare practices, and public policies.
S27	Teachers and Educators	Teachers and educators who use research findings in their curriculum and teaching materials are stakeholders as they rely on journals for accurate and up-to-date information.

S28	Media Outlets	Newspapers, magazines, and online media outlets often reference research published in journals for news articles, contributing to public awareness and understanding of scientific discoveries.

CHAPTER 3: REQUIREMENTS ELICITATION OF PEER REVIEWED JOURNAL

The objective of this chapter is to discuss about software requirements elicitation methods. The list of requirements of Peer Review Journal is also at the end of this chapter.

3.1 Introduction

The emergence of digital technologies has revolutionized scholarly publishing, facilitating streamlined processes for manuscript submission and peer review. In this context, we have explored the pivotal role played by Journal Submission Portals in the dissemination of scholarly work. Specifically, we focused on the critical aspects of "Requirements Elicitation of Peer Reviewed Journals," which underpins the functionality of these portals. By precisely gathering and analyzing the needs and expectations of stakeholders, this process ensures that the portal aligns with the standards and objectives of peer-reviewed journals. Through this report, we explored the significance of requirements elicitation in enhancing the efficiency, requirements elicitation techniques, and effectiveness of journal submission portals.

Requirements elicitation is the process of determining software requirements from stakeholders. It involves collecting potential requirements, refining them, and analyzing them to form a preliminary model of the system. There are several activities in this sub-process i.e., identification of stakeholders and their requirements, software requirements prioritization, and analysis. It is important to note that the requirements elicitation process focuses on "what" is expected to be achieved by the predicted system irrespective of "how" it is to be achieved.

3.2 Some Requirements Elicitation Methods are Given below: -

There are majorly three requirements elicitation methods which are traditional method, goaloriented method and group requirement elicitation.

3.2.1 Traditional Method

In the traditional method of requirements elicitation, the requirements are gathered by asking "what" the system needs to do. There are a few requirements elicitation techniques involved in traditional method which are given below.

1. **Interviews**: Engage stakeholders in individual discussions to gather ideas and perspectives on their needs and expectations of the system.
2. **Questionnaires**: Distribute structured surveys to stakeholders to collect quantitative and qualitative data about their needs, preferences, and priorities.
3. **Brainstorming Sessions**: Facilitate collaborative ideation sessions with stakeholders to explore different perspectives and uncover potential requirements.
4. **Survey:** Used for eliciting information from many people, anonymously, in a relatively short time. A survey is often referred to as a questionnaire to collect information about customers, products, work practices, and attitudes.
5. **Existing Document Analysis**: Review documents such as reports, policies, and user guides to extract requirements and information relevant to the new system.

3.2.2 Goal Oriented Method

In goal-oriented method the requirement engineering takes the view that requirement should initially focus on the "why" and "how" questions. "Why" a certain functionality is needed and "how" it can be implemented. There are some techniques involve in goal-oriented method of requirement elicitation are given below.

Decomposition using AND/OR graph: Decompose complex requirements into smaller components using AND/OR diagrams to better understand their interdependencies and relationships. AND/ OR graph is constructed by decomposing the high-level objective of stakeholders into sub-goals or requirements. This graph is used to identify the functional and nonfunctional requirements.

3.2.3 Group Requirement Elicitation

Group requirements elicitation methods involve gathering requirements from multiple stakeholders simultaneously. These methods foster collaboration, communication, and

consensusbuilding among stakeholders. Some common group requirements elicitation methods include:

1. **Multi-Criteria Decision Making (MCDM)**: Use decision-making techniques that incorporate multiple criteria to prioritize requirements based on their importance and impact.
2. **Fuzzy Environment**: Apply fuzzy logic techniques to handle imprecise or uncertain requirements, enabling flexibility and adaptability in system design.

3.3 Functional Requirements

The Functional Requirements part discusses the functionalities required from the system. Functional Requirements are like a set of instructions for a system. They describe what the system should do and how it should do it. They cover what the system should accept as input, what it should produce as output, and how it should interact with users and other methods. These requirements are essential because they help ensure that the result is what everyone wants and needs.

3.3.1 Functional Requirements (FRs)

Based on the stakeholders and their roles, here are a list of functional requirements (FRs) for the Journal Submission Portal:

FR1: Submission Guidelines

Stakeholders: Authors

Ensure the portal provides clear submission guidelines and mechanisms to ensure authors comply with them.

FR2: User Registration and login

Stakeholders: Researchers, Authors, Editors

Ensure the portal supports new user registration and login via username and password authentication.

FR3: Peer Review Feedback Management

Stakeholders: Authors, Reviewers

Provide a platform for authors to respond to peer review feedback and for reviewers to provide constructive feedback securely.

FR4: Research and Learning

Stakeholders: Readers

Enable readers to access content for research, learning, and staying updated in their field through user-friendly navigation and search functionalities.

FR5: Content Quality Assurance

Stakeholders: Editors, Language Editors

Ensure the portal supports mechanisms for editors and language editors to maintain the quality and integrity of published content.

FR6: Publication Decision Support

Stakeholders: Editors, Editorial Board

Provide tools and systems for editors and editorial boards to make publication decisions efficiently.

FR7: Financial and Administrative Management

Stakeholders: Publishers

Support functionalities for publishers to handle financial and administrative aspects effectively.

FR8: Advertising Management

Stakeholders: Advertisers

Provide tools for advertisers to create, target, and manage advertising space effectively.

FR9: Funding Allocation Monitoring

Stakeholders: Funding Agencies

Provide mechanisms for funding agencies to allocate funding and monitor compliance with grant requirements.

FR10: Research Support

Stakeholders: Professional Societies, Academic Institutions

Ensure the portal provides support for research initiatives and upholds academic standards.

FR11: Data Accuracy and Citation Support

Stakeholders: Data Providers

Ensure the portal supports mechanisms for data providers to ensure data accuracy, availability, and proper citation.

FR12: Portal Functionality and Security

Stakeholders: Technology Providers

Ensure the portal's functionality, security, and usability are maintained at optimal levels.

FR13: Language Translation Support

Stakeholders: Translation Services

Provide tools and support for accurate and high-quality translations of published content.

FR14: Content Discoverability Enhancement

Stakeholders: Indexing and Abstracting Services

Enhance the discoverability and accessibility of content through indexing and abstracting services.

FR15: Community Engagement

Stakeholders: User Community

Facilitate community activities, feedback mechanisms, and knowledge sharing within the portal.

FR16: Expert Peer Review Management

Stakeholders: Editorial Board, Guest Editors

Support mechanisms for expert peer reviews, recommendations regarding acceptance, revisions, or rejection, and contributions to journal policy decisions.

FR17: Guest Editor Management

Stakeholders: Guest Editors

Support guest editors in managing the submission and review process for specific issues related to particular topics or conferences.

FR18: User Notification

Notify authors about the status of their submissions, reviews, and publication decisions.

Notify reviewers and editors about new assignments and deadlines.

FR19: Submit Articles

Stakeholders: Manuscripts Submission

Research scholars can submit articles in the form of pdf documents with specifications in their area of interest and get notified by email/contact information provided.

FR20: Track Articles

Stakeholders: Manuscripts Tracking

Research scholars can track the status of submitted articles. Users can view the list of submitted articles in the form of a table and the current status of articles in a column of the same table.

FR21: Admin Module

Stakeholders: Administrator

Admin can log in using user ID and password provided manually through email and can update the status of all submitted articles one by one. They can also view or download submitted articles in form of pdf/docx format.

3.4 Non-Functional Requirements

Non-Functional Requirements describe how a system should work, not just what it should do. They include how fast it should run, how secure it should be, and how easy it should be to use. They help make sure that the system is well and meets people's expectations. Examples of NFRs are security, performance, ease of access etc. Both Functional and Non-Functional requirements are essential for capturing and documenting the complete set of specifications and expectations for a software system. They help guide the software development process, enable effective communication between stakeholders, and serve as a basis for system design, implementation, and testing activities.

3.4.1 Non-Functional Requirements (NFRs)

Based on software attributes there are list of some non-functional requirements of Journal Submission Portal.

NFR1: Performance

The portal should be responsive and able to handle high-traffic loads without significant delays.

NFR2: Usability

The portal should have an intuitive user interface to ensure ease of use for all stakeholders.

NFR3: Reliability

The portal should be available and operational 24/7 with minimal downtime for maintenance.

NFR4: Security

The portal should have robust security measures in place to protect user data, content integrity, and system access.

NFR5: Accessibility

The portal should comply with accessibility standards to ensure all users, including those with disabilities, can access and use the platform effectively.

CHAPTER 4: REQUIREMENTS SELECTION USING FUZZY TOPSIS

The objective of this chapter is to discuss the methods and steps involved in requirements selection and prioritization using Fuzzy TOPSIS. The list of requirements for the Peer Review Journal after the ranking is also at the end of this chapter.

