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Theme

ConfMan: A Conference Management System

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Sincerely,

Amel and Aziza Ibtissam

List of Abbreviations

CMS Conference Management System

CFP Call for Papers

PC Program Committee

TEP Technical Event Program

UI User interface

UX User experience

OCR Optical Character Recognition

CP Constraint Programming

API Application Programming Interface

UML Unified Modeling Language

MVC Model-View-Controller

CRUD Create, Read, Update, Delete

إهداء

الحمد لله الذي يسر لنا الدرب وأعاننَا عليه ووفقنا فيه الحمد لله الذي لولا لُطفه وعونه وتيسيره لنا ما تم بحثنا.

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ABSTRACT

The exponential growth of scientific and academic research has engendered significant challenges in conference organization and management. This is primarily due to the exponential growth in submitted papers, which creates a substantial workload for conference committees. Conference Management systems have emerged to provide support to the organizers in managing the conference tasks.

While existing conference management software can provide valuable support in specific tasks like paper reviewer assignments, they often prioritize manual operations over the adoption of automated solutions for numerous other tasks. This can hinder both efficiency and user experience and often comes at an additional financial cost.

This thesis is dedicated to the design and implementation of *ConfMan*, a conference management system that leverages the automation of multiple tasks making it almost fully automated. ConfMan elevates conference organization by streamlining the entire event lifecycle. ConfMan automates cumbersome tasks such as call-for-paper (CFP) creation and distribution, a double-blind review verification. Its functionalities also include automated paper scoring, ranking, and reviewer assignment based on expertise, ensuring a meticulous and efficient evaluation process. ConfMan empowers organizers by generating dynamic conference schedules that accommodate attendee preferences and presentation needs. Furthermore, ConfMan prioritizes user-friendly interface.

Keywords: Conference Management System, Papers Assignment, Academic Conference, Double-Blind manuscript verification, TEP Schedule, Character Recognition

ملخص

أدى النمو الهائل للبحوث العلمية والأكاديمية إلى ظهور تحديات كبيرة في تنظيم المؤتمرات وإدارتها. ويرجع ذلك في المقام الأول إلى النمو الهائل في الورقات المقدمة، مما يخلق عبئا كبيرا على لجان المؤتمرات. وقد ظهرت نظم إدارة المؤتمرات لتقديم الدعم للمنظمين في إدارة مهام المؤتمر.

وفي حين أن البرامج الحاسوبية الحالية لإدارة المؤتمرات يمكن أن توفر دعما قيما في مهام محددة مثل مهام المراجعين الورقيين، فإنها كثيرا ما تعطي الأولوية للعمليات اليدوية على اعتماد حلول آلية للعديد من المهام الأخرى. هذا يمكن أن يعيق كل من الكفاءة وتجربة المستخدم وغالبًا ما يأتي بتكلفة مالية إضافية.

هذه الأطروحة مخصصة لتصميم وتنفيذ كونفمان ، وهو نظام إدارة المؤتمرات الذي يستفيد من أتمتة المهام المتعددة مما يجعله آليًا بالكامل تقريبًا.

يطور كونفمان تنظيم المؤتمر من خلال تبسيط دورة حياة الحدث بأكملها. يقوم كونفمان بأتمتة المهام المرهقة مثل إنشاء وتوزيع الدعوة للورق ، والتحقق من المراجعة المزدوجة التعمية. تشمل وظائفها أيضًا تسجيل درجات الورق الآلي، والترتيب، وتعيين المراجع بناءً على الخبرة، مما يضمن عملية تقييم دقيقة وفعالة. تمكن ثنفين المنظمين من خلال إنشاء جداول مؤتمرات ديناميكية تستوعب

تفضيلات الحضور واحتياجات العرض. علاوة على ذلك، تعطي ثنفين الأولوية للواجهة سهلة الاستخدام.

الكلمات المفتاحية: نظام إدارة المؤتمرات، إسناد الأوراق، المؤتمر الأكاديمي، التحقق من المخطوطات المزدوجة التعمية، جدول الحصص التقنية، التعرف على الحروف

RÉSUMÉ

La croissance exponentielle de la recherche scientifique et universitaire a engendré d'importants défis dans l'organisation et la gestion des conférences. Cela est principalement dû à la croissance exponentielle des documents soumis, ce qui crée une charge de travail importante pour les comités de conférence. Des systèmes de gestion des conférences ont vu le jour pour aider les organisateurs à gérer les tâches de la conférence.

Bien que les logiciels de gestion de conférences existants puissent fournir un support précieux pour des tâches spécifiques telles que les tâches de relecteur, ils privilégient souvent les opérations manuelles par rapport à l'adoption de solutions automatisées pour de nombreuses autres tâches. Cela peut nuire à l'efficacité et à l'expérience utilisateur et entraîne souvent un coût financier supplémentaire.

Cette thèse est dédiée à la conception et la mise en œuvre de emphConfMan, un système de gestion de conférence qui tire parti de l'automatisation de plusieurs tâches, le rendant presque entièrement automatisé. ConfMan améliore l'organisation des conférences en rationalisant l'ensemble du cycle de vie des événements. ConfMan automatise des tâches fastidieuses telles que la création et la distribution de call-for-paper (CFP), une vérification de révision en double aveugle. Ses fonctionnalités incluent également la notation papier automatisée, le classement et l'affectation des évaluateurs en fonction de l'expertise, assurant un processus d'évaluation méticuleux et efficace. ConfMan permet aux organisateurs de générer des horaires de conférence dynamiques qui répondent aux préférences des participants et aux besoins de présentation. En outre, ConfMan privilégie l'interface conviviale.

Mots-clés: Système de gestion de conférence, Assignement Des Papiers, Con-

férence académique, Vérification de manuscrit en double aveugle, Calendrier TEP, Reconnaissance de caractères

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General Introduction

Academic conference serves as an essential forum for researchers, scholars, and professionals to present their work and exchange knowledge with the scientific community. Preparing and managing a conference requires a Conference Management System (CMS), it is an all-encompassing solution developed to enhance the efficiency of conference planning, organization, and management processes. It is tailored to support the full continuum of the conference workflow, extending from the inception of planning stages to the final evaluation post-event.

