

DOI: doi.org/10.58797/cser.040202

Digitalizing Scholarly Communication: Development and Functional Validation of a Web-Based Scientific Conference Management System

Pandu Wicaksono¹, Nur Aziezhah^{1,*}, Walidatush Sholihah²

¹*Vocational School, Software Engineering Technology Study Program, IPB University, Jl. Kumbang, No. 14 Bogor 16128, Indonesia*

²*Faculty of Science and Engineering, University of Groningen, Broerstraat 5, 9712 CP Groningen, The Netherlands*

*Corresponding Author Email: nuraziezhah@apps.ipb.ac.id

Abstract

This study developed a standalone web-based system for managing scientific conferences, with a focus on manuscript submission and peer review. The work used the Waterfall model. Development moved through requirements analysis, system design, implementation, and functional validation. The requirements analysis identified four user roles: admin, reviewer, author, and guest. It also defined the main functions needed for manuscript submission, verification, reviewer assignment, review and feedback, status monitoring, and Letter of Acceptance (LoA) issuance. The system used separate frontend and backend components. Vue.js was used for the frontend, Laravel for the backend, and MySQL for the database. The components communicated through a JSON-based RESTful API. Functional validation was carried out with scenario-based black-box testing to check whether each function met its stated requirement without examining the source code. In total, 59 test scenarios were run. Every scenario produced the expected output, giving a 100% functional conformity rate. The results show that the system can perform the defined conference management functions within one digital platform for manuscript submission and peer review. It therefore provides a technical basis for a more structured process of research dissemination and scholarly communication. Further work is still needed to evaluate usability, performance, accessibility, security, and user satisfaction before its broader effectiveness can be assessed.

Keywords: black box testing, conference management, manuscript submission, waterfall model

Received: 2 May 2026
Revised: 10 July 2026
Accepted: 19 July 2026
Published: 21 July 2026
Issued: 30 August 2026

**Current Steam and
Education Research**
e-ISSN: 3025-8529



INTRODUCTION

Scientific conferences disseminate research findings and ensure the quality of scholarly work through selection and peer review (Deveugele & Silverman, 2017; Shamir, 2010; Zhang et al., 2022). Because peer review is the backbone of scientific evaluation, the review process needs to be designed carefully so that decisions are not only quick but also fair and accountable, considering that the literature shows serious attention to the potential bias in the peer review process and the importance of testing approaches to detect such bias (Deveugele & Silverman, 2017; García et al., 2025; Sun et al., 2024). Scientific conferences serve as an important channel for researchers, educators, and academic communities to disseminate research findings, exchange knowledge, and communicate scholarly ideas (Anuraga et al., 2023; Shamir, 2010). In this context, scholarly communication involves interconnected activities, including manuscript submission, peer review, feedback, decision-making, and communication among stakeholders. When these activities are managed through fragmented or disconnected procedures, the process becomes harder to monitor and coordinate (Listyorini et al., 2024).

The core process that determines organizational quality includes manuscript collection, peer review, decision-making, and final manuscript management (Anuraga et al., 2023; Keyno & Novikov, 2021). National literature indicates that the basic needs of conference management include paper collection, paper review, paper acceptance, and the management of camera-ready or proceedings, so submission and peer-review management must be organized systematically to ensure academic decisions can be traced and accounted for (Anuraga et al., 2023). In practice, international conferences generally accept submissions through a conference management system portal, after which the committee invites several reviewers to evaluate the manuscripts. This review process often occurs voluntarily and without compensation, requiring efficient, structured workflow management (Aczel et al., 2021; Popescu et al., 2021).

However, many organizations still manage conference submissions with separate tools, such as forms, committee email, or direct correspondence. Records can then become spread across different places. Submission status and metadata may also be missing, which makes papers harder to track and adds routine work for the committee. The Conflab study describes similar problems with mailbox-based submission management, including disorganized storage, limited status information, and difficulty finding records (Keyno & Novikov, 2021). A centralized system can reduce these problems by keeping submission data together and making communication between the committee and participants easier during manuscript collection and evaluation.