4.1 Introduction

Fuzzy logic is a mathematical tool for dealing with uncertainty. It is a form of multivalued logic to deal with reasoning that is approximate rather than precise. This is in contradiction with crisp logic that deals with precise values. Binary sets have binary or Boolean logic (0 and 1). Fuzzy logic may have truth values that range between 0 and 1. Fuzzy logic operates on the concept of membership. Fuzzy logic is all about the degree of truth. Both fuzzy logic and probability are closely related to each other.

Uncertainty

- Randomness:
- It is one source of uncertainty
- Probability
- Vagueness:
- It is another source of uncertainty
- It arises from imprecise information (Fuzzy Logic).

There is no uncertainty in the classical sets because they have crisp boundaries.

Examples:

- I will come back soon. (**Vagueness)**
- He/she can come within 0.1-minute, 0.2 minute, …, or 1 minute.
- Here you have the range from 0 to 1.

- I will come back within one minute. (**Crisp)**

Fuzzy logic is not logic that is fuzzy but logic that is used to describe the fuzziness. This fuzziness is characterized by its membership functions. The membership function represents the degree of truth in fuzzy logic. The membership function is a curve that defines how each point in the input space is mapped to a membership value between 0 and 1.

4.2 Algorithm of Fuzzy TOPSIS

The algorithm for the Fuzzy TOPSIS goes like this [13] –

Step 1: First of all, a committee of decision-makers is. formed. In a decision committee that has K decision-makers; the fuzzy rating of each decision-maker D (k=1, 2, ...K) can be represented as a triangular fuzzy number $\tilde{R}_k$ = (k = 1, 2, ...K) with membership function $\mu_{Rk}\tilde{}$ (x).

Step 2: Then evaluation criteria are determined.

Step 3: After that, appropriate linguistic variables are chosen for evaluating criteria and alternatives.

Step 4: Then the weight of criteria is aggregated. If the fuzzy ratings of all decision-makers are described as triangular fuzzy numbers Rx (a_k, b_k, c_k), k=1,2,..., K., then the aggregated fuzzy rating can be determined as R= (a, b, c), k=1,2,..., K. Here;

$a = \min_{mink}\{a_k\}$, $b = \frac{1}{K}\sum_{kk=1} b_k$, $c = max_k\{c_k\}$

If the fuzzy rating and importance weight of the kth decision-maker are $\tilde{x}_{ijk}$ = (a_{ijk}, b_{ijk}, C_{ijk}) and $\tilde{w}_{ijk}$ = (W_{jk1}, W_{jk2}, W_{jk3}), i=1,2, ...m, j=1,2, ...n respectively, then the aggregated fuzzy ratings ($\tilde{x}_{ij}$) of alternatives concerning each criterion can be found as ($\tilde{x}_{ij}$) = (a_{ij}, b_{ij}, c_{ij})

Here,

$a_{ij} = min_k\{a_{ijk}\}$, $b_{ij} = \frac{1}{k}\sum_k^k{}_{=1} b_{ijk}$, $c_{ij} = max_k\{c_{ijk}\}$

Then the aggregated fuzzy weights ($\tilde{w}_{ij}$) to each criterion is calculated as:

($\tilde{w}_j$) = (w_{j1}, w_{j2}, w_{j3})

Here,

$W_{jl} = min_k\{w_{jk1}\}$, $w_{j2} = 1_k - \sum_k^k{}_{=1} w_{jk2}$, $w_{j3} = max_k\{w_{jk3}\}$

Step 5: Then the fuzzy decision matrix is constructed as:

$$a = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn} \end{bmatrix}$$

$\tilde{w} = [\tilde{w}_1, \tilde{w}_2, \cdots, \tilde{w}_n]$

Here $\tilde{x}_{ij} = (a_{ji}, b_{ij}, c_{ij})$ and $\tilde{w}_j = (w_{j1}, w_{j2}, w_{j3})$ i=1, 2, … m. j=1, 2, ... can be approximated by positive triangular fuzzy numbers.

Step 6: After constructing the fuzzy decision matrix, it is normalized. Instead of using the complicated normalization formula of classical TOPSIS, the linear scale transformation can be used to transform the various criteria scales into a comparable scale. Therefore, we can obtain the normalized fuzzy decision matrix R.

$R = [\tilde{r}_{ij}]_{m*n}$ I =1,2, …,m; j = 1, 2, …n Where:

$$\tilde{r}_{ij} = \left(\frac{a_{ij}}{c^*_j}, \frac{b_{ij}}{c^*_j}, \frac{c_{ji}}{c^*_j}\right)_{a_c \quad b_c \quad c_c},$$

$$c^*_j = \max_i c_{ij}$$

Step 7: Considering the different weights of each criterion, the weighted normalized decision matrix is computed by multiplying the importance weights of evaluation criteria and the values in the normalized fuzzy decision matrix. The weighted normalized decision matrix V is defined as:

$\tilde{v} = [\tilde{v}_{ij}]_{m*n}$ i= 1,2, …,m j =1,2, …, n

$\tilde{v}_{ij} = r_{ij}(.)\tilde{w}_j$

Here $\tilde{w}_j$ represents the importance weight of criterion C_j. According to the weighted normalized fuzzy decision matrix, normalized positive triangular fuzzy numbers can also approximate the elements $\tilde{v}_{ij}$, $\forall i$, j.

Step 8: Then, the fuzzy positive ideal solution (FPIS, A*) and fuzzy negative ideal solution (FNIS, A^-) are determined as:

$$A_* = (\tilde{v}_1^-, \tilde{v}_2^-, \cdots, \tilde{v}_n^-)$$

$$A\_ = (\tilde{v}_1^{-}, \tilde{v}_2^{-}, \cdots \tilde{v}_n^{-}),$$

where,

$$v_* = \max_j \{v_{ij3}\} \quad \text{and} \quad v_j^{-} = \min_j \{V_{ij1}\}$$

I =1, 2, … m, j = 1, 2, $\cdots n$.

Our objective is to find a new location and it has three alternatives:

A new location and it has three alternatives (A_1, A_2, A_3). First of all, a committee of decisionmakers formed. There are three decision- maker (D_1, D_2, D_3) in the committee. Then evaluation criteria are determined as favorable labor climate (C_1), proximity to market (C_2), community consideration (C_3), quality of life (C_4), proximity to suppliers and resource (C_5). The hierarchical structure for the selection of the best facility location is seen as in Fig. 4.

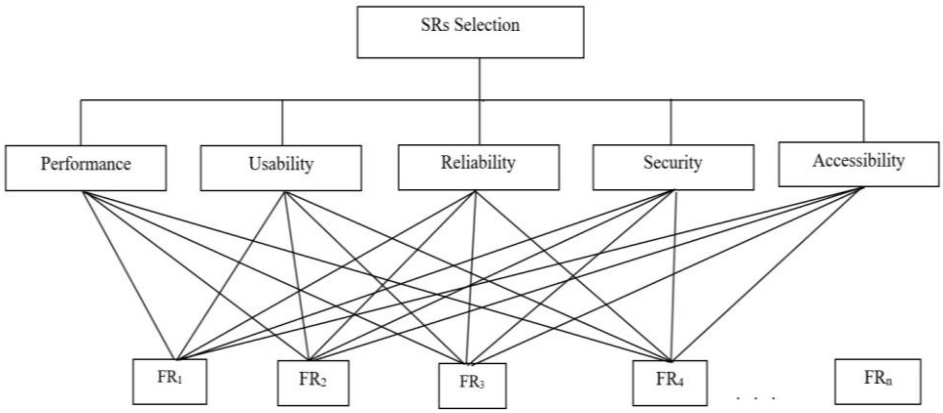


Fig. 4.1: Relation between functional and non-functional requirements

Firstly, three decision-makers evaluated the importance of criteria by using the linguistic variables in Table 4.1. The importance weights of the criteria determined by these three decision-makers are shown in Table 4.2.

4.3 Prioritization of Functional requirements

Table 4.1: Linguistic variables for the importance of each NFR

S. No.	Linguistic variables	Triangular Fuzzy Numbers

1	VL (very low)	(0,0,0.25)
2	L (Low)	(0,0.25,0.5)
3	M (Middle)	(0.25, 0.5, 0.75)
4	H (High)	(0.5, 0.75, 1.0)
5	VH (very high)	(0.75, 1.0, 1.0)

Table 4.2: Importance weight of criteria from 3 decision-makers

NFR	Decision maker		
	D1	D2	D3
Performance	VH	VH	VH
Usability	M	H	H
Reliability	VH	H	VH
Security	H	M	VH
Accessibility	H	H	VH

Three decision-makers use the linguistic variables shown in Table 4.3 to evaluate the ratings of alternatives concerning each criterion. The rating of three alternatives under five non-functional requirements (NFRs) is shown in Table 4.4.