Many Existing CMSs struggle with non-ergonomic user interfaces, making them difficult and inefficient to use. The free versions of these systems often offer only basic functionalities, while advanced event management features, which are crucial for organizing successful conferences, are locked behind paid licenses. Moreover, these systems rarely provide full automation of essential tasks required for seamless conference creation, promotion, and management. This lack of automation means that organizers must often perform repetitive and time-consuming tasks manually, leading to inefficiencies and increased workload. Consequently, there's a significant gap in the market for a CMS that combines an intuitive user interface with extensive free features and full automation capabilities to simplify the entire conference management process.

To address these shortcomings, we propose to design a conference management system, baptized *ConfMan*, that supports the full continuum of the conference workflow by provid-

ing an *ergonomic user interface* and offering the automation of *duplicated paper verification*, *simple "papers reviews" process, paper scoring*, and *paper ranking*.

Additionally, we utilize AI tools to verify that submitted manuscripts comply with double-blind requirements, if such a review process is adopted.

We also introduce two important features: first, we offer an automatic paper reviewer assignment feature based on a novel problem formulation in which we aim to minimize reviewers' workloads while ensuring that each paper receives the required number of reviews and that expertise constraints are met. Optimization tools are then used to provide the assignment.

Second, a novel graph coloring algorithm, based on a new graph formulation, is employed to create the Technical Event Program for the conference, effectively resolving scheduling conflicts.

The thesis is divided into 4 chapters as follows:

Chapter 1 provides a comprehensive overview of the academic conference landscape. It delves into the typical conference workflow, highlighting key stages involved in organizing and managing such events. Additionally, this chapter explores related research in conference management systems and identifies the motivation for the proposed system.

Chapter 2 focuses on the conception and design of ConfMan. This chapter outlines the system's requirements, both functional and non-functional, ensuring the proposed solution caters to the essential needs of conference organizers while also considering performance and usability aspects. Furthermore, Chapter 2 explores the system architecture, providing a high-level overview of the key components and their interactions. This architectural blueprint lays the foundation for the system's functionality. Finally, the chapter details the system design using Unified Modeling Language (UML) diagrams, visually depicting the functionalities, core components, and message flows within the proposed CMS.

Chapter 3 is dedicated to a comprehensive description of the key functionalities and features of ConfMan. This chapter delves into the system's core components, detailing how each functionality contributes to streamlining the conference management process.

Chapter 4 focuses on implementing and evaluating ConfMan. It details the technology stack used, including programming languages, frameworks, optimization, and AI tools. After thoroughly describing the testing process, we provide an overview of ConfMan's various functionalities and identify its benefits and limitations.

Finally, the thesis concludes with a discussion of potential future work opportunities to further enhance the system's capabilities.

CHAPTER 1

ACADEMIC CONFERENCE

1 INTRODUCTION

Academic conferences serve as a vital platform for the exchange of knowledge and collaboration within the research community. They provide a venue for scientists, scholars, and researchers to Disseminate their research findings, Engage in scholarly exchange and Foster collaboration.

Organizing and managing a successful academic conference is a complex logistical challenge, given the vast number of tasks involved and the large number of participants. To address these challenges, conference organizers utilize Conference Management Systems that streamline the conference management process, automating tasks and facilitating efficient communication with participants. Existing CMS solutions offer a wide range of features, but they may not always meet the specific needs of all conferences. Additionally, some CMS solutions require paid subscriptions, which can be a cost barrier for some organizers.

This chapter aims to provide a comprehensive overview of academic conference management. Section 2 will offer a concise definition of academic conferences. Section 3 will delve into the typical workflow of an academic conference, highlighting key stages involved in or-

ganizing and managing such events. Finally, Section 4 will explore established Conference Management Systems, focusing on those offering the most effective features to support the conference management process.

2 ACADEMIC CONFERENCE

Academic conferences serve as a vital platform for knowledge exchange and collaboration within the research community. They provide a venue for scholars, scientists, and researchers to:

Disseminate their research findings: Conferences offer a valuable opportunity to present research results to a targeted audience of peers, fostering wider dissemination of knowledge.

Engage in scholarly exchange: Presentations and discussions at conferences stimulate intellectual exchange, allowing researchers to exchange ideas and receive feedback on their work.

Foster collaboration: Conferences facilitate networking and collaboration opportunities. Researchers can connect with colleagues, explore potential research partnerships, and identify new avenues for investigation.

Academic conferences facilitates the exchange of knowledge, research findings, and ideas within specific disciplines by attending to the organized events that include presentations, panel discussions, and workshops [10].

3 CONFERENCE WORKFLOW

Organizing an academic conference involves several main steps [10]:

3.1 CONFERENCE PREPARATION

This initial phase involves planning and organizing the conference in these steps:

- The selection and appointment of key personnel, including the designation of the general chair, organizing committee members, and program committee chairmen, along with their respective committee members.
- The program committee, in collaboration with the general chair, defines the topics of the conference, which subsequently guides the composition of the program committee itself.
- Securing sponsorship, identifying and inviting prominent keynote speakers, and drafting the Call for Papers (CFP).
- The CFP serves as a critical document outlining crucial deadlines for the conference, such as submission and registration windows, acceptance notifications, and the conference date itself.
- Finally, to establish a central hub for disseminating information and facilitating communication with potential attendees, the development of a dedicated conference website concludes this initial phase.

3.2 CONFERENCE PROMOTION

Effective promotion is paramount in ensuring a successful scientific conference. A well-executed promotional strategy enhances the event's visibility within the broader scientific community and therefore increases the opportunities for receiving high-quality papers which directly affects the reputation of the conference. To achieve this objective, a multi-pronged approach is recommended:

- First, targeted email campaigns can be implemented by leveraging dissemination lists obtained from relevant national and international academic institutions and societies
- Then, social media platforms provide a powerful tool for disseminating the Call for Papers (CFP) and generating interest among potential attendees.
- Finally, the conference's CFP can be strategically disseminated through dedicated conference announcement websites such as Papercrowd, WikiCfP, and Conferize, ensuring maximum exposure within the target scientific audience.

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3.3 SUBMISSION

Online platforms facilitate the submission process, ensuring efficient management of a potentially high volume of papers. Once the submission deadline closes, a multi-step evaluation process commences. A screening is necessary to identify duplicated submissions, submissions that are plagiarized or considered out of scope. These papers are promptly rejected. Additionally, if the double-blind review process is adopted, submissions are checked to ensure this requirement is met.

