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Original Article

Design and Evaluation of Article Submission and Monitoring System Using White/Black-box Testing

Benedicto B. Balilo Jr.[1], Ryan A. Rodriguez[2], Hannah Louis Maraña[3], Janet I. Triunfante[4], Dede Kurniadi[5]

[1,2]*Bicol University, College of Science, Legazpi City, Philippines.*
[3]*Castilla College, Castilla, Sorsogon.*
[4]*Bicol University, Publication and Knowledge Management Division, Legazpi City, Philippines.*
[5]*Department of Computer Science, Institut.*

[1]*Corresponding Author : bjbbalilo@bicol-u.edu.ph*

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Abstract *- This study presents the development and evaluation of an Article Submission and Monitoring System (ASMS) as an important tool for managing the editorial workflow of journals and online publications. The system was assessed using white/black-box software testing techniques to identify potential issues and enhance the overall user experience. Results showed that selecting a testing evaluation technique in many ways improves the system's performance through a scrutinised evaluation of the system's internal logic and external behavior. The study concludes that the ASMS successfully achieves its objectives and improves the efficiency in editorial management. These findings offer valuable insights for academic institutions seeking to implement similar information systems, contributing to the advancement of knowledge management practices in academic scholarly publications.*

Keywords - *Software testing, System design, Online publication, User experience, System evaluation.*

1. Introduction

An organization can succeed only when consistent management with efficient information systems exists. Most companies and institutions have invested in these new technologies and customization of information systems for better planning and decision-making and to attain the desired results [1]. Other advantages of having an information system include reduction, operational efficiencies, and producing real-time data.

For many years, article submissions for journal publication in academic institutions have provided boundless contributions in terms of scholarly sources of information. This is, in fact, due to the mass digitization efforts, institutional requirements, and emergence of new technologies [2]. Some institutions and universities have seen the widespread advantages and benefits of improving efficiency, accessibility, and transparency.

Some used and invested in online platform subscriptions, off-the-shelf applications, and open journal system (OJS) applications for managing and publishing scholarly journal articles. The OJS may offer improved publishing efficiency, enhanced visibility, and workflow management, but it is limited in addressing customization and implementation challenges.

A journal is a systematic publication by various researchers and innovations. It is a method of sharing knowledge and collaborating on research findings. Also, a study indicates that effective management and systems can encourage researchers to research [3]; thus, E-journals have become essential resources for preserving scientific communication among researchers over the last few years. In the late 1970s, e-journals started to grow until early 1990. The second period of evolution occurred when the World Wide Web was developed during the early 1990s [4].

In complex record management, manual recordings are difficult and time-consuming [5], and the service level depends on the availability of documents and the individual in charge. These practices can be substituted by an information system that will handle the record management of these projects. Developing an information system will benefit the organization by improving individual and office performance, eliminating redundancies, directing accountability, establishing consistency, reducing bureaucracy [6], reducing downtime, and increasing the company's performance [7]. In online article submission, the client can navigate the system in which necessary information, such as manuscript template, editorial board, review process, and submission guidelines, is readily

available. The author must ensure that their manuscript meets the particular journal's requirements to prevent delays [8]. Undoubtedly, providing in-depth, simple-to-understand guidelines for the author is essential.

The submission of the manuscript process is bothersome and needlessly complicated [9]. Navigating a submission system is pretty challenging; however, it is essential to have clear guidance on manuscript preparation, the peer-review process, and other aspects of publication. For example, researchers attended workshops and seminars with practical writing skills before taking the necessary steps to publish the paper [10].

Much literature has investigated and developed online submission systems for papers and tracking systems. With the current trends, some use machine learning algorithms to build and deliver better systems effectively. The work of [11] and [12] investigated extracting TF–IDF and statistical features utilizing logistic regression and multiple perceptions for building the recommendation engine.

[13] presented an efficient paper submission recommendation algorithm using different bidirectional transformer encoders and the Mixture of Transformer Encoders technique. Some known journal publications indexed in Scopus, Elsevier, and ISI have managed their respective electronic article submission with article tracking and updating mechanisms. The online submission gained visibility for external researchers. A similar article also provides a guideline for manuscript submission to peer-reviewed journals to improve the overall possibility of researcher reproducibility [14]. Also, the use and adoption of information systems in office transactions offer work motivation, especially to personnel/staff [15].