Table 4.3: Linguistic variables for ratings

Linguistic variables	Triangular fuzzy number
VP (very poor)	(0,0,2.5)
P (poor)	(0,2.5,5.0)
F (fair)	(2.5,5,7.5)
G (good)	(5,7.5,10)
VG (very good)	(7.5,10,10)

Table 4.4: Ratings of 21 FRs by decision-makers under 5 NFRs

NFR	FR	Decision makers		
		D1	D2	D3
Performance	Submission guideline	G	VG	VG
	User registration and login	VG	VG	VG
	Peer review feedback management	F	G	G
	Research and learning	VG	F	G
	Content Quality Assurance	VG	VG	VG
	Publication Decision Support	G	G	VG
	Financial and Administrative Management	F	G	F
	Advertising Management	G	F	P
	Funding Allocation Monitoring	G	G	G
	Research Support	VG	G	VG

	Data Accuracy and Citation Support	VG	VG	VG
	Portal Functionality and Security	VG	VG	VG
	Language Translation Support	G	VG	G
	Content Discoverability Enhancement	F	G	G
	Community Engagement	VG	F	F
	Expert Peer Review Management	G	VG	VG
	Guest Editor Management	VG	VG	G
	User Notification	F	F	P
	Submit Articles	VG	VG	VG
	Track Articles	VG	VG	VG
	Admin Module	VG	VG	VG
Usability	Submission guideline	VG	VG	G
	User registration and login	VG	VG	VG
	Peer review feedback management	F	G	G
	Research and learning	G	F	G
	Content Quality Assurance	VG	G	VG
	Publication Decision Support	VG	VG	VG
	Financial and Administrative Management	G	P	P

	Advertising Management	P	F	P
	Funding Allocation Monitoring	G	G	G
	Research Support	G	VG	VG
	Data Accuracy and Citation Support	VG	G	VG
	Portal Functionality and Security	VG	VG	VG
	Language Translation Support	VG	VG	F
	Content Discoverability Enhancement	G	F	G
	Community Engagement	G	G	F
	Expert Peer Review Management	P	G	G
	Guest Editor Management	G	VG	F
	User Notification	G	F	F
	Submit Articles	VG	VG	VG
	Track Articles	VG	VG	VG
	Admin Module	VG	VG	VG
Reliability	Submission guideline	VG	VG	VG
	User registration and login	VG	VG	G
	Peer review feedback management	G	G	VG
	Research and learning	VG	G	G
	Content Quality Assurance	F	F	F
	Publication Decision Support	VG	VG	G
	Financial and Administrative Management	G	F	G
	Advertising Management	G	G	F

	Funding Allocation Monitoring	F	G	VG
	Research Support	VG	VG	G
	Data Accuracy and Citation Support	VG	VG	VG
	Portal Functionality and Security	VG	G	G
	Language Translation Support	G	VG	VG
	Content Discoverability Enhancement	G	VG	VG
	Community Engagement	F	F	F
	Expert Peer Review Management	G	G	G
	Guest Editor Management	F	G	F
	User Notification	F	G	G
	Submit Articles	VG	VG	VG
	Track Articles	F	G	VG
	Admin Module	VG	G	F
Accessibility	Submission guideline	VG	G	G
	User registration and login	VG	VG	VG
	Peer review feedback management	F	G	F
	Research and learning	F	G	G
	Content Quality Assurance	F	F	F
	Publication Decision Support	VG	G	G
	Financial and Administrative Management	VG	VG	VG
	Advertising Management	F	P	P
	Funding Allocation Monitoring	P	P	F
	Research Support	VG	G	G
	Data Accuracy and Citation Support	VG	VG	G
	Portal Functionality and Security	G	G	VG
	Language Translation Support	G	F	G
	Content Discoverability Enhancement	P	G	F
	Community Engagement	F	F	F
	Expert Peer Review Management	G	G	G
	Guest Editor Management	G	VG	G
	User Notification	F	G	P
	Submit Articles	VG	VG	VG
	Track Articles	G	G	G
	Admin Module	G	G	VG
Security	Submission guideline	G	G	F
	User registration and login	VG	VG	VG
	Peer review feedback management	P	F	P
	Research and learning	G	G	F
	Content Quality Assurance	F	P	F
	Publication Decision Support	F	F	F
	Financial and Administrative Management	VG	VG	G
	Advertising Management	G	G	G

	Funding Allocation Monitoring	VG	VG	VG
	Research Support	F	F	P
	Data Accuracy and Citation Support	VG	VG	G
	Portal Functionality and Security	G	G	F
	Language Translation Support	G	F	F
	Content Discoverability Enhancement	G	F	F
	Community Engagement	F	P	P
	Expert Peer Review Management	F	P	P
	Guest Editor Management	G	F	F
	User Notification	G	G	G
	Submit Articles	VG	G	G
	Track Articles	G	F	F
	Admin Module	VG	G	G

The linguistic variables from Table 4.2 and 4.4 are converted into triangular fuzzy numbers to form fuzzy decision matrix as shown in Table 4.5.

Table 4.5: Fuzzy decision matrix and fuzzy weights of 5 NFRs

	NFR_1	NFR_2	NFR_3	NFR_4	NFR_5
FR_1	(5,9.16,10)	(5,5.83,10)	(7.5,10,10)	(5,8.33,10)	(2.5,6.66,10)
FR_2	(7.5,10,10)	(7.5,10,10)	(5,9.16,10)	(7.5,10,10)	(7.5,10,10)
FR_3	(2.5,6.67,10)	(2.5,6.67,10)	(5,8.33,10)	(2.5,5.83,10)	(0,3.33,7.5)
FR_4	(2.5,7.5,10)	(2.5,6.67,10)	(5,8.33,10)	(2.5,6.66,10)	(2.5,6.66,10)
FR_5	(7.5,10,10)	(5,5.83,10)	(2.5,5,7.5)	(2.5,5,7.5)	(0,4.16,7.5)
FR_6	(5,8.3,10)	(7.5,10,10)	(5,9.16,10)	(5,8.33,10)	(2.5,5,7.5)
FR_7	(2.5,7.5,10)	(0,4.17,10)	(2.5,6.67,10)	(7.5,10,10)	(5,9.16,10)
FR_8	(0,4.83,10)	(0,3.33,7.5)	(2.5,6.67,10)	(0,3.33,7.5)	(5,7.5,10)
FR_9	(5,7.5,10)	(5,7.5,10)	(2.5,7.5,10)	(0,3.33,7.5)	(7.5,10,10)
FR_{10}	(5,9.16,10)	(5,5.83,10)	(5,9.16,10)	(5,8.33,10)	(0,4.16,7.5)
FR_{11}	(7.5,10,10)	(5,5.83,10)	(7.5,10,10)	(5,9.16,10)	(7.5,9.16,10)
FR_{12}	(7.5,10,10)	(7.5,10,10)	(5,8.33,10)	(5,8.33,10)	(2.5,6.66,10)
FR_{13}	(5,9.16,10)	(2.5,8.33,10)	(5,9.16,10)	(2.5,6.66,10)	(2.5,5.83,7.5)
FR_{14}	(2.5,6.67,10)	(2.5,6.67,10)	(5,9.16,10)	(0,5,10)	(0,3.33,7.5)
FR_{15}	(2.5,6.67,10)	(2.5,6.67,10)	(2.5,5,7.5)	(2.5,5,7.5)	(2.5,5.83,10)
FR_{16}	(5,9.16,10)	(0,5.83,10)	(5,7.5,10)	(5,7.5,10)	(0,3.3,7.5)
FR_{17}	(5,9.16,10)	(2.5,7.5,10)	(2.5,5.83,10)	(5,8.33,10)	(2.5,5.83,7.5)
FR_{18}	(0,4.16,7.5)	(2.5,5.83,10)	(2.5,6.67,10)	(0,5,10)	(5,7.5,10)
FR_{19}	(7.5,10,10)	(7.5,10,10)	(0.75,10,10)	(7.5,10,10)	(5,8.33,10)

FR_{20}	(7.5,10,10)	(7.5,10,10)	(2.5,7.5 10)	(5,7.5,10)	(2.5,5.83,7.5)
FR_{21}	(7.5,10,10)	(7.5,10,10)	(2.5,7.5,10)	(5,8.33,10)	(5,8.33,10)

Table 4.5.1: Weights of 5 NFRs

FR_1	(0.75,1.0,1.0)
FR_2	(0.25,0.67,1.0)
FR_3	(0.5,0.92,1.0)
FR_4	(0.25,0.83,1.0)
FR_5	(0.25,0.83,1.0)

The normalized fuzzy decision matrix is formed as in Table 4.6. Then weighted normalized fuzzy decision matrix is formed as in Table 4.7.