3.4 REVIEWING PROCESS

The remaining papers undergo a rigorous peer-review process. Employing a predefined strategy:

- First, the matching scores between papers and reviewers, which indicate the reviewers' level of expertise for each manuscript, are calculated using a validated formula [9, 2].
- Reviewers are carefully assigned manuscripts based on their expertise and the thematic alignment with the conference topics [2]
- Finally, upon receiving all reviews, a comprehensive merging and analysis are conducted. The reviewed papers are then ranked to guide the ultimate selection process for conference presentations.

3.5 FINAL DECISIONS

The Program Committee (PC) undertakes the critical task of rendering final decisions regarding paper acceptance or rejection. The rankings established during the review stage serve as a valuable foundation; however, for manuscripts with conflicting evaluations, additional reviews may be solicited to ensure a fair and comprehensive assessment. This meticulous decision-making process includes:

- The selection of high-quality presentations, categorized for either oral delivery or poster sessions.

- The PC sends acceptance notifications to the corresponding authors.
- Initiating the process of collecting final versions of the accepted papers.

3.6 CONFERENCE DOCUMENTS PREPARATION

Following the collection of the final versions of accepted papers, two primary tasks need to be completed:

- Prepare the conference proceedings.
- Schedule the technical event program, this involves dividing the accepted papers into coherent sessions where papers within the same session have a common theme. These sessions are then organized based on the available time slots and venue resources to formulate the technical event program.

3.7 AUTHORS REGISTRATION

Authors are invited to register in the conference. Typically, for each accepted paper, the participation of at least one author in the conference events is required. The tasks mentioned can be divided into three categories: logistical, administrative, and scientific.

The organizing committee members primarily handle logistical and administrative responsibilities, while the program committee members fulfill the scientific tasks, which are fundamental to an academic conference.

Clearly, the management of a conference requires considerable time and effort. Conference Management Systems (CMS) were developed years ago to assist conference organizers by automating various tasks. The next section will outline the key features of some recent systems widely recognized and used by numerous international conferences. Figure 1.1 illustrates the main steps of a conference.

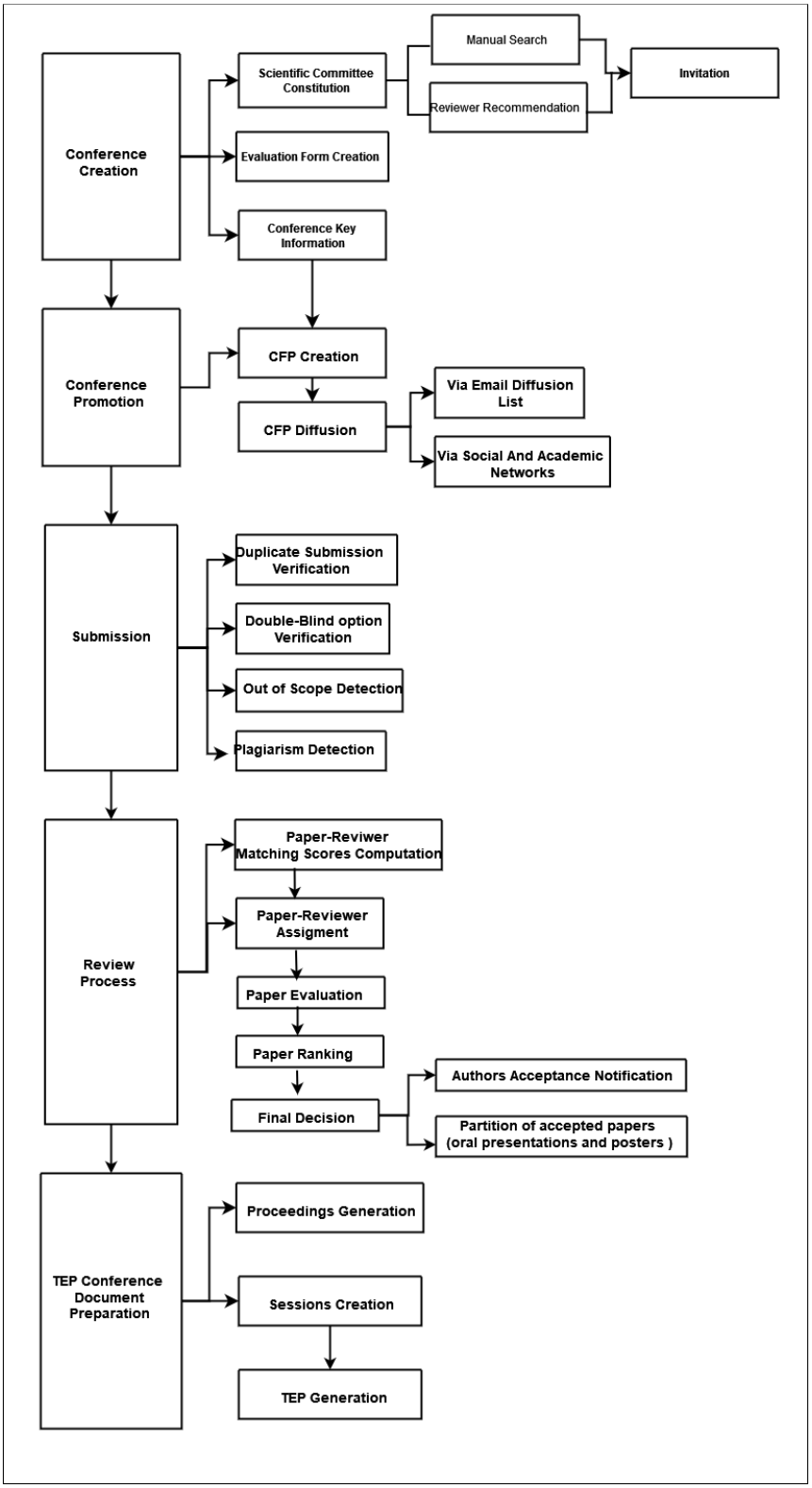

Figure 1.1: Conference Workflow

4 OVERVIEW OF EXISTING CMS

EasyChair: Is a web-based conference management system that simplifies tasks such as organizing research paper submissions and reviews. The main features of EasyChair are: Conference management, Conference registration, Smart CFP for publishing calls for papers, Smart Slide for publishing conference presentations, Publishing conference proceedings and other volumes, and Preprints [6].