Several studies have developed web-based systems for conference management and checked how their functions work. Utomo (2022), for example, built a conference system that supports paper submission and evaluated it with black box testing. Bawono et al. (2017) also developed a system with roles for authors, reviewers, and administrators, and tested its functions through black box scenarios. eConf emphasizes the need to manage registration, collect abstracts and full papers, and announce eligibility, including the administrator's ability to change abstract status based on review results (Ahmar et al., 2018). WeBEST highlights the need for an integrated system to simplify

documentation and activity tracking (Listyorini et al., 2024), while the chair module development indicates the need to support reviewer assignment and manuscript approval (Anuraga et al., 2023). However, some studies have not yet translated user needs into explicit, measurable requirements or shown clear traceability from requirements to test scenarios. Bidirectional requirement traceability is a widely recognized practice to support quality, early testing, and system maintenance, and can be managed through a traceability matrix that links requirements to design artifacts and test cases (Alturayef et al., 2026; Hayes et al., 2007; Zrelli et al., 2026). In that context, recommendations for further testing, such as usability testing, are often positioned as the next improvement agenda, rather than as part of the evidence of meeting requirements at the evaluation stage (Listyorini et al., 2024). The need for requirement traceability becomes important because it helps control changes throughout the development cycle and strengthens quality assurance, and can be represented through a traceability matrix that maps requirements to design artifacts (Hayes et al., 2007; Hotomski & Glinz, 2019; Zrelli et al., 2026).

Based on these findings, this research is directed toward the development of a standalone web-based scientific conference management system that focuses on the submission and peer review processes through three main stages: requirements analysis, design, and functional validation. The needs analysis was conducted to formulate explicit requirements for the roles of the committee, reviewers, and presenters, including manuscript status management, reviewer assignment, feedback and revisions, and acceptance decisions. Functional validation is structured as test scenarios mapped to the requirements to ensure measurable fulfillment of core functions. Additionally, access control and document confidentiality must be considered because the conference system manages sensitive documents, and international literature indicates that the complexity of information flow in conference management systems can pose a risk of confidentiality breaches if access restrictions are not adequately designed (Popescu et al., 2021).

METHOD

This research is a software engineering study that develops a standalone web-based scientific conference management system. A Waterfall model is used because the development stages follow a sequence and produce a clear output at each step, from requirements analysis to functional testing.

Data Collection and Requirements Analysis

Functional requirements are defined from interviews and a literature review of user needs. This process identifies the user roles and the functions required for each role. Functional validation then uses scenario-based black box testing. Each requirement is checked through input and expected-output scenarios, and the number of successful scenarios is used to calculate testing effectiveness.

System Design

System design uses UML to show how actors interact with the system and how the main processes flow. The database is also designed with an entity-relationship diagram so that its

structure can support submission and review activities. The design includes use case diagrams for the functions assigned to each actor, activity diagrams for the main process flow, and class diagrams for the class structure. It also defines database entities for users, manuscripts, review assignments, and assessment results.

System Implementation

The system uses separate frontend and backend components. Vue.js is used for the frontend, Laravel for the backend, and MySQL for the database. Data are exchanged through HTTP services in JSON format, with a RESTful API connecting the user interface to backend processing. The system also manages the files needed during manuscript submission and review.

Functional Validation

Black box testing is used to check whether the system functions meet their requirements without examining the internal code structure (Alshamaa & Saleem, 2025; Boukhris et al., 2017). The tests are grouped into use case scenarios for each feature. In total, 59 test cases are included. Each result is recorded by its success status, and testing effectiveness is calculated from the number of successful scenarios divided by the total number of scenarios. The result is then expressed as a percentage. This study only covers scenario-based functional validation. Web application security testing has a different scope and requires specialized techniques, so it is left for further development (Erden, 2026; Wen & Katt, 2023).