Nine out of ten surveyed authors were dissatisfied with the manuscript submission process in several journals due to their submission requirements. Hence, [9] suggested a possible improvement by adopting a universal format for submission. One frequent error is that incomplete data, or any deviation from the author's guidelines, will result in being sent back. However, it can be solved by simply demanding the necessary changes, and a cross-check report can prevent a significant overlap.

In the academic field, information systems have become increasingly common; hence, several studies focus on this area of knowledge, such as various systems development, improvement, and implementation—for instance, an Electronic Journal management system, submission system, peer review, and monitoring system. [16][17][18]. Universities are becoming competitive and always look for enhancement through different techniques. University rankings are very useful in comparing a university's performance [19]; therefore, implementing and deploying an online submission could improve the university's reputation and globalization [4]. However, a system might need to upgrade after a few years to leap into more advanced functions such as reviewer recommendation, plagiarism check, and security to assist the editorial process [20]. The reviews of literature and similar platforms underscore that the development of the Open Journal Systems and other similar platforms offers academic publishing features. However, a critical gap remains in institutions like Bicol University, where submissions were done manually, and review processes are still done either manually or via email. Most documents are kept in filing cabinets, storage areas, and unsecured locations. The review process takes some time, and researchers, from time to time, request updates on the submitted paper.

This study aims to propose a solution by developing an information system that automates the manuscript submission processes, tracks and monitors manuscript progress, and generates reports. The developed system could address the publication timeliness, improve data management, improve reporting and data analysis, and serve as a motivation for researchers' competitive advantage. The inclusion of black/white-box testing enables the developed system to provide a holistic evaluation of software quality. This improves test effectiveness, optimizes resource usage, and contributes to uncovering issues and functional defects from a user perspective.

2. Materials and Methods

The study is a developmental-descriptive type of research. The Rational Unified Process (RUP) methodology was used to support the development and simulation process. A desk review, interviews, and surveys were undertaken to provide comprehensive information on the current processes, challenges, and opportunities to develop the features of the system. The white/black-box testing was used to analyze the study's internal and external structure, design, and implementation. The construction of the test cases was significant in verifying that the system attained the required user requirements and delivered the expected results. The test cases examined the system's functionality, usability, access control, and performance, as shown in decision table testing, state transition, functional testing, and rules simulation testing. The respondents of the study comprise faculty members, office personnel, and IT experts who determine whether the system aligns with the user's needs and functionality.

3. Results and Discussion

One of the major responsibilities of the office is managing the BU R&D Journal, which serves as the platform for Bicol University faculty members to publish their results of completed research and welcomes quality publishable paper submissions from external researchers. The journal

aims to disseminate significant research findings across various fields of discipline, including education, engineering, science, and technology. The submission and monitoring of manuscripts are handled through hard/softcopy submissions and email, which may result in inefficiencies and challenges in monitoring and tracking the document. By automating these processes, the journal can provide a more streamlined and transparent experience for authors and reviewers, ultimately attracting more quality submissions and enhancing the impact of academic publications.

3.1. The Developed System

The system's main page serves as the central hub, providing access to published issues and individual articles (Fig. 1). Designed with user-centric features such as easy navigation, clear information presentation, and efficient retrieval, the platform ensures that users can easily browse, search, and download articles. The system operates under the open-access model, allowing unrestricted access for all users and thereby promoting wider dissemination of scholarly knowledge. Recent studies highlight that articles published in open-access journals received 18% more citations than average [21], and 11% Scopus citations in 2010 [22]. In addition, the main page also features timely announcements and updates on office activities, further enhancing user engagement and keeping the academic community informed.

Fig. 1 Sample Homepage interface

This allows authors to submit their articles while enabling the office to manage the submission and review process efficiently. The system includes six distinct user types: Researcher, Editor-in-Chief (EIC), Editorial Board Member, Administrator, Reviewer, and Staff. Each user type has specific privileges and roles tailored to their responsibilities.

The EIC and Editorial Board Committee possess the authority to determine the acceptance or rejection of submitted papers. The Administrator is responsible for managing accounts and adding or removing reviewers, the editorial board, and EIC accounts. The Administrator and Staff also oversee activities, announcements, published journals, and articles. The system also includes monitoring. Regarding generated reports, researchers can view only their submissions, while reviewers can access papers they have reviewed or assigned to review.