Microsoft CMT (Conference Management Toolkit): Is a hosted academic conference management system sponsored by Microsoft Research. It runs on the Microsoft Azure cloud platform. Main Features: Multiple Roles, Multi-Track Support, Customizable Form, Full Submission Life Cycle, Instruction Message, File and Media, Conflicts Management, Program Committee Invite, Bidding, Reviewer Suggestion, Assignment, Discussion, Rebuttal, Author Notification, Copyright, Export, Download, Email, Note, Session and Presentation and Audit [11].

OpenConf: Is a widely-used abstract management and peer-review system, renowned for its user-friendliness, comprehensive features, and exceptional support. Main Features of OpenConf: Customize submission forms, Assigning reviews manually or automatically, bulk acceptance, Provide access to accepted submissions and Multilingual [12].

ConfTool: Is a web-based event management system designed for academic conferences, workshops, congresses, and seminars. Main Features of ConfTool: unlimited Submission and Review, Delegate Registration, creating dynamic schedules, showcase posters, and engage global attendees [4].

Oxford Abstracts: Is an end-to-end solution for academic conferences. It offers abstract management, conference platforms, and more. Main Features of Oxford Abstracts: Abstract Management, Conference Platform, Delegate Registration and double-blind peer review [14].

FourWaves: Is a cutting-edge platform designed for academic events. It allows rapid setup of conferences of any size. Main Features of FourWaves: Publish Event Website, Abstract Management, Peer Reviews, Conference Program, Virtual Poster Sessions, Application Types and Editions [7].

Ex Ordo: Is an easy-to-use, efficient software for scientific, medical, and technical events. Main Features of Ox Ordo: Abstract Collection, Online Event Creation, Management, Event Marketing and Networking [13].

Cvent: Is an industry-leading event platform for in-person, virtual, and hybrid events. It empowers event planners, marketers, hoteliers, and travel professionals. Main Features: Event Lifecycle Management, Venue Sourcing, Vendor Sourcing, Registration and Payments, Virtual Experience [5].

Bizzabo: Provides an integrated event experience, suitable for academic conferences and other events. Main Features of Bizzabo: Event Website, Registration and Ticketing, Networking and Engagement, Event Marketing, Analytics and Insights [3].

5 MOTIVATION OF THE CURRENT WORK

Existing Conference Management Systems often suffer from non-ergonomic user interfaces and limited free functionalities. They offer advanced event management features only under a paid licence. Furthermore, no system fully automates all the necessary features for easy conference creation, promotion and management.

To address these limitations, we design and develop *ConfMan*, a novel conference management system that complements a previous work [10]. While features in [10] focus on the scientific aspect, we mainly emphasize the logistical and administrative aspects. The latter involves new features including evaluation form creation, automated paper scoring and ranking, duplicated submission verification, and double-blind submission control.

In addition, we propose a new mathematical formulation of the assignment of papers to reviewers that aims to minimize the reviewers' workload while ensuring review coverage

and expertise constraints.

We also propose a novel graph formulation to establish the Technical Event Program (TEP) of the conference.

ConfMan features an ergonomic user interface designed to automate most operational functions, providing a streamlined user experience. Additionally, our platform will be available and free from payment-based restrictions or limitations.

5.1 MAIN FEATURES OF CONFMAN

Professional Templates: Our system generates high-quality call-for-paper and Invitation templates.

Double Blind review process: If the double-blind option is activated, the system automatically verifies the anonymity of the submitted papers.

Automated Paper Assignments: Reviewers are assigned papers automatically, streamlining the process.

Customize Evaluation Forms: Conference chairs can create tailored evaluation forms.

Automatic Paper Scoring and Ranking: The system calculates paper scores efficiently and ranks them according to the acceptance settings.

Paper Duplication Verification: Ensures accurate representation of submitted papers.

Automatic Technical Event Program (TEP) scheduling: The system automatically schedules sessions based on the available time slots and venue resources.