Maintenance

Maintenance begins after the system is considered functional. At this stage, errors found during use are fixed, small changes can be made from user feedback, and performance can be adjusted when needed. These activities are intended to keep the system stable for the next conference.

RESULTS AND DISCUSSION

User Needs Analysis Results

The needs analysis identified four main actors: admin, reviewer, author, and guest. Each actor has different access rights and tasks in the conference process. The admin manages the system and the overall conference flow. Reviewers assess manuscripts and provide feedback, while authors submit papers and revise them after receiving review results. Guests can view general information without logging in. These roles were then used to define functional requirements, prepare use cases, and develop the test scenarios. Table 1 shows how the main system functions are assigned to each actor.

Table 1. Mapping actors to core system functions

Actor	Core functions facilitated by the system
Admin	Managing user accounts; verifying and monitoring submissions; assigning reviewers, including second reviewers; tracking review progress; managing recaps; generating LoA documents; sending status emails; and managing schedules and supporting information.
Reviewer	Accessing the assigned manuscript, providing an assessment, sending the review results, and giving feedback.
Author	Submitting a paper, viewing the submission list, monitoring the status and review summary, resubmitting or revising.
Guest	Accessing general conference information and the published schedule

Figure 1 shows the scientific publication flow used in the conference. The process starts when authors submit manuscripts. The admin then verifies the submission and assigns reviewers, who carry out the review and provide feedback. The flow ends with the issuance of the LoA. This diagram makes the sequence of activities easier to follow and provides a reference for the system design, so each step in the conference workflow can be traced more clearly.

System Implementation Results

The system was developed as a web application with a separation of frontend and backend. The implementation provides different interfaces according to user roles to support a structured submission and review process. The system facilitates the submission process by the author, verification and assignment of reviewers by the admin, execution of the review by the reviewers, up to the output of decisions and management of supporting documents.

Functional Validation Results

Functional validation is conducted using scenario-based black box testing. Testing was conducted on a total of 59 test case scenarios. The test results showed that all scenarios performed as expected, and the testing effectiveness reached 100 percent based on the ratio of the number of successful tests to the number of test scenarios.