Table 4.6: Normalized fuzzy decision matrix

	NFR_1	NFR_2	NFR_3	NFR_4	NFR_5
FR_1	(0.5,0.91,1)	(0.5,0.58,1)	(0.75,1,1)	(0.5,0.83,1)	(0.25,0.66,1)
FR_2	(0.75,1,1)	(0.75,1,1)	(0.5,0.91,1)	(0.75,1,1)	(0.75,1,1)
FR_3	(0.25,0.67,1)	(0.25,0.67,1)	(0.5,0.83,1)	(0.25,0.58,1)	(0,0.33,0.75)
FR_4	(0.25,0.75,1)	(0.25,0.67,1)	(0.5,0.83,1)	(0.25,0.66,1)	(0.25,0.66,1)
FR_5	(0.75,1,1)	(0.5,0.58,1)	(0.25,0.5,0.75)	(0.25,0.5,0.75)	(0,0.416,0.75)
FR_6	(0.5,0.83,1)	(0.75,1,1)	(0.5,0.91,1)	(0.5,0.83,1)	(0.25,0.5,0.75)
FR_7	(0.25,0.58,1)	(0,0.41,1)	(0.25,0.67,1)	(0.75,1,1)	(0.5,0.916,1)
FR_8	(0,0.48,1)	(0,0.33,0.75)	(0.25,0.67,1)	(0,0.33,0.75)	(0.5,0.75,1)
FR_9	(0.5,0.75,1)	(0.5,0.75,1)	(0.25,0.75,1)	(0,0.33,0.75)	(0.75,1,1)
FR_{10}	(0.5,0.91,1)	(0.5,0.58,1)	(0.5,0.91,1)	(0.5,0.83,1)	(0,0.416,0.75)
FR_{11}	(0.75,1,1)	(0.5,0.58,1)	(0.75,1,1)	(0.5,0.91,1)	(0.75,0.916,1)
FR_{12}	(0.75,1,1)	(0.75,1,1)	(0.5,0.83,1)	(0.5,0.83,1)	(0.25,0.66,1)
FR_{13}	(0.5,0.91,1)	(0.25,0.83,1)	(0.5,0.91,1)	(0.25,0.66,1)	(0.25,0.583,0.75)
FR_{14}	(0.25,0.67,1)	(0.25,0.67,1)	(0.5,0.91,1)	(0,0.5,1)	(0,0.33,0.75)
FR_{15}	(0.25,0.66,1)	(0.25,0.67,1)	(0.25,0.5,0.75)	(0.25,0.5,0.75)	(0.25,0.583,1)
FR_{16}	(0.5,0.91,1)	(0,0.58,1)	(0.5,0.75,1)	(0.5,0.75,1)	(0,0.33,0.75)
FR_{17}	(0.5,0.91,1)	(0.5,0.58,1)	(0.25,0.58,1)	(0.5,0.83,1)	(0.25,0.583,0.75)
FR_{18}	(0,0.41,0.75)	(0.25,0.58,1)	(0.25,0.67,1)	(0,0.5,1)	(0.5,0.75,1)
FR_{19}	(0.75,1,1)	(0.75,1,1)	(0.75,1,1)	(0.75,1,1)	(0.5,0.833,1)
FR_{20}	(0.75,1,1)	(0.75,1,1)	(0.25,0.75,1)	(0.5,0.75,1)	(0.25,0.583,0.75)
FR_{21}	(0.75,1,1)	(0.75,1,1)	(0.25,0.75,1)	(0.5,0.83,1)	(0.5,0.833,1)

After a weighted normalized fuzzy decision matrix is formed, fuzzy positive ideal solution (FPIS) and fuzzy negative ideal solution (FNIS) are determined as in the following:

A^* = [(1,1,1), (1,1,1), (1,1,1), (1,1,1), (1,1,1)]
A^- = [(0,0,0), (0,0,0), (0,0,0), (0,0,0), (0,0,0)]

Table 4.7: Weighted normalized fuzzy decision matrix

	NFR1	NFR2	NFR3	NFR4	NFR5
FR1	(0.375,0.91,1)	(0.125,0.38,1)	(0.375,0.92,1)	(0.12,0.68,1)	(0.063,0.552,1)
FR2	(0.5625,1,1)	(0.18,0.67,1)	(0.25,0.84,1)	(0.18,0.83,1)	(0.187,0.83,1)
FR3	(0.1875,0.67,1)	(0.62,0.45,1)	(0.25,0.76,1)	(0.06,0.48,1)	(0,0.273,0.75)
FR4	(0.1875,0.75,1)	(0.625,0.45,1)	(0.25,0.76,1)	(0.06,0.54,1)	(0.062,0.547,1)
FR5	(0.5625,1,1)	(0.125,0.38,1)	(0.125,0.76,1)	(0.06,0.41,0.75)	(0,0.345,0.75)
FR6	(0.375,0.83,1)	(0.187,0.67,1)	(0.25,0.84,1)	(0.12,0.68,1)	(0.062,0.415,0.75)
FR7	(0.1875,0.58,1)	(0,0.27,1)	(0.125,0.61,1)	(0.18,0.83,1)	(0.125,0.760,1)
FR8	(0,0.48,1)	(0,0.22,0.75)	(0.125,0.61,1)	(0,0.27,0.75)	(0.125,0.622,1)
FR9	(0.375,0.75,1)	(0.125,0.5,1)	(0.125,0.69,1)	(0,0.27,0.75)	(0.187,0.83,1)
FR10	(0.375,0.75,1)	(0.125,0.38,1)	(0.25,0.84,1)	(0.12,0.68,1)	(0,0.345,0.75)
FR11	(0.5625,1,1)	(0.125,0.38,1)	(0.375,0.92,1)	(0.12,0.75,1	(0.187,0.760,1)
FR12	(0.5625,1,1)	(0.187,0.67,1)	(0.25,0.76,1)	(0.12,0.68,1)	(0.062,0.547,1)
FR13	(0.375,0.91,1)	(0.625,0.56,1)	(0.25,0.84,1)	(0.06,0.54,1)	(0.062,0.483,0.75)
FR14	(0.1875,0.67,1)	(0.625,0.45,1)	(0.25,0.84,1)	(0,0.41,1)	(0,0.273,0.75)
FR15	(0.1875,0.67,1)	(0.625,0.45,1)	(0.125,0.46,75)	(0.06,0.41,0.75)	(0.062,0.273,1)
FR16	(0.375,0.91,1)	(0,0.38,1)	(0.25,0.69,1)	(0.12,0.62,1)	(0,0.273,0.75)
FR17	(0.375,0.91,1)	(0.625,0.5,1)	(0.125,0.54,1)	(0.12,0.68,1)	(0.062,0.483,0.75)
FR18	(0,0.41,0.75)	(0.625,0.38,1)	(0.125,0.61,1)	(0,0.41,1)	(0.125,0.622,1)
FR19	(0.5625,1,1)	(0.18,0.67,1)	(0.375,0.92,1)	(0.18,0.83,1)	(0.125,0.691,1)
FR20	(0.5625,1,1)	(0.18,0.67,1)	(0.125,0.69,1)	(0.12,0.62,1)	(0.062,0.483,0.75)
FR21	(0.5625,1,1)	(0.18,0.67,1)	(0.125,0.69,1)	(0.12,0.68,1)	(0.125,0.691,1)

Then the distance of each alternative form FPIS and FNIS with respect to each criterion are calculated by using vertex as:

$$d(A_1, A^*) = \sqrt{\frac{1}{3}[(\square)^2 + (\square)^2 + ()^2]}$$

$$d(A_1, A^-) = \sqrt{\frac{1}{3}[(\square)^2 + (\square)^2 + ()^2]}$$

Here only the calculation of the distance of the first alternative to FPIS and FNIS for the first criterion is shown, as the calculations are similar in all steps. The results of all alternative distances from FPIS and FNIS are shown in Tables 4.8 and 4.9.

Table 4.8: Distance between A_i(i= 1, 2, 3) and A^*concerning each FR

	NFR_1	NFR_2	NFR_3	NFR_4	NFR_5
$d\ (A_1, A^*)$	0.36	0.6	0.36	0.54	0.6
$d\ (A_2, A^*)$	0.25	0.51	0.44	0.48	0.48
$d\ (A_3, A^*)$	0.51	0.38	0.45	0.62	0.72
$d\ (A_4, A^*)$	0.49	0.38	0.45	0.6	0.6
$d\ (A_5, A^*)$	0.25	0.61	0.59	0.65	0.7
$d\ (A_6, A^*)$	0.37	0.51	0.44	0.54	0.37
$d\ (A_7, A^*)$	0.53	0.71	0.55	0.48	0.52
$d\ (A_8, A^*)$	0.67	0.45	0.55	0.72	0.55
$d\ (A_9, A^*)$	0.39	0.57	0.53	0.72	0.48
$d\ (A_{10}, A^*)$	0.36	0.61	0.44	0.54	0.7
$d\ (A_{11}, A^*)$	0.25	0.61	0.36	0.52	0.48
$d\ (A_{12}, A^*)$	0.25	0.51	0.44	0.54	0.6
$d\ (A_{13}, A^*)$	0.36	0.33	0.44	0.6	0.63
$d\ (A_{14}, A^*)$	0.51	0.38	0.44	0.67	0.72
$d\ (A_{15}, A^*)$	0.51	0.38	0.39	0.65	0.68
$d\ (A_{16}, A^*)$	0.36	0.67	0.47	0.55	0.72
$d\ (A_{17}, A^*)$	0.36	0.36	0.57	0.54	0.63
$d\ (A_{18}, A^*)$	0.69	0.41	0.55	0.67	0.55
$d\ (A_{19}, A^*)$	0.25	0.50	0.36	0.48	0.53
$d\ (A_{20}, A^*)$	0.25	0.50	0.53	0.55	0.63
$d\ (A_{21}, A^*)$	0.25	0.50	0.53	0.54	0.53