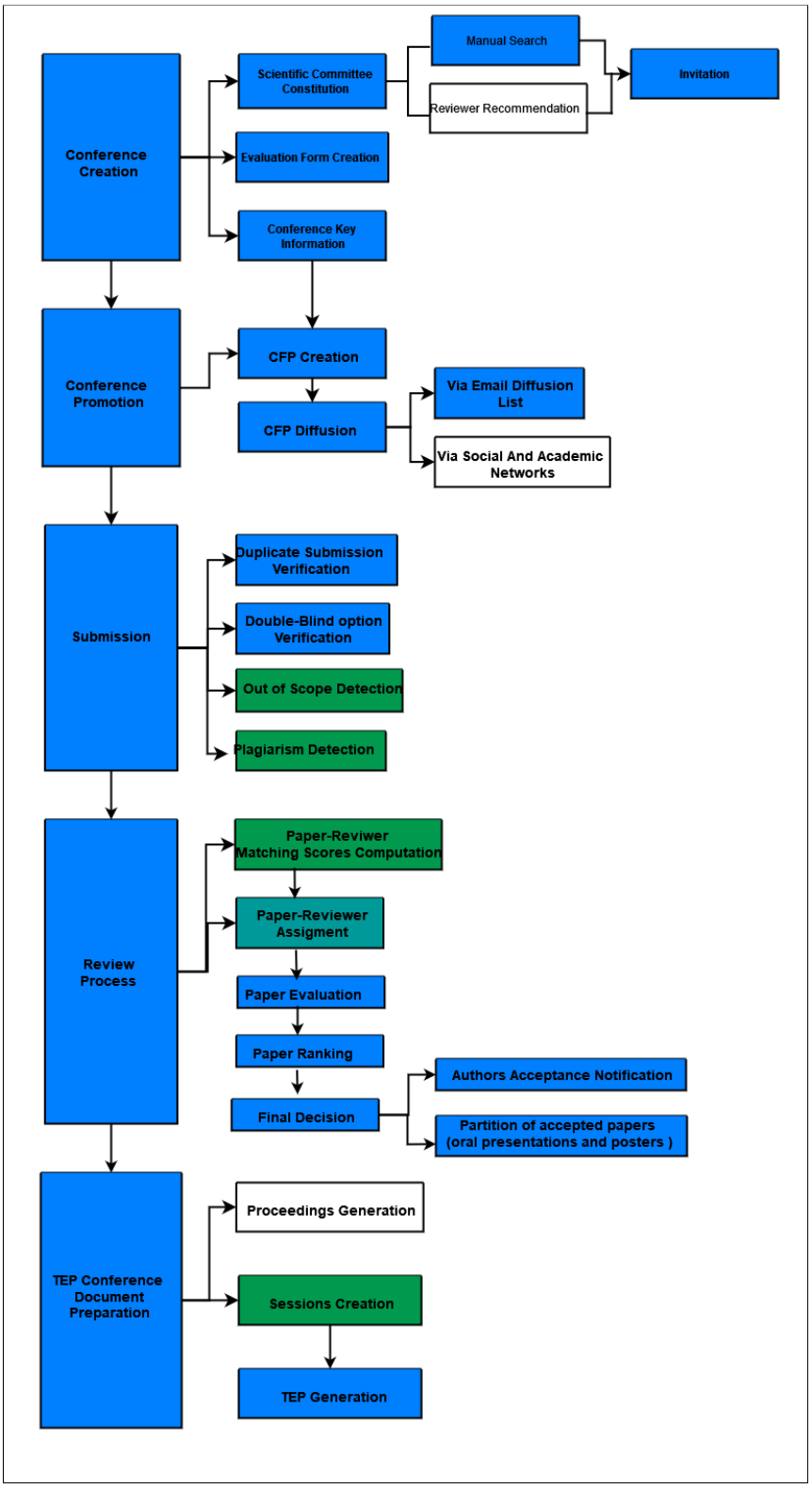

Figure 1.2: ConfMan workflow highlighting features from the previous works [10, 9] in (light green) and ours (blue). Different assignment algorithms have been proposed in this work and the work in [10] (blue-green).

6 CONCLUSION

This chapter has explored the vital role of academic conferences in fostering knowledge exchange and collaboration within the research community. We discussed how conferences provide a platform for scientists, scholars, and researchers to disseminate their findings, engage in scholarly exchange, and build collaborative networks.

The chapter also highlighted the complexities of managing academic conferences, particularly as the number of participants and tasks involved grows. To navigate these challenges, Conference Management Systems (CMS) have emerged as essential tools, streamlining the management process and facilitating efficient communication. We explored the diverse features offered by existing CMS solutions, acknowledging that specific needs and budgetary constraints may not always be fully addressed.

After providing a comprehensive overview of academic conferences and conference management systems, we discuss in the next chapter the design of ConfMan to address the limitations of existing CMSs.

CHAPTER 2

CONFMAN: CONCEPTION AND DESIGN

1 INTRODUCTION

Building upon the discussion of existing Conference Management Systems (CMS) in Chapter 1, this chapter introduces a novel CMS proposal. While existing solutions offer a variety of features, limitations such as subscription fees and potential gaps in functionality remain.

This chapter introduces ConfMan, a novel CMS designed to tackle these limitations. ConfMan empowers organizers with a suite of automated features, eliminating the burden of manual tasks. Section 2 will delve into the system requirements, outlining both functional and non-functional specifications. These specifications will ensure that the proposed CMS caters to the essential needs of conference organizers while also considering performance and usability aspects. Section 3 will explore the system architecture, providing a high-level overview of the key components within the CMS and how they interact with each other. Finally, Section 4 will delve into the intricate details of system design. Utilizing Unified Modeling Language (UML) diagrams ensures a well-defined and robust foundation upon which the conference management system can be built.

2 REQUIREMENTS SPECIFICATIONS

The ConfMan system is designed and developed to achieve the specifications and objectives that follow:

2.1 FUNCTIONAL SPECIFICATIONS

The system automate the conference creation and management process by providing several key functions:

Conference Creation and Updates: Users can easily create conferences by submitting requests and subsequently updating essential details via the chair console. These details include conference topics, dates, submission deadlines, and venue locations. The chair console serves as a central hub for managing conference logistics and ensuring seamless communication between organizers and participants.

Professional Templates: Conference chairs employ professionally crafted call-for-paper and invitation templates generated by the system. These templates serve as standardized communication tools for engaging with authors and reviewers effectively. As the conference planning progresses, the templates are dynamically updated with specific conference details, including submission deadlines, venue information, and other relevant particulars. This systematic approach ensures consistent and informative communication throughout the conference management process.

Participant Lists: Submitted papers and reviewers who have joined the conference are organized in lists within the chair console.

Evaluation Form Creation: Conference chairs have the capability to design evaluation forms customized to meet academic specifications. Within these forms, chairs can add relevant fields and assign coefficients based on the chosen evaluation method. By tailoring the forms to the specific context of the conference.

Automated Paper Assignments: Once an adequate number of papers and reviewers have been gathered, conference chairs initiate the automated assignment process by matching papers (along with their corresponding evaluation forms) to reviewers based on their specialized fields and the topics addressed in the papers. Furthermore, conference chairs retain the flexibility to manually assign papers to reviewers as needed. Proper assignment ensures fair evaluation and timely feedback.

Paper Duplication Detection : Authors are not allowed to submit the same paper multiple times; the system checks to ensure that the papers submitted have not been previously included in the conference's database. If a paper already exists, the system alerts the author and cancels the submission process.

Double Blind Review: The conference chair has the ability to enable the Double Blind Review feature. Once activated, the system checks to ensure that submitted papers are anonymous. If they are not, it notifies the author to resubmit the paper anonymously.

Automatic Paper Evaluation and Ranking: Reviewers evaluate assigned papers by filling evaluation forms provided by the conference chair. Within these forms, reviewers evaluate various aspects, including content quality, research methodology, and the significance of each paper. Their feedback plays a crucial role in informing acceptance decisions. Simultaneously, the system automatically computes paper scores and categorizes them based on the chair's predefined criteria, resulting in lists for oral presentations, posters, waiting list, and rejected papers.

Automatic Technical Event Program scheduling: After the review process is complete and the list of accepted papers is finalized, the chair enters the available time slots and venue resources into the system, which will then automatically schedule the sessions accordingly.

2.2 NON FUNCTIONAL SPECIFICATIONS

The system guarantees a straightforward and efficient process for creating and managing conferences by ensuring non-functional requirements such as performance, security,

usability, and reliability are met as follows:

Speed: The system provides swift responses to user interactions, thanks to the brief pages loading duration, quick API response times and transaction processing times.

Scalability: The system efficiently manages an increase in users, data or workload without a significant degradation in performance facilitating the creation and management of large-scale conferences with ease.