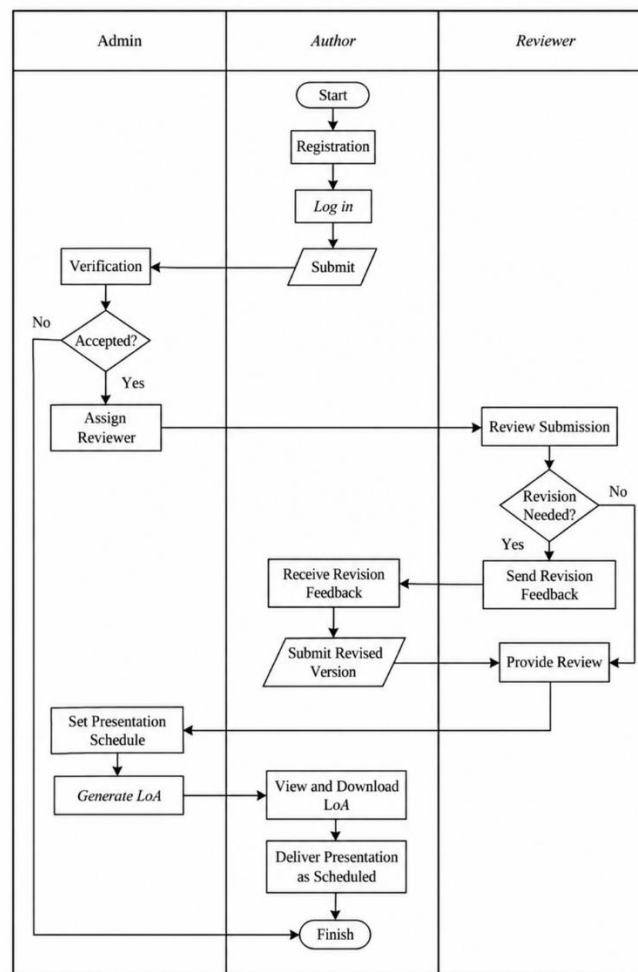


Figure 1. Conference Flow

Table 2. Recapitulation of the black box test group

Testing group	Test case code	Number of scenarios
Authentication	TC-AUTH-001 s.d. TC-AUTH-005	5
Account management	TC-ACC-001 s.d. TC-ACC-002	2
Submission by the author	TC-SA-001 s.d. TC-SA-005	5
Submission management by the admin	TC-SM-001 s.d. TC-SM-009	9
Review process by the reviewer	TC-RM-001 s.d. TC-RM-003	3
Recap and export by the admin	TC-REV-001 s.d. TC-REV-010	10
Creation of the LoA document	TC-LOA-001 s.d. TC-LOA-002	2
Email status update	TC-MAIL-001 s.d. TC-MAIL-002	2
Streaming link management	TC-STR-001 s.d. TC-STR-003	3
Template management	TC-TM-001 s.d. TC-TM-004	4
Schedule management	TC-JS-001 s.d. TC-JS-004	4
Presentation schedule	TC-JP-001 s.d. TC-JP-003	3
Feedback management	TC-FB-001 s.d. TC-FB-003	3
Scientific category	TC-SCM-001 s.d. TC-SCM-003	3
Total		59

The results of the needs analysis indicate that conference management cannot be treated as a simple registration, as it involves submission workflows, reviewer assignments, feedback provision, revisions, and decision-making. By limiting the focus to submission and review, this system ensures that the core functions of the conference are managed in a documented and traceable workflow through manuscript status and actor activities.

In implementation, mapping user roles to core functions clarifies the division of operational responsibilities. Authors obtain a submission mechanism and review status monitoring, reviewers can access assigned manuscripts and submit evaluations, while admins have control over verification, reviewer assignment, and progress monitoring. The structure of this function is relevant to the end-to-end lifecycle needs highlighted in the conference management system literature, especially in the initial phases of manuscript submission and review (Keyno & Novikov, 2021; Utomo, 2022).

Functional validation through 59 test scenarios shows that the system's functions have operated according to the formulated functional requirements, with testing effectiveness reaching 100 percent. These findings reinforce the claim that the system not only can be run but also meets the core usage scenarios in a measurable way. However, the results of the black box testing primarily assess the functional suitability against the scenarios and do not yet include evaluations of usability quality such as formal usability or load testing. Therefore, further testing can be directed toward evaluating user experience and performance as the number of submissions increases (Veral & Macías, 2019).

The system shows how digital technology can bring several conference tasks into one workflow. Manuscript submission, peer review, status monitoring, and communication are handled through a centralized platform instead of as separate administrative activities. A role-based architecture supports this setup. Admins, authors, reviewers, and guests have different responsibilities, so each role is given access to the functions it needs. At the same time, their activities remain connected within the overall conference workflow.

The development process also links stakeholder requirements, system functions, and functional validation. First, the identified requirements are translated into specific functions. Those functions are then checked through defined test scenarios. This creates a clear link between what stakeholders require and what the system actually implements. All 59 scenarios produced the expected outputs, providing evidence that the implemented functions met their stated requirements. On this basis, the system is functionally ready for the conference workflow defined in the study. Broader testing is still needed, however, before its effectiveness in real-world use can be determined.