Table 4.9: Distance between A_i (i= 1, 2, 3) and A^- with respect to each FR

	NFR_1	NFR_2	NFR_3	NFR_4	NFR_5
$d\ (A_1, A^-)$	0.810087	0.62	0.81	0.7	0.66
$d\ (A_2, A^-)$	0.878712	0.7	0.77	0.75	0.75
$d\ (A_3, A^-)$	0.703339	0.72	0.74	0.64	0.46
$d\ (A_4, A^-)$	0.729762	0.72	0.74	0.65	0.65
$d\ (A_5, A^-)$	0.878712	0.62	0.64	0.49	0.47
$d\ (A_6, A^-)$	0.780924	0.7	0.77	0.7	0.49

$d\ (A_7, A^-)$	0.656155	0.59	0.68	0.75	0.72
$d\ (A_8, A^-)$	0.626206	0.45	0.68	0.46	0.68
$d\ (A_9, A^-)$	0.753464	0.64	0.71	0.46	0.75
$d\ (A_{10}, A^-)$	0.810087	0.62	0.77	0.7	0.47
$d\ (A_{11}, A^-)$	0.878712	0.62	0.66	0.72	0.73
$d\ (A_{12}, A^-)$	0.878712	0.7	0.74	0.7	0.65
$d\ (A_{13}, A^-)$	0.810087	0.75	0.77	0.65	0.51
$d\ (A_{14}, A^-)$	0.703339	0.72	0.77	0.62	0.46
$d\ (A_{15}, A^-)$	0.703339	0.72	0.72	0.49	0.59
$d\ (A_{16}, A^-)$	0.810087	0.61	0.71	0.68	0.46
$d\ (A_{17}, A^-)$	0.810087	0.75	0.66	0.7	0.51
$d\ (A_{18}, A^-)$	0.493491	0.71	0.68	0.62	0.68
$d\ (A_{19}, A^-)$	0.878712	0.71	0.81	0.75	0.7
$d\ (A_{20}, A^-)$	0.878712	0.71	0.71	0.68	0.51
$d\ (A_{21}, A^-)$	0.878712	0.71	0.71	0.7	0.7

d_i^* and d_j^* of 21 FRs are shown in Table 4.10. The closeness coefficients of 21 FRs are calculated by this formula-

$$CC_i = \frac{d_i^-}{d_i^* + d_i^-},\ i = 1,2,\ldots,n$$

CC_1 - $\frac{3.603.}{+602.46} = 0.5941$

$CC_2 = \frac{}{3.853.+852.16} = 0.6405$

$CC_3 = \frac{}{3.263.+262.68} = 0.5491$

$CC_4 = \frac{}{3.493.+492.52} = 0.5807$

$CC_5 = \frac{}{3.103.+102.80} = 0.5253$

$CC_6 = \frac{}{3.443.+442.23} = 0.6068$

$CC_7 = 3.403.+402.79 = 0.5490$

CC_8 = 2.902.+902.94 =0.4962

CC_9 = 3.373.+312.65 =0.5519

CC_{10} = 3.373.+372.65 =0.5598

CC_{11} = 3.613.+612.22 =0.6191

CC_{12} = 3.673.+672.34 =0.6106

CC_{13} = 3.493.+492.36 =0.5966

CC_{14} = 3.273.+272.72 =0.5462

CC_{15} = 3.223.+222.61 =0.5526

CC_{16} = 3.273.+272.77 =0.5414

CC_{17} = 3.433.+432.46 =0.5823

CC_{18} = 3.183.+182.87 =0.5259

CC_{19} = 3.853.+852.12 =0.6448

CC_{20} = 3.493.+492.46 =0.5865

CC_{21} = 3.703.+702.35 =0.6115

The ranking order of the 21 FRs given above will be as given –

$$FR_{19} > FR_2 > FR_{11} > FR_{21} > FR_{12} > FR_6 > FR_{13} > FR_1 > FR_{20} > FR_{17} > FR_4 > FR_{10} > FR_{15} > FR_9 > FR_7 > FR_3 > FR_{14} > FR_{16} > FR_{18} > FR_5 > FR_8$$

The portal should provide a seamless LOGIN and REGISTER process for users, ensuring the security of their personal information. Authors must have the ability to easily SUBMIT MANUSCRIPTS, CHECK STATUS. Admins should be equipped with tools to MANAGE JOURNALS, ensuring a streamlined editorial process, and to maintain AUTHENTICATION CONTROL for user accounts. To support the overall functionality, the implementation should include a database system for data storage, user roles and permissions management, and a userfriendly interface for both desktop and mobile devices.

After the ranking of requirements of journal portal, we have implemented some functional requirements which snapshots are shown in given figures.