Availability: The percentage of time the system is up and running and accessible to users might target 99.99 percent availability (very little downtime).

Authentication: Users gain authentication and authorization to access the system by registering and verifying their email.

Authorization: Access levels for different users are assigned based on their roles within the system (admin) and the conference (chair, reviewer and author).

Encryption: The system encrypts sensitive information such as user passwords, scrambling the data to protect it against unauthorized access.

Data integrity: The data on the system is accurate, consistent, and hasn't been tampered with.

Ease of use: The system is easy to learn and perform due to its clear instructions, intuitive workflows, and the few steps required to complete tasks.

User interface (UI): The system boasts an aesthetically pleasing, organized, and consistent interface. It employs clear labeling, suitable icons, and adheres design patterns that are familiar to users.

User experience (UX): The system's user-friendly interface and ease of use ensure efficiency, user satisfaction, and positive emotional engagement.

Fault tolerance: The system offers features such as error handling, retry mechanisms, and redundancy to ensure it can handle errors and unexpected events without crashing or losing data.

Compliance: The system must adhere to the standards for creating and managing academic conferences.

3 SYSTEM ARCHITECTURE

The high-level architecture of the ConfMan system is composed of multiple critical components that collaborate to facilitate effortless conference creation and management, as follows:

User Interface (UI): The UI serves as the system's front-end, enabling user interaction with the system via a web interface accessible through a browser. It allows users to register, create and update conference details, manage conferences, and participate in other conferences as an author or a reviewer.

Database: The system employs a central database to store all user and conference data. This encompasses user profiles including the conferences they have attended, details of the conferences, as well as papers and their evaluation scores.

AI and Optimization Tools: ConfMan leverages functionalities using AI and optimization tools in several key areas to enhance its efficiency and effectiveness.

- Double-Blind Review: To maintain anonymity in the review process, an Optical Character Recognition (OCR) AI tool Tesseract is employed. This tool converts scanned paper submissions into machine-readable text, enabling the system to verify the absence of author names within the submitted documents. This safeguards the integrity of the double-blind review process.

Data Flow: The system leverages an Application Programming Interface (API) to manage data flow. An API acts as an intermediary component, facilitating communication and data exchange between the user interface and the database [8]. This enables users to interact with the system and access or modify information stored within the database. Data flow within the system:

- Users interact with the UI to input personal details, such as their academic email, affiliation, and attended conferences, as well as to create and update conference information, including the creation of evaluation forms. All this data is then stored in the database.
- CFP and Invitation templates are crafted to retrieve conference details from the database, ensuring that the Call for Papers and Invitations are tailored specifically for the event.
- Information on papers are stored in the database to verify their existence prior to the author's submission process.
- Papers documents and evaluation form data are stored in the database. This information can be retrieved and forwarded to reviewers after the assignment process.
- During the evaluation process, whenever a reviewer modifies a paper's evaluation score, the system automatically recalculates the paper's overall mark, updates it in the database, and displays it in the user interface.

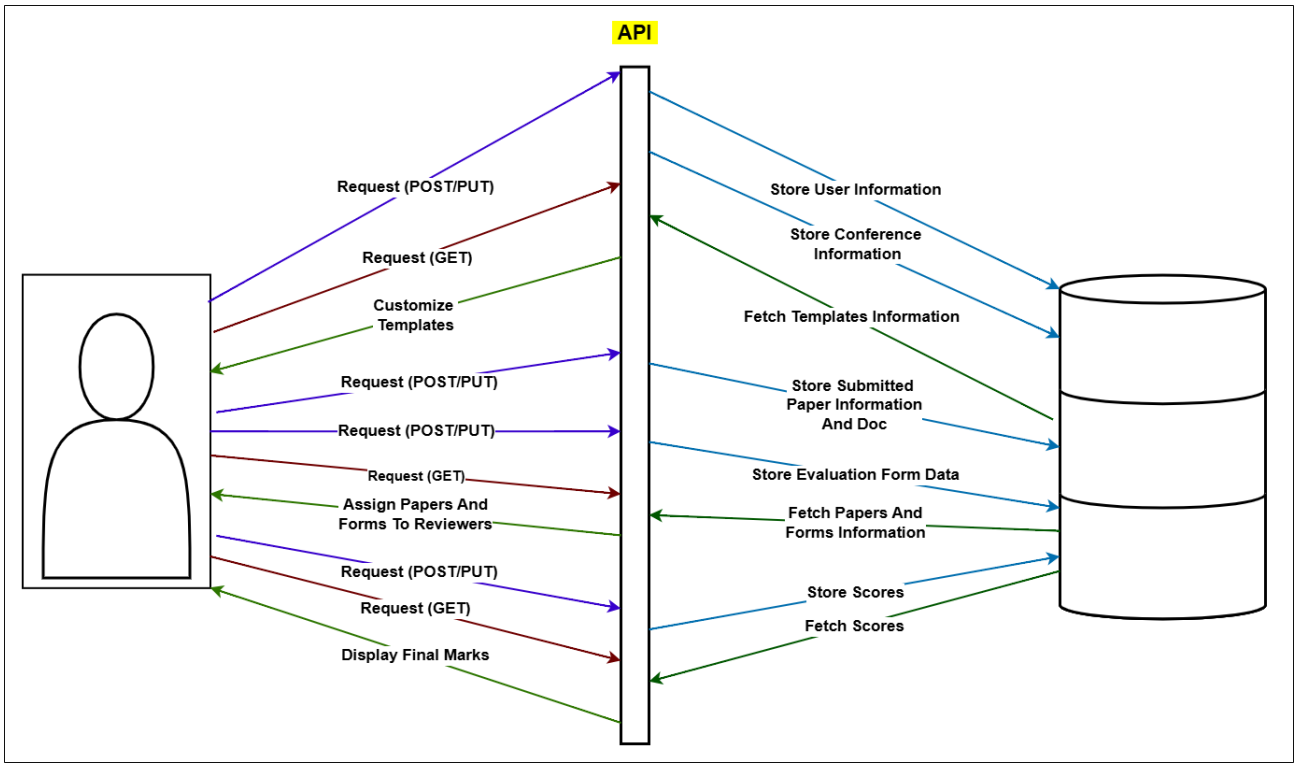

Figure 2.1: Schema Of The Exchange Of Data Between The Data-Base And User Interface

4 SYSTEM CONCEPTION

Establishing a clear system concept is a critical step in developing a robust system, to achieve this, we'll utilize a combination of Unified Modeling Language (UML) diagrams and distinct system views. UML diagrams, with their visual notation, provide a powerful tool to represent the system from various perspectives. Distinct system views, independent of specific diagramming tools, provide a framework for analyzing the system from various angles.