Although this study is not a learning intervention, it still has relevance to education through scholarly communication and knowledge sharing. Researchers, educators, and academic communities use scientific communication to share findings, exchange ideas, and make knowledge available to wider communities (Anuraga et al., 2023; Shamir, 2010). The developed system supports these activities by bringing manuscript submission, peer review, feedback, and communication into

one digital environment. Its contribution is therefore mainly technological rather than pedagogical. The study did not measure learning outcomes or teaching effectiveness. This point matters because the results show that the system functions as intended, but they do not show that it improves learning, teaching, or research productivity. Instead, the platform provides an organized way to support how scholarly knowledge is communicated and shared. This may be useful for education and research communities that need a digital system for communicating research findings. Future studies with actual users could examine usability, communication efficiency, accessibility, and satisfaction.

CONCLUSION

This study developed a web-based system to support scholarly communication in scientific conferences, especially manuscript submission and peer review. The system brings the requirements of administrators, authors, reviewers, and guests into one structured digital workflow. It supports manuscript submission, reviewer assignment, review and feedback, status monitoring, and Letter of Acceptance issuance through a centralized platform. Functional validation used scenario-based black-box testing with 59 scenarios. Every scenario produced the expected output, resulting in 100% functional conformity with the defined requirements. These results show that the system provides a practical technical basis for organizing conference-related scholarly communication and research dissemination. The current evaluation, however, only covers functional conformity. Further work should examine usability, performance, accessibility, security, and user satisfaction to determine how effective and scalable the system is in broader use.

STATEMENTS AND DECLARATIONS

Competing Interests. The authors declare no competing interests.

Author Contributions. P.W. conducted system development, data collection, testing, and manuscript preparation. N.A. and W.S. contributed to conceptualization, methodology, and manuscript review. All authors approved the final manuscript.

Ethics Approval. Ethical approval for this study was granted by IPB University.

Informed Consent to Participate. Informed consent was obtained from all interview participants.

Consent for Publication. Not applicable.

Data Availability. Data are available from the corresponding author upon reasonable request.

Use of Artificial Intelligence Tools. Paperpal was used only for grammar, language clarity, and manuscript readiness. All changes were reviewed by the authors.