Additionally, the count of submitted articles published in journals and articles, as well as activities conducted by the office, is available on the main page. Also, part of the main page. It displays the instructions and process for submitting an article to the publication office, including the Submission Preparation Checklist. A privacy statement is available on the "About" page. A list of downloadable files can also be found in the “Download” section, providing more detailed instructions for authors. The submission of articles is the primary feature of the system, as illustrated in Figure 2.

Fig. 2 Sample article submission interface

Researchers must input essential information, including the title, abstract, and keywords, and attach necessary documents such as the manuscript, cover letter, and a screenshot of the plagiarism certificate. Additionally, researchers have the option to suggest two potential reviewers, although the editorial team reserves the right to assign reviewers independently. Detailed information about co-authors and their contributions is also required during the article submission. It is important to note that once an article is submitted, the manuscript becomes immutable until it undergoes review by the editor-in-chief (Fig. 3)

Following the researcher's submission, the article undergoes a double-blind peer review process overseen by the Editor-in-Chief (EIC) and the Editorial Board. The EIC assesses the submitted paper to determine whether it should be accepted with revisions, accepted for further review by the Editorial Board, or rejected outright, providing comments and remarks.

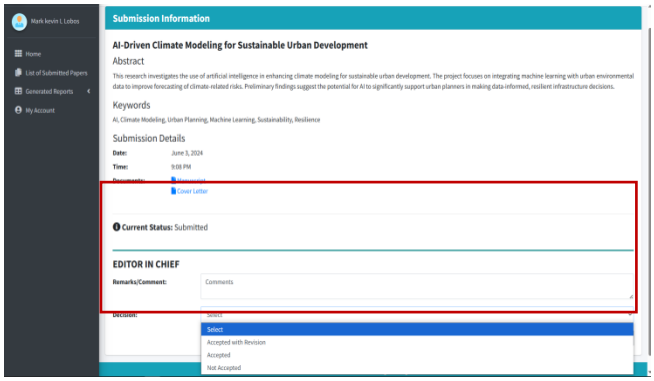

Fig. 3 Sample Editor-in-Chief (EIC) interface

If the EIC decides that the paper needs revisions, the researcher must submit a revised manuscript for the EIC to re-evaluate. This process continues until the EIC is satisfied with the revisions. Once the EIC accepts the paper, it is forwarded to the Editorial Board, which assigns reviewers for further evaluation. Upon acceptance by the EIC, the article is then forwarded to the Editorial Board for evaluation, leading to the reviewers' assignment (Fig. 4).

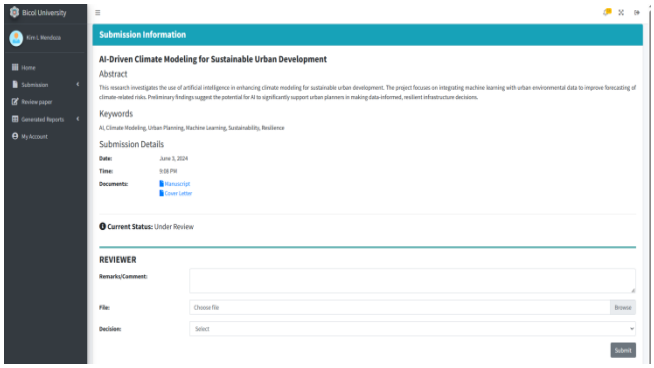

Fig. 4 Assign Reviewer interface

The assignment of reviewers is automated based on the field of discipline, ensuring that only those with relevant expertise are considered. This default feature leverages the recorded database of reviewers' specialization, which streamlines the selection process and reduces the risk of mismatched assignments or inappropriate reviewers' assignment [23] – a common issue in the manual process. By automating this step, the Editorial Board can efficiently select suitable reviewers, monitor the review progress, and provide timely feedback, thereby streamlining the editorial workflow.

The reviewer's decision is significant in the publication process, as it directly influences whether a manuscript is accepted, requires revision, or is rejected. In cases where the initial reviews are unsatisfying or conflicting, the system facilitates the assignment of a third reviewer, whose assessment serves as the final referee in the decision-making process [24].