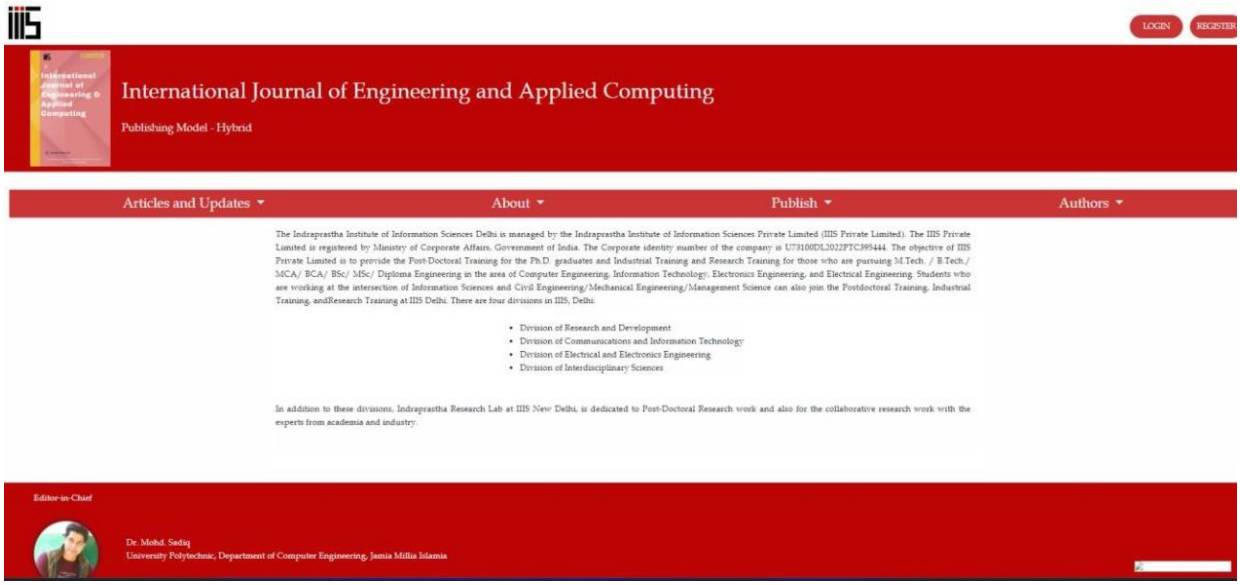


Fig.4.2: Index page

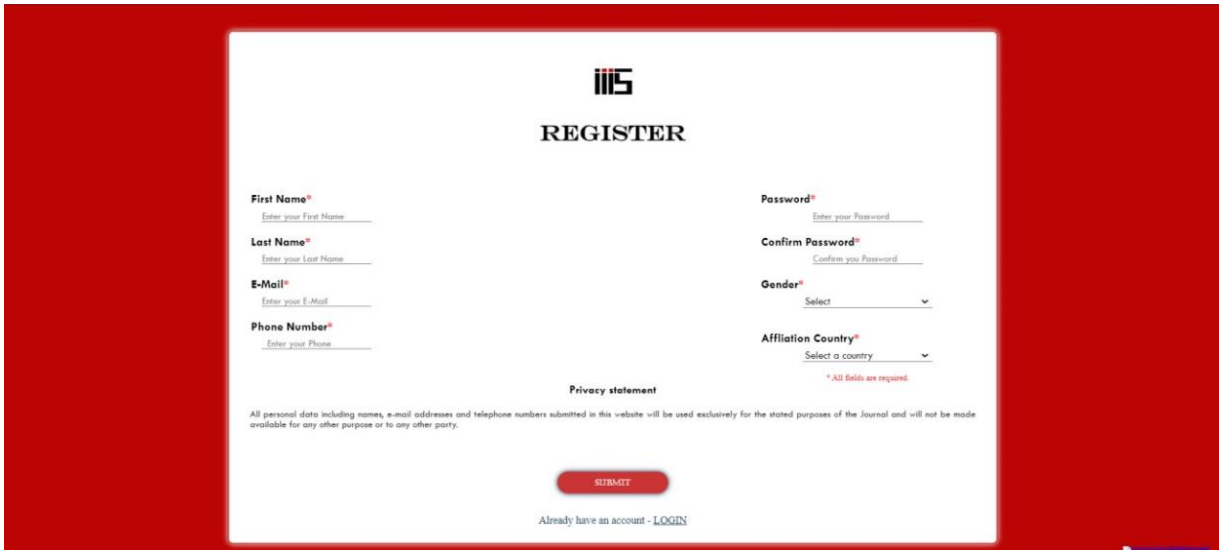


Fig.4.3: Register Page

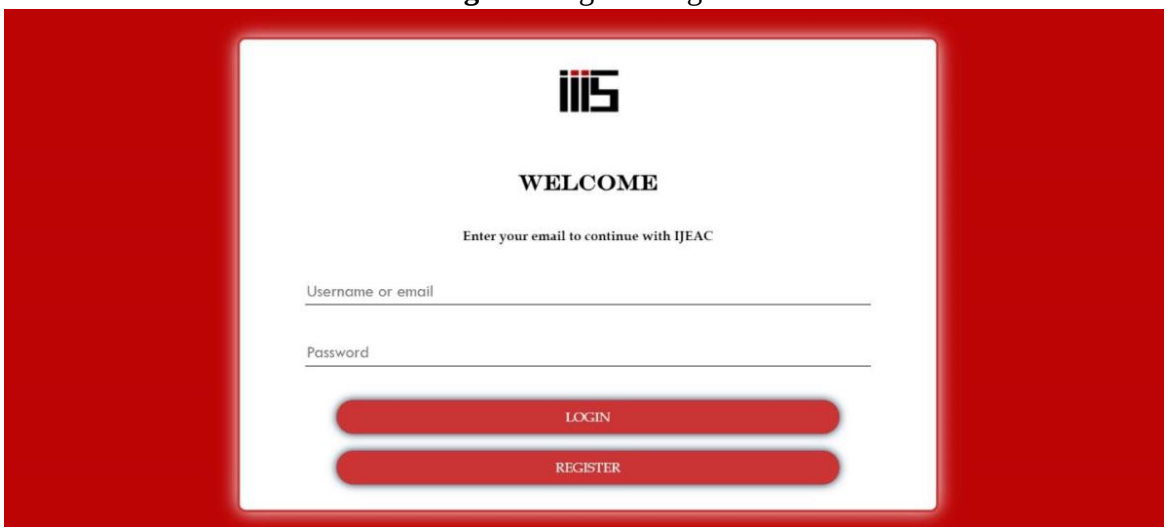
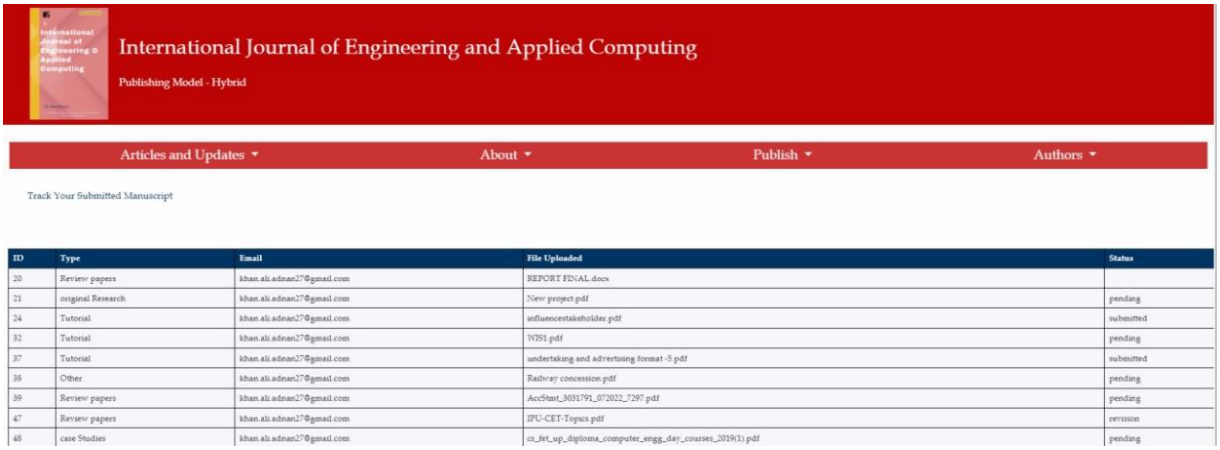


Fig.4.4: Login Page

Fig.4.5: Dashboard Page



ID	Type	Email	File Uploaded	Status
20	Review papers	khan.ali.adnan27@gmail.com	REPORT FINAL.docx	
21	original Research	khan.ali.adnan27@gmail.com	New project.pdf	pending
24	Tutorial	khan.ali.adnan27@gmail.com	influencestakeholder.pdf	submitted
32	Tutorial	khan.ali.adnan27@gmail.com	WIS1.pdf	pending
37	Tutorial	khan.ali.adnan27@gmail.com	undertaking and advertising format -5.pdf	submitted
38	Other	khan.ali.adnan27@gmail.com	Railway concession.pdf	pending
39	Review papers	khan.ali.adnan27@gmail.com	AccStmt_3031791_072022_7297.pdf	pending
47	Review papers	khan.ali.adnan27@gmail.com	IPU-CET-Topics.pdf	revision
48	case Studies	khan.ali.adnan27@gmail.com	cs_fet_up_diploma_computer_engg_day_courses_2019(1).pdf	pending

Fig.4.6: Track article page

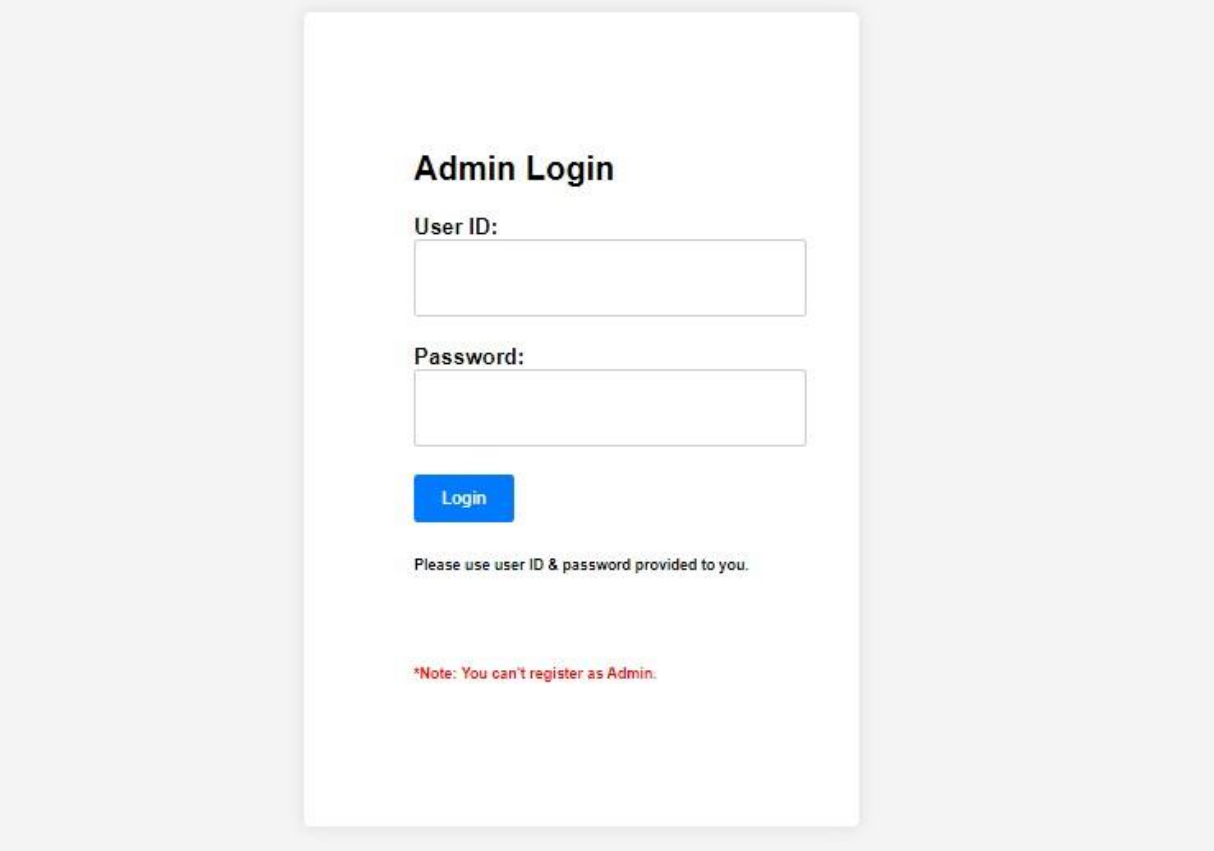
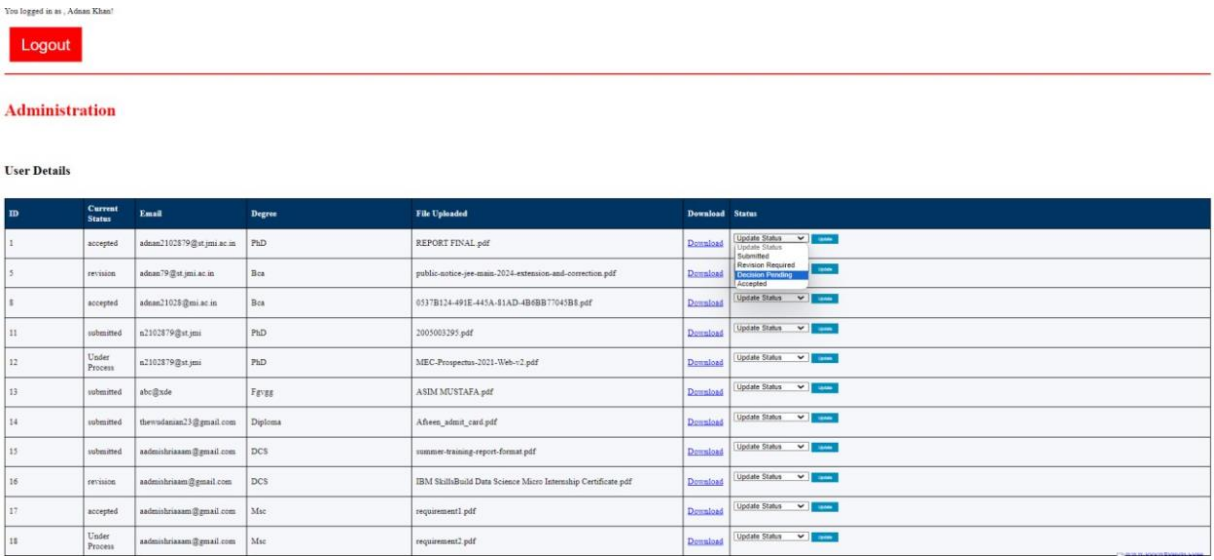