By employing UML diagrams and the complementary views during the conception phase, we can establish a solid foundation for a system that is both functional and efficient.

4.1 THE FUNCTIONAL VIEW

The functional view offers a user-centric perspective, ensuring the system caters to user needs with appropriate functionalities. This perspective is typically illustrated through use

case and Activity diagrams. It focuses on identifying user roles, their interactions with the system, and the functionalities associated with each role [**?**].

DIFFERENT USER ROLES IN OUR SYSTEM

ConfMan system consists three types of actors; guest, user and admin:

GUEST:

Guests have limited access. They can view conference information and its essential details. Additionally, they have the capability to create a new account within the system, granting them access to its full features.

USER:

Users who already have an account must sign in to access the system, they can modify their personal details and reset their accounts passwords. In our system, users are assigned one of three roles; Chair, Reviewer and Author, each with its own specific set of actions:

Chair: The Chair holds the responsibility for managing the conference. This includes creating conferences, updating their details such as topics, deadlines, session slots, and venue, issuing calls for papers, and sending invitations to reviewers. Additionally, the Chair can customize the evaluation form used to assess submissions and assign it, along with the papers, to reviewers.

Reviewer: Reviewers join the conference by accepting an invitation. Their role is to assess assigned papers by completing the evaluation form for each paper.

Author: Authors submit the conference by accepting the call for paper, they confirm their submission by uploading the papers for consideration by the conference. If their papers are accepted, they are invited to join the programmed sessions to present their work.

ADMIN:

administrators have the authority to delete or update user accounts within the system.

4.1.1 USE CASE DIAGRAM

Use Case Diagram is the graphical representation of the interactions between users and a system enabling the achievement of specific goals or tasks. This diagram depicts the actors (users) interacting with the system and the functionalities (use cases) they utilize [19]. It clarifies the system's functionality scope and identifies the different user roles (authors, reviewers, conference chairs) and their interactions with features like paper submission, review assignment, and schedule viewing. Below is the general use case diagram of our system:

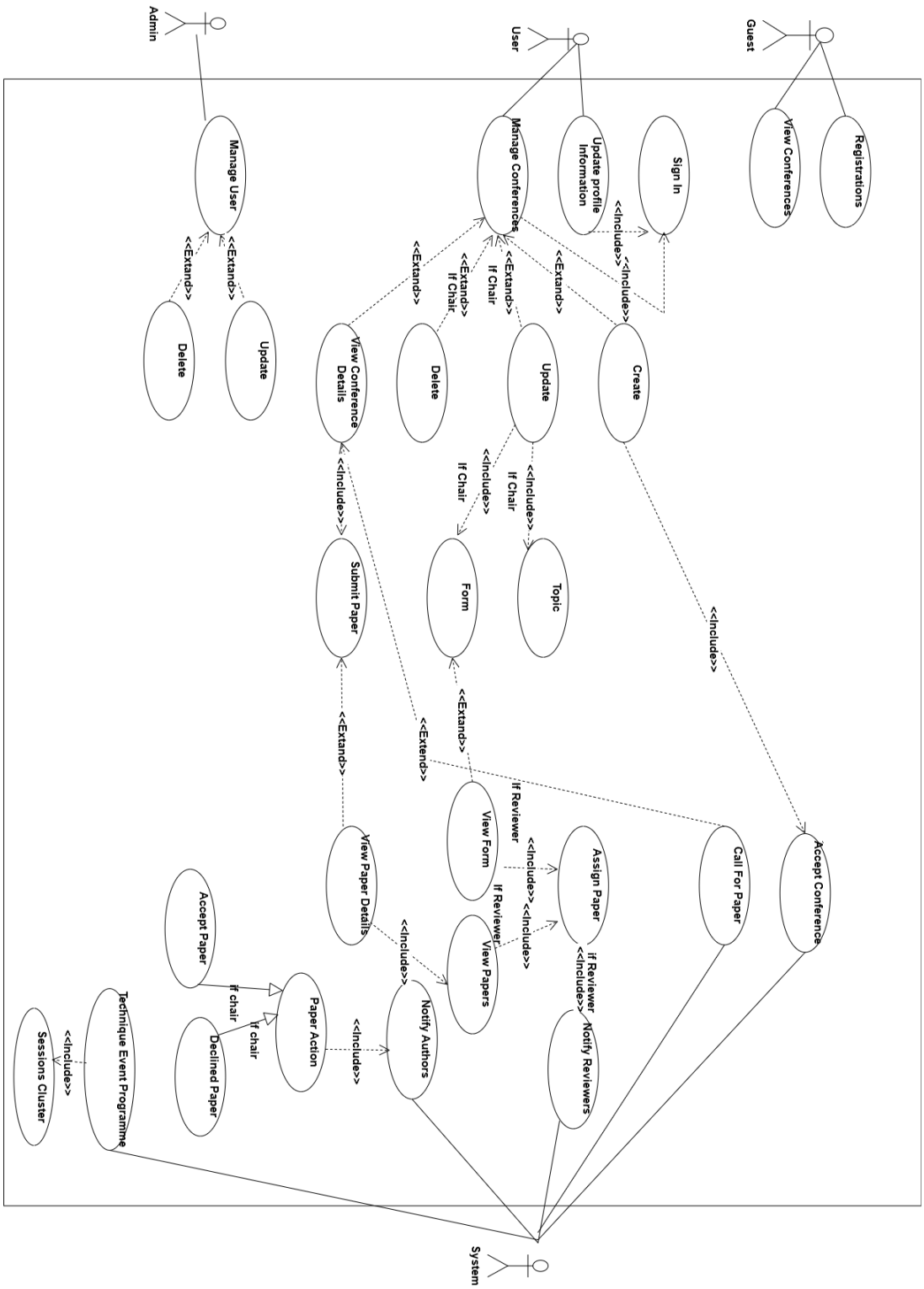

Figure 2.2: Use Case Diagram of ConfMan Platform

4.1.2 ACTIVITY DIAGRAM

Activity Diagram models the dynamic behavior of a system by describing how activities (actions) are coordinated in response to events, it is used to show the flow from one activity to another [17]. This diagram helps visualize the complete workflow for a the system functionalities as follows:

Create Conference Request

- The initial activity involves creating a conference request.
- If the request is accepted, the user assumes the role of a conference chair. Otherwise, the system notifies the user of the denial, highlighting any mistakes in the request.