This multi-tiered review mechanism ensures a fair and rigorous peer-review process, improving the quality and credibility of published work. This feature not only reduces administrative problems but also enhances the integrity and efficiency of the peer-review process, as supported by recent studies emphasizing the benefits of algorithm-driven reviewer matching systems [25].

3.2. White/Black-Box Testing

There are several methods to examine the system's internal and external behavior. All testing techniques are related to black/white box testing [26]. Black-box testing considers the external behavior of the system. It checks the system's accuracy regarding the internal implementation, and White-box testing considers the internal environment of the system, which analyzes the internal coding.

The Black-box testing is performed without knowing the system's internal code, which can check the system's functionality, security, and performance. Also, it simulates the user's perspective on how well the system meets the system requirements, tests multiple inputs and conditions, and focuses on the output. Correctness of the inputs, boundary conditions, error handling, usability, performance, and security are some aspects that can be verified through Black Box testing [27]. Black box testing can also use boundary value analysis, decision tables, state transition diagrams, and all-pairs techniques. In this study, the testers create test cases based on requirements and specifications. The user simulates by adding new journal issues and articles, checking journals and articles, and verifying if the information is reflected in the dashboard. This is an example of a test case verifying the successful uploading of journal articles.

Finding errors internal to the system needs specialized skills. The White Box testing is a detailed investigation of the internal logic and structure of the code. This means the testers should know the system's internal code, or someone with programming skills. The advantage of this testing technique is that it reveals errors hidden in the code and possibly removes extra lines of code; however, the disadvantage is that this technique is expensive as it requires expertise [28]. This technique can employ statement testing, branch testing, path testing, and condition coverage testing [26].

3.2.1. Black Box Testing

A testing procedure is where the internal procedures of the system are examined, as well as the expected deliverables. The testers identify the set of rules with a combination of conditions and identify the outcome of the rule. For example, a paper may only be accepted if it follows the BU R&D Journal Guide to Authors. As part of the evaluation procedures, the managing editor checks the format of the paper and sends it to the EIC for comment. In this case, this generates the four rules and the outcomes (Table 1).

A paper may be accepted for publication in the BU R&D journal only after it complies with the journal's editorial policy. Initially, the paper may be given to referees only after the evaluation by the Editor-In-Chief (EIC), who provides comments and recommendations; only after addressing these concerns shall the paper be forwarded to referees for peer review. Manuscripts failing to meet the journal's requirements or the EIC's comments are subject to rejection to maintain publication standards.

Table 1. Decision table testing

Condition	Rule 1	Rule 2	Rule 3	Rule 4
Following the BU R&D Format	False	False	True	True
Checking/ Approval of IEC	False	True	False	True
Outcome				
1. Approval of Submission				✅
2. Return or Reject Submission	✅	✅	✅	

Table 2. Sample results of functional testing

Test Case	Current State	Event	Expected Output	Next State	Results
Display username and password	S1	Retrieve user data	Passed first-level validation	S2, S3	accomplished
Invalid login attempt	S2	Check entry	Display error message	S1	accomplished
Input valid user entry	S3	Check entry	Access system	S4	accomplished
Submit a paper for review	S4	Check entry	Display message	S5	
Logout to system	S5	System features	Destroy sessions	S1	accomplished

The advantage of decision table testing is that it evaluates various conditions and cases based on the defined rules, enabling the selection of appropriate and possible test case scenarios. This method enhances the accuracy of testing by ensuring all logical conditions are considered, which is valuable in complex decision-making processes [29; 30].

Some of the test cases that cover interactions of users with the login page include:

- Users should log in with a valid username and password
- Users should not supply an invalid username and password, for the system will display an error message
- Sign-up and forgotten password should be visible to the user
- Users should not input invalid expressions.

Figure 5 shows the state transition diagram**.** This testing depends on the past inputs of values or operations in the system. The acceptance of the article depends on the referee's decision to accept or reject it.

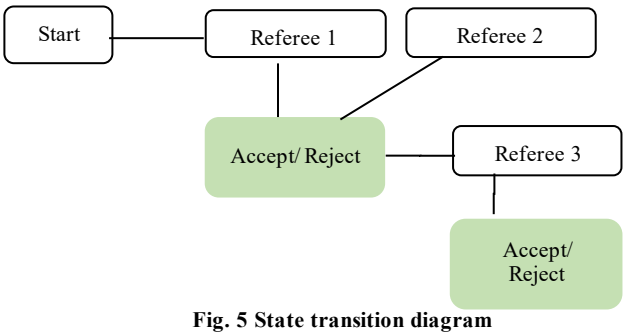

Fig. 5 State transition diagram

Table 2 presents the functional testing evaluation, which is used to determine the system's accuracy, specifically on a user's ability to log in using the code generated by the system.