Fig.4.7: Admin login Page



ID	Current Status	Email	Degree	File Uploaded	Download	Status
1	accepted	adnan2102879@st.jmi.ac.in	PhD	REPORT FINAL.pdf	Download	Update Status
5	revision	adnan79@st.jmi.ac.in	Bca	public-notice-jee-main-2024-extension-and-correction.pdf	Download	Update Status
8	accepted	adnan21028@mi.ac.in	Bca	0537B124-491E-445A-81AD-4B6BB77045B8.pdf	Download	Update Status
11	submitted	a2102879@st.jmi	PhD	2005003295.pdf	Download	Update Status
12	Under Process	a2102879@st.jmi	PhD	MEC-Prospectus-2021-Web-v2.pdf	Download	Update Status
13	submitted	abc@xde	Fgvgg	ASIM MUSTAFA.pdf	Download	Update Status
14	submitted	thewsdanian23@gmail.com	Diploma	Afreen_admit_card.pdf	Download	Update Status
15	submitted	aadmishriaaam@gmail.com	DCS	summer-training-report-format.pdf	Download	Update Status
16	revision	aadmishriaaam@gmail.com	DCS	IBM SkillsBuild Data Science Micro Internship Certificate.pdf	Download	Update Status
17	accepted	aadmishriaaam@gmail.com	Msc	requirement1.pdf	Download	Update Status
18	Under Process	aadmishriaaam@gmail.com	Msc	requirement2.pdf	Download	Update Status

Fig.4.8: Admin page

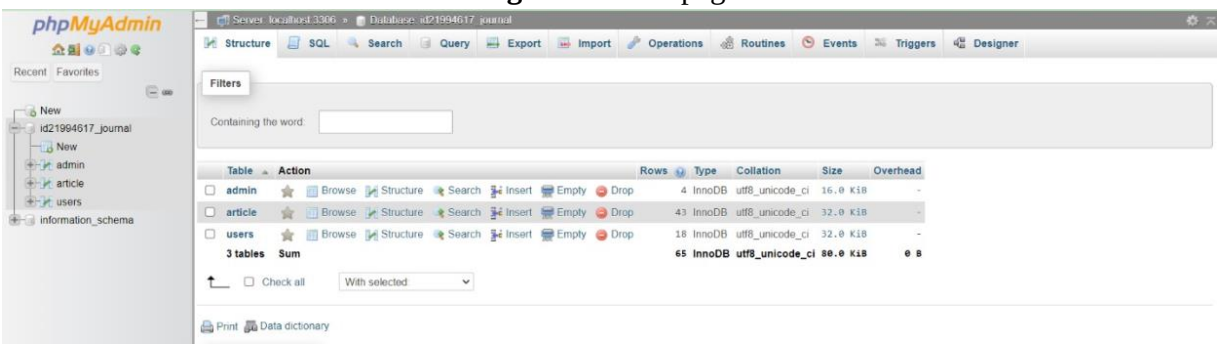


Fig.4.9: Database and tables

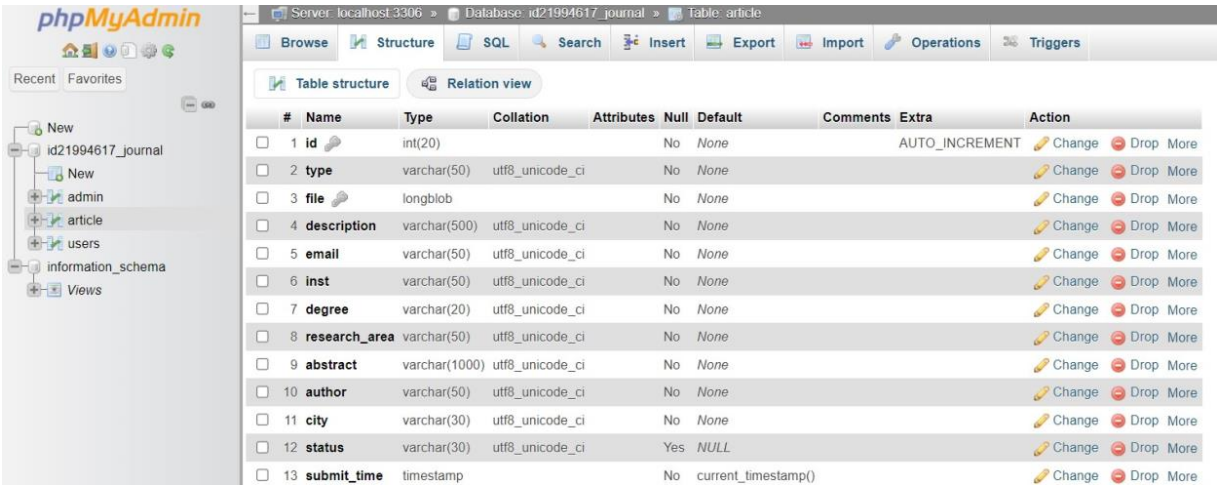


Fig.4.10: User table

4.4 Programs related to web portal

Database Connection Page

```
<!--db_connection.php-->
<?php
$servername = "localhost";
$username = "id21994617_ijeacdelhi";
$password = "Adnan@123";
$dbname = "id21994617_journal";
$conn = new mysqli($servername, $username, $password, $dbname); if
($conn->connect_error) {
   die("Connection failed: " . $conn->connect_error);
}
?>
```

Dashboard page

```
<?php
session_start();

include       'db_connection.php';
if(isset($_SESSION['email']))   {
$email = $_SESSION['email'];
   $sql  =  "SELECT  fname,lname  FROM  users  WHERE  email='$email'";
$result = $conn->query($sql);

   if ($result && $result->num_rows > 0) {
      $row = $result->fetch_assoc();
      $fname = $row['fname'];
      $lname = $row['lname'];
      $name =  $fname." ".$lname;
   } else {
      echo "Error: Unable to fetch user data.";
   }
} else {
   header("Location:          login.html");
exit();
}
?>
```