REFERENCES

- Aczel, B., Szaszi, B., & Holcombe, A. O. (2021). A billion-dollar donation: Estimating the cost of researchers' time spent on peer review. *Research Integrity and Peer Review*, 6, 14. <https://doi.org/10.1186/s41073-021-00118-2>
- Ahmar, A. S., Hidayat, R., Napitupulu, D., Rahim, R., Sonatha, Y., & Azmi, M. (2018). eConf: An information system to manage the conference. *Journal of Physics: Conference Series*, 1028(1), 012044. <https://doi.org/10.1088/1742-6596/1028/1/012044>
- Alshamaa, Z. M., & Saleem, N. N. (2025). Black box software testing techniques: A literature review. *Passer Journal of Basic and Applied Sciences*, 7(2), 1001–1011. <https://doi.org/10.24271/psr.2025.508216.1963>
- Alturayef, N., Ahmad, I., & Hassine, J. (2026). TraceLLM: Leveraging large language models with prompt engineering for enhanced requirements traceability. *Requirements Engineering*, 31(1), Article 6. <https://doi.org/10.1007/s00766-026-00460-1>
- Anuraga, R., Lubis, M., & Musnansyah, A. (2023). Development of chair module in web-based conference management system. *Electronic Integrated Computer Algorithm Journal*, 1(1), 1–8. <https://doi.org/10.62123/enigma.v1i1.10>
- Bawono, S. A. T., Purnomo, F. A., Purnomo, A., & Nuzuliati, R. (2017). Conferec (Conference CMS). *IJAI (Indonesian Journal of Applied Informatics)*, 2(1), 1–16. <https://doi.org/10.20961/ijai.v2i1.13170>
- Boukhris, S., Andrews, A., Alhaddad, A., & Dewri, R. (2017). A case study of black box fail-safe testing in web applications. *Journal of Systems and Software*, 131, 146–167. <https://doi.org/10.1016/j.jss.2016.09.031>
- Deveugele, M., & Silverman, J. (2017). Peer-review for selection of oral presentations for conferences: Are we reliable? *Patient Education and Counseling*, 100(11), 2147–2150. <https://doi.org/10.1016/j.pec.2017.06.007>
- Erden, A. (2026). Modern web application security in practice: National-scale measurement and managerial insights from Türkiye. *Computers & Security*, 164, 104847. <https://doi.org/10.1016/j.cose.2026.104847>
- García, J. A., Rodríguez-Sánchez, R., & Fdez-Valdivia, J. (2025). A systematic approach to assessing the accuracy of a peer review process in an academic journal. *Scientometrics*, 130(11), 6323–6347. <https://doi.org/10.1007/s11192-025-05452-6>
- Hayes, J. H., Dekhtyar, A., Sundaram, S. K., Holbrook, E. A., Vadlamudi, S., & April, A. (2007). REquirements TRacing On target (RETRO): Improving software maintenance through traceability recovery. *Innovations in Systems and Software Engineering*, 3(3), 193–202. <https://doi.org/10.1007/s11334-007-0024-1>
- Hotomski, S., & Glinz, M. (2019). GuideGen: An approach for keeping requirements and acceptance tests aligned via automatically generated guidance. *Information and Software Technology*, 110, 17–38. <https://doi.org/10.1016/j.infsof.2019.01.011>
- Keyno, P. P., & Novikov, A. Y. (2021). ConfLab: Web-based conference management system with full lifecycle support. *CEUR Workshop Proceedings*, 2869, 41–50. https://ceur-ws.org/Vol-2869/PAPER_05.pdf
- Listyorini, T., Wibowo, B. C., Dahlan, M., Tauhida, D., & Rahmawati, R. (2024). Web-based conference management pada The International Conference on Computer Science and Technology (WeBEST). *Journal of Science and Education (JSE)*, 5(1), 234–245. <https://doi.org/10.58905/jse.v5i1.421>
- Popescu, A., Lammich, P., & Hou, P. (2021). CoCon: A conference management system with formally verified document confidentiality. *Journal of Automated Reasoning*, 65(2), 321–356. <https://doi.org/10.1007/s10817-020-09566-9>
- Shamir, L. (2010). The effect of conference proceedings on the scholarly communication in Computer Science and Engineering. *Scholarly and Research Communication*, 1(2), 1–7. <https://doi.org/10.22230/src.2010v1n2a25>
- Sun, Z., Pang, K. L., & Li, Y. (2024). The fading of status bias during the open peer review process. *Journal of Informetrics*, 18(3), 101528. <https://doi.org/10.1016/j.joi.2024.101528>

- Utomo, M. N. Y. (2022). Sistem manajemen konferensi ilmiah berbasis web menggunakan metode pengembangan waterfall. *Jurnal Teknologi Elektroika*, 6(1), 1–7. <https://doi.org/10.31963/elekterika.v6i1.2751>
- Veral, R., & Macías, J. A. (2019). Supporting user-perceived usability benchmarking through a developed quantitative metric. *International Journal of Human-Computer Studies*, 122, 184–195. <https://doi.org/10.1016/j.ijhcs.2018.09.012>
- Wen, S.-F., & Katt, B. (2023). A quantitative security evaluation and analysis model for web applications based on OWASP application security verification standard. *Computers & Security*, 135, 103532. <https://doi.org/10.1016/j.cose.2023.103532>
- Zhang, G., Xu, S., Sun, Y., Jiang, C., & Wang, X. (2022). Understanding the peer review endeavor in scientific publishing. *Journal of Informetrics*, 16(2), 101264. <https://doi.org/10.1016/j.joi.2022.101264>
- Zrelli, R., Misson, H. A., Kamkuimo, S., Attia, M. B., Shabah, A., de Magalhaes, F. G., & Nicolescu, G. (2026). Integrating formal methods and automated tools for DO-178C compliance in UAV software. *Information and Software Technology*, 194, 108068. <https://doi.org/10.1016/j.infsof.2026.108068>