The results of the testing showed that the flow control was effective in achieving the desired objectives. This can be seen from the fact that the user could log in to the system using the correct code upon testing.

3.2.2. White Box Testing

Several test cases were used to inspect specific processes in validating the required information. These test cases helped the researcher to counter-check the program flow and the expected results. Table 3 shows the results of the test cases for logging in to the system.

The username and password are entries to test if they consist of a string of characters, numbers, and special characters. The actual results acknowledged that this procedure attained the test case. When submitting the paper, the required entries are in the document and PDF format.

An error shall occur when an invalid submission is detected upon submission, and an error message will be displayed. This implies that the test cases for validating login requests and submitting papers to the system attained the expected results.

Any entries can be simulated through rules simulation testing, following the test cases (Table 4). In the example, the user attempts to upload a journal article, and relevant conditions are set.

Table 3. Results of the test cases

Test ID	Description	Expected Results	Actual Results
1	Initialization: The username and password values are suitable character combinations	String of characters Numbers, Special Characters	PASSED
2	Submission of paper for publication	Text entry, attached file (docs/pdf)	PASSED
3	Invalid submission	Error Message	PASSED
4	Successful paper submission	Information Message redirected to the previous page	PASSED

Table 4. Summary of rules simulation results

Condition Entries	User Account	Required Information	Upload/ View Article	Action
1	Correct	Match	Yes	A1
2	Correct	Match	No	A2
3	Correct	Not Match	Yes	?
4	Correct	Not Match	No	?
5	Incorrect	Match	Yes	A3
6	Incorrect	Match	No	?
7	Incorrect	Not Match	Yes	?
8	Incorrect	Not Match	No	?

?: There are no rules defined for possibilities

Example: Consider the user who attempted to upload journal articles. The relevant conditions and actions are:
C1: The user account is correct
C2: The required information is correct
C3: Accept and upload the article
A1: View the article
A2: Send notification
A3: Alert administrator!

For the above situation, the decision table for the system consists of:

Input:
C1: User Account: Correct, Incorrect
C2: Required Information: Complete, Incomplete
C3: Accept/Upload: Yes, No

Outputs:-
A1: View Article
A2: Send notification and error message (if any)
A3: Call Administrator

Now, the Rules are:
A1 When the correct user account
A2 When the required information is correct
A3: When an error occurs or needs admin intervention

The table presents the conditions derived from specific user requests, where each entry corresponds to an authenticated user account providing the necessary information to achieve the desired output and respective actions. For example, in condition A1, a registered and authenticated user successfully uploads a valid file, which must be either a PDF or a document format. Ensuring proper file format validation is crucial for maintaining system integrity and facilitating all-in-one processing, as supported by studies emphasizing the importance of user validation in secure and efficient information systems [31; 32].

Use Case Diagram

A use case diagram is a graphical representation that illustrates the possible interactions between the user and a system. It highlights the system's functional requirements from the user's perspective, showing the different use cases and different types of users. It comprises four components: actors, the system boundary, use cases, and the relationships among them. Actors represent entities such as users, people, organizations, or external systems that interact with the system to achieve specific goals. In the developed system (Figure 6), the primary actors include author/researchers, administrators, editorial board, editor-in-chief (EIC), staff, and reviewers, each playing a distinct role within the publication workflow.

Use case diagrams are widely recognized for providing a high-level overview showing how the system interacts with the external entities. It aids in requirement analysis and system design by clearly defining what functionalities are involved. It served as the first draft between the system analyst and the customer, before going to the formal modelling for the system [33].