Signup.php

```
<?php
include 'db_connection.php'; $fname
= $_POST['fname'];
$lname = $_POST['lname'];
```

```
$email = $_POST['email'];
$phone = $_POST['phone'];
$password = $_POST['password'];
$cpassword = $_POST['cpassword'];
$gender = $_POST['gender'];
$affiliation = $_POST['affiliation'];

if (empty($fname) || empty($lname) || empty($email) || empty($phone) || empty($password) || empty($cpassword) || empty($gender) || empty($affiliation)) {
    echo '<script>alert("All fields are required."); window.history.back();</script>';
die("All fields are required");
}

if ($password !== $cpassword) {
    echo '<script>alert("Password and Confirm Password do not match."); window.history.back();</script>';
   die("Password and Confirm Password do not match");
}

if (strlen($password) < 8) {
   echo '<script>alert("Password must be at least 8 character s long."); window.history.back();</script>';
   die("Password must be at least 8 characters long");
}

$hashed_password = password_hash($password, PASSWORD_DEFAULT);

$stmt = $conn->prepare("SELECT * FROM users WHERE email = ?");
$stmt->bind_param("s", $email);
$stmt->execute();
$result = $stmt->get_result();

if ($result->num_rows > 0) {
   echo '<script>alert("Email already registered."); window.history.back();</script>';
die("Email already registered");
}

if (strlen($phone) !== 10 || !is_numeric($phone)) {     echo
'<script>alert("Phone number must be 10 digits long.");
window.history.back();</script>';
   die("Phone number must be 10 digits long");
}
```

```
$stmt = $conn->prepare("INSERT INTO users (fname, lname, email, phone, password, gender, affiliation) VALUES (?, ?, ?, ?, ?, ?, ?)");
$stmt->bind_param("sssssss", $fname, $lname, $email, $phone, $hashed_password, $gender, $affiliation); if ($stmt-
>execute()) {
   echo '<script>alert("Registration successfull, please do login to continue!"); window.location.href = "login.html";</script>';

} else {
   echo "Error: " . $stmt->error;
}

$stmt->close();
$conn->close();
?>
```

Admin Dashboard

```
<?php
  include 'db_connection.php';  $sql
= "SELECT * FROM article";
$result = $conn->query($sql);
if (!$result) {
   die("Error in SQL query: " . $conn->error);
} session_start();
if(isset($_SESSION['user_id'])) {

   $user_id = $_SESSION['user_id'];
$sql2 ="SELECT username FROM admin WHERE user_id = '$user_id'" ;
   $result2 = $conn->query($sql2);

   if ($result2 && $result2->num_rows > 0) {
      $row2 = $result2->fetch_assoc();
      $username = $row2['username'];


echo "<p>You logged in as , $username!</p>";       echo
"<form action='logout.php' method='post'>";       echo
"<input id='log-btn' type='submit' value='Logout'>";       echo
"</form>";       echo'<hr color="red">';
   } else {
      echo "Error: Unable to fetch user data.";
   }
```

```
} else {

   header("Location:          admin_login.html");
exit();
}
?>
<?php
// Close database connection
$conn->close();
?>
```

CHAPTER 5: CONTRIBUTION AND FUTURE WORK

The objective of this chapter is to discuss future work and present the conclusion. The list of requirements for the Peer Review Journal is also at the end of this chapter.

5.1 Conclusion

In conclusion, the development and implementation of the Journal Submission Portal for the "INTERNATIONAL JOURNAL OF ENGINEERING AND APPLIED COMPUTING " has been a significant milestone in our mission to enhance the accessibility and efficiency of scholarly communication within the field of engineering and computation. This portal has been carefully designed to cater to the diverse needs of our authors, readers, and the editorial board, providing a user-friendly platform that fosters seamless interaction and knowledge dissemination.

Our website encompasses various webpages that have been meticulously crafted to facilitate every aspect of the journal submission process. The "Submitting Guidelines" and "Guide for Authors" pages offer clear and concise instructions to assist authors in preparing their submissions effectively. "Submit Articles" provides a straightforward platform for authors to submit their research work, while "Aim & Scope" clearly delineates the focus and objectives of our journal.

The "Abstract & Index" page ensures that readers and researchers can easily access relevant articles through comprehensive indexing. The "Editorial Board" section introduces our esteemed team of experts, contributing to the credibility and integrity of our journal. "Journal Update" keeps our audience informed about the latest developments and activities within the journal.

Moreover, "Latest Issues" provides a repository of our most recent publications, making it simple for readers to stay up to date with cutting-edge research. "Contact the Journal" establishes a direct line of communication between our users and the editorial team, enhancing the transparency and accessibility of our journal. Lastly, the "Ethics and Disclosure" page reaffirms our commitment to upholding ethical standards in research and publication.

The inclusion of a user-friendly navbar in the dashboard further enhances the accessibility of these webpages, allowing users to navigate seamlessly and find the information they need with ease. With this Journal Submission Portal, we have not only simplified the submission and publication process but also reinforced our commitment to promoting high-quality research and ethical publishing practices. We believe that this platform will not only benefit our existing authors and readers but also attract new contributors from the global scientific community, fostering innovation and knowledge sharing.

As we move forward, we remain dedicated to improving and expanding this portal based on user feedback and emerging technological trends. Our vision for the "INTERNATIONAL JOURNAL OF ENGINEERING AND APPLIED COMPUTING" is to be at the forefront of scholarly publishing, and this portal is a significant step in that direction.

We express our gratitude to the entire team that worked tirelessly on the creation of this portal and to our authors and readers for their continued support. Together, we will continue to advance the frontiers of engineering and computation through the dissemination of high-quality research and knowledge.

5.2 Future Work

Future work in the field of journal submission and reviewal website portals can involve various aspects, such as:

a) **Improved User Experience:** Enhancing the user interface and experience for authors, reviewers, and editors to streamline the submission and review process.
b) **Automation and AI:** Implementing AI tools for plagiarism detection, automated manuscript formatting, and identifying suitable reviewers.
c) **Data Analytics:** Using data analytics to gain insights into submission trends, reviewer performance, and improving the editorial process.

d) **Open Access Initiatives:** Supporting open access publishing and integrating with open access repositories.

e) **Security and Privacy:** Ensuring data security and privacy of authors and reviewers during the submission.

As for references, you can look for academic papers and articles in the field of scholarly publishing and peer review. Relevant journals and conferences in this domain include:

a) Journal of Scholarly Publishing
b) Learned Publishing
c) Research Integrity and Peer Review
d) COASP (Conference on Open Access Scholarly Publishing)

These sources can provide you with insights into the latest developments and future directions in the field of journal submission and reviewal website portals. You can search for specific papers and articles related to your project's scope and objectives.

REFERENCES

In the development of our Journal Submission Portal for the "INTERNATIONAL JOURNAL OF ENGINEERING AND APPLIED COMPUTING," we drew upon a wide range of valuable references and resources to ensure the creation of a robust and user-friendly platform. These references played a crucial role in guiding our design and development processes. Below, we provide a list of some of the key references that greatly influenced our work:

[1] Post-publication-peer-review/on 15 December 2015. Armstrong S.J. (1996) We need to rethink the editorial role of peer reviewers. The Chronicle of Higher Education 43(9), B3.

[2] Mohd Sadiq & V. Susheela Devi (2021): Prioritization and Selection of the Software Requirements using Rough-Set Theory, IETE Journal of Research, DOI: 10.1080/03772063.2021.1973593

Link to this article: https://doi.org/10.1080/03772063.2021.1973593

[3] Report on Prioritization and Selection of the Software Requirements using Rough-Set Theory

[4] Software Engineering Institute, Carnegie Mellon University, 4500 Fifth Avenue, Pittsburgh, PA 15213-2612 link: http://www.diva-portal.org/smash/get/diva2:1191769/FULLTEXT02.pdf

[5] Report on Comparison between fuzzy TOPSIS and fuzzy AHP for software requirements selection problem, by Mr Entizar Malik and Miss Mantasha Aberdeen, June 2017. [6] Springer: https://www.springer.com/journal/13198

[7] Alexandria: https://www.sciencedirect.com/journal/alexandria-engineering-journal

[8] European Bulletin of Chemistry: https://www.eurchembull.com/editorial-policies

[9] W3Schools**:** https://www.w3schools.com/js/default.asp

[10] P. Achimugu, A. Selamat, R. Ibrahim, and M. N. Mahrin, "A systematic literature review of software prioritization research," Inf. Softw. Technol., Vol. 56, no. 6, pp. 568–85, 2014. DOI: 10.1016/j.infsof.2014.02.001

[11] Software Engineering Institute, Carnegie Mellon University, 4500 Fifth Avenue, Pittsburgh, PA 15213-2612.

Link: http://www.diva-portal.org/smash/get/diva2:1191769/FULLTEXT02.pdf

[12] Report on Comparison between fuzzy TOPSIS and fuzzy AHP for software requirements selection problem, by Mr. Entizar Malik and Miss Mantasha Aberdeen, June 2017.

[13] Comparison of fuzzy AHP and fuzzy TOPSIS methods for facility location selection İrfan Ertuğrul & Nilsen Karakaşoğlu. Int J Adv Manuf Technol (2008) 39:783–795. DOI 10.1007/s00170-007-1249-8

These references provided a strong foundation and guidance throughout the development of our Journal Submission Portal. They helped ensure that our platform not only met industry standards but also incorporated best practices in web development and academic publishing. By leveraging the expertise and knowledge shared by these resources, we were able to create a portal that is userfriendly, informative, and aligned with the high standards of scholarly publishing in the field of engineering and computation.