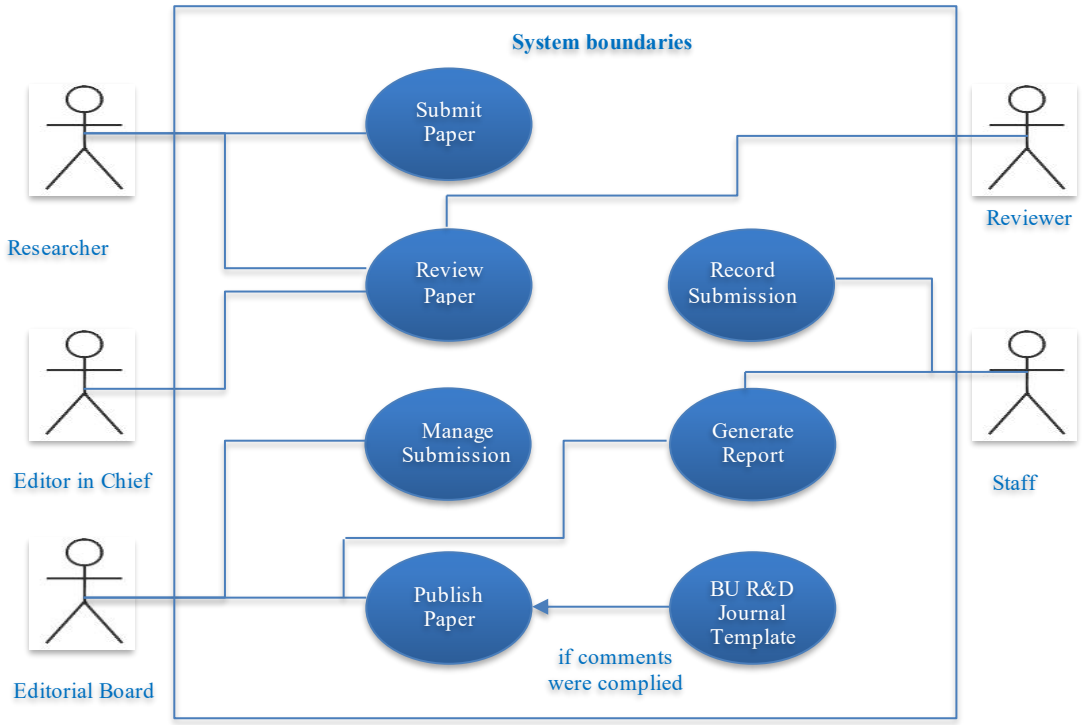

Fig. 6 Use case diagram

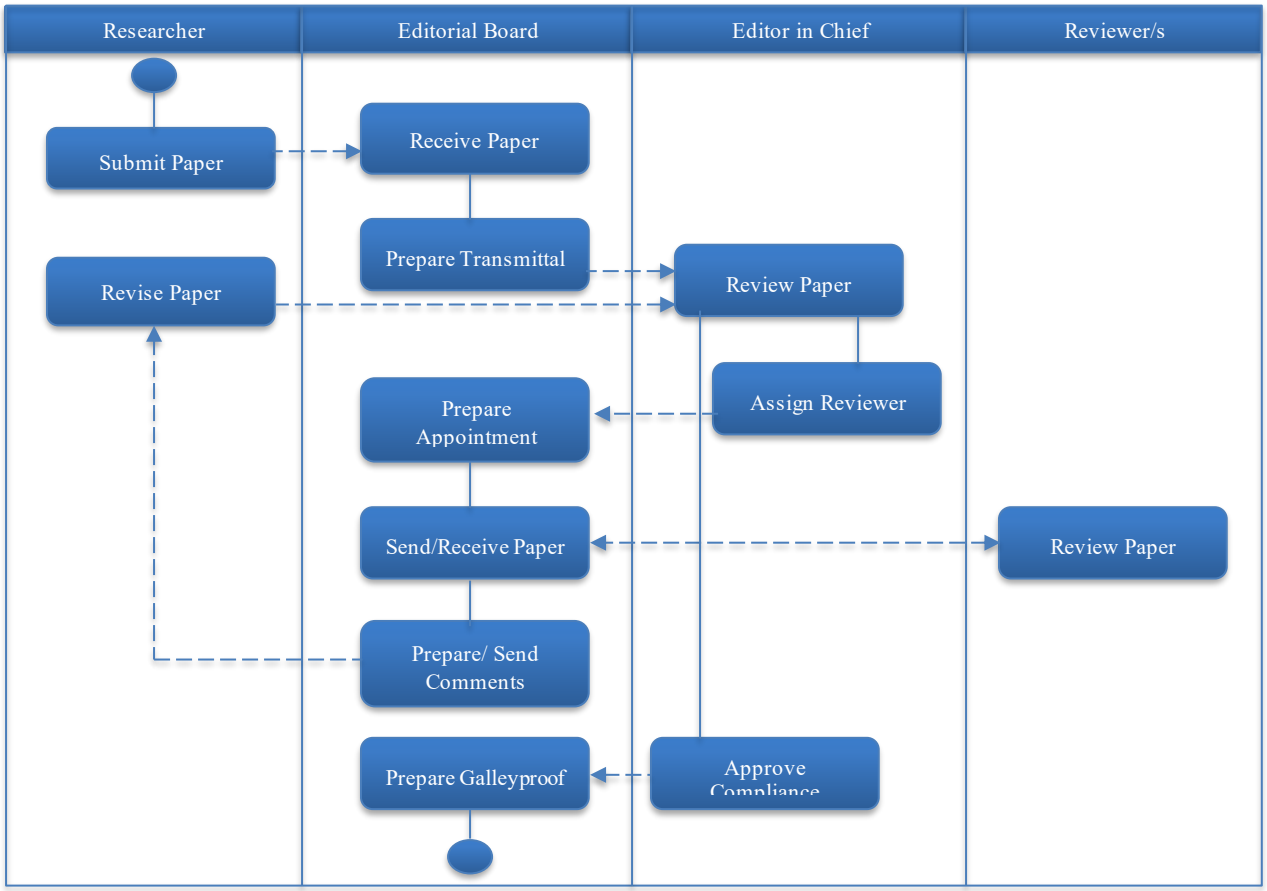

Fig. 7 Activity diagram for submission of paper to reviewer

Activity Diagram

An activity is an enhanced form of a flowchart that represents the sequence and coordination of activities and describes what must happen in the system. This illustrates how the activities are coordinated and can be viewed at different levels of abstraction (Figure 7).

Each actor plays a distinct role in the submission process, with responsibilities and boundaries defined by their position within the workflow. The editorial board initially receives the submitted manuscript and forwards it to the Editor-In-Chief (EIC) for review and comments. The office maintains a pool of expert referees and considers reviewers suggested by the researchers, ensuring that the peer review process is based on journal standards, relevance, and quality. The editorial board oversees the entire process, from submission to sending the galley proof to the author and managing communication and quality control.

Publication review establishes quality and standards for scholarly research, offering prestige and standing to individuals in the academic community [34]. This structured activity workflow is aligned with the traditional journal publication practices, where the editorial board ensures the manuscript meets the scope and quality standards before submission to peer review. Coordination among the actors shall leverage monitoring, and all the actors coordinate and monitor the progress, and uphold publication integrity.

4. Conclusion

The study aimed to automate and streamline the article submission and review processes to reduce the turnaround time, improve the efficiency of the manual process, and increase productivity. The developed system features comprehensive article submission, management of office activities, real-time tracking and monitoring, and automated report generation. It was carefully evaluated using white/black-box testing employing decision tables and state transition techniques to validate the external functionality. It also utilized test cases to verify the internal logic, control flow, and data handling, ensuring the system's strength and reliability.

Based on the analysis and findings, the Publication and Knowledge Management Division (PKMD) is recommended to adopt the developed system to improve submission, reporting, monitoring, and overall management of the BU R&D Journal. Its features encourage international researchers to submit papers online, expand the journal's reach, and take academic advantage. Future enhancements may include integrating an advanced encryption algorithm within HTTPS, optimizing reporting through controlled Major Final Outputs (MFO) templates, automating the generation of pre-selection incentive lists for qualified researchers, and establishing a regular feedback mechanism to identify and address user challenges. Crucial to the management is a comprehensive training to ensure effective user adoption and proficiency. Additionally, a follow-up assessment is essential to evaluate sustained user satisfaction, monitor the system's effectiveness, identify emerging issues, and promote technology enhancements.

In the long term, the developed system is positioned to transform the institution's vision of becoming a globally recognized institution of higher learning by enhancing operational efficiency, transparency, and user satisfaction. This transformation will support the university's commitment to excellence in research and extension, and elevate the RDE competitiveness at national and international levels. Moreover, the system will foster a sustainable culture of innovation and academic excellence, aligning with the institution's mission to provide quality education, promote relevant research, and contribute to regional and global development.

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