Conference Chair Actions After becoming a conference chair, the user can perform the following actions:

- Update Conference Information: The chair has the authority to modify conference details, and to activate the Double Blind Review option.
- Send Call for Papers (CFP): The system generates CFPs according to the conference information allowing the chair to send them to authors.
- Customize Evaluation Form: Designing an evaluation form for the reviewing process.
- Send Invitations: The system generates Invitations according to the conference information allowing the chair to send them to reviewers.

Author Submissions

- Authors submit papers aligned with the conference topics.

Reviewer Interaction

- Reviewers receive invitations based on their expertise in relevant topics.
- If they accept, they join the conference; otherwise, they are marked as refused invitations in the chair console.

Review Process

- streamlines the review process by automatically assigning submitted papers along with their corresponding evaluation forms to suitable reviewers. Additionally, the system automatically sends notification emails to reviewers, informing them of their assigned papers and prompting them to begin the review process.
- Paper scores are automatically calculated.

Automatic Ranking

- The system automatically ranks papers according to their evaluation and displays lists in the chair console.
- If a paper is accepted, the author makes the paper file re-submission.
- If a paper is rejected, then the authors receive a rejection notification containing the reviewers' comments.

Technical Event Program

- Chair inputs the available sessions slots and venue information.
- The system does session scheduling by prioritizing thematic similarity between presentations. This strategy ensures that thematically related sessions are not scheduled concurrently.

Send Notification

- Reviewers and authors receive notifications about the programmed schedule.
- Authors join the programmed event to present their work.

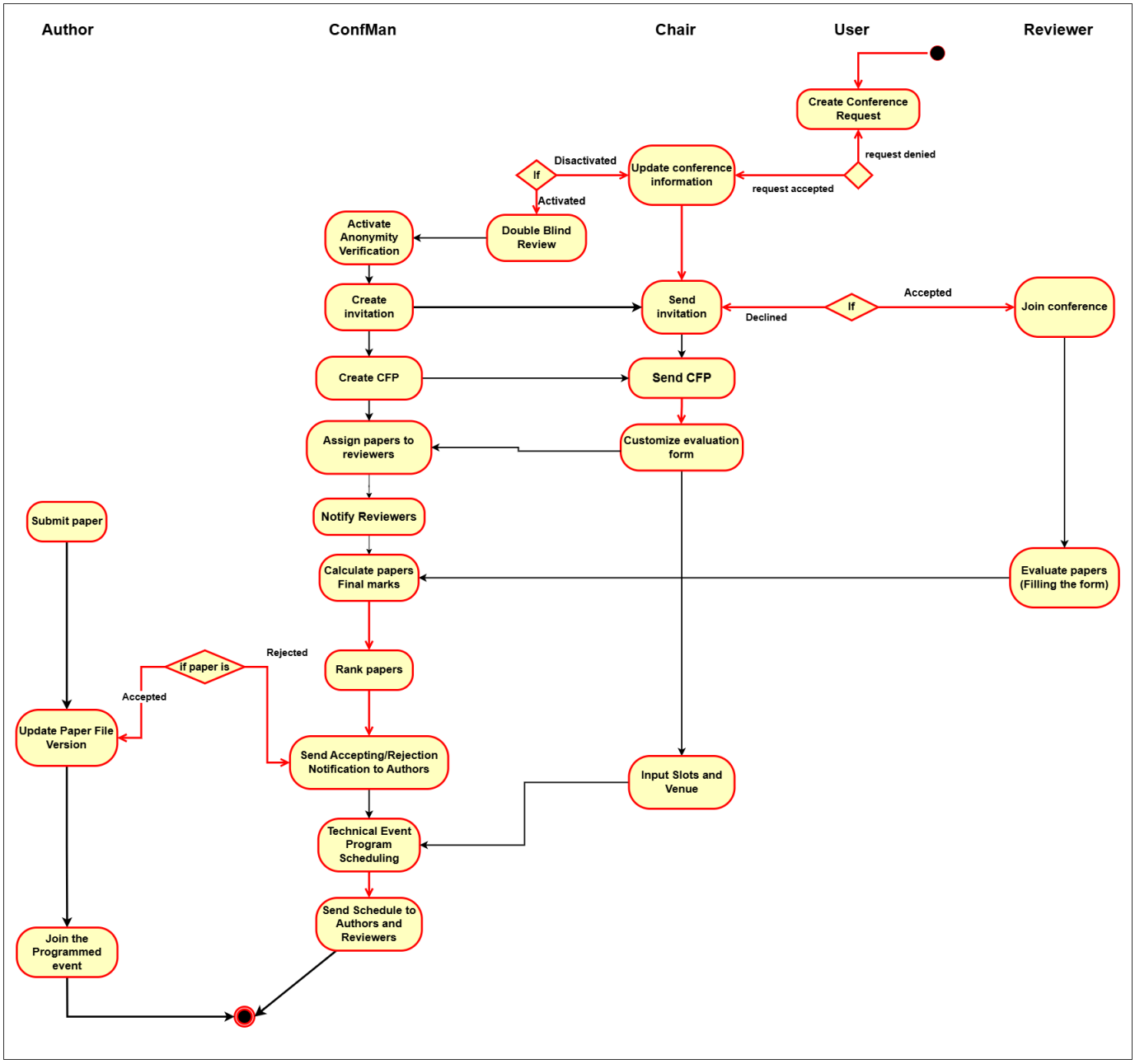

Figure 2.3: Activity Diagram of ConfMan

4.2 STATIC VIEW

The static view outlines the fundamental structure of the system's architecture.It offers a high-level overview of the system's structure and enhancing efficiency. This view is often

represented using class diagrams, which depict the various classes within the system and the relationships that exist between them [**?**].

4.2.1 CLASS DIAGRAM

Class Diagram in UML describes the structure of a system by showing classes, their attributes, methods, and relationships among objects. It represents the static aspects of a system, focusing on the classes and their associations [18].It defines the core building blocks of the system, such as classes for Conference, Paper, User, Form, and Sessions. It shows how these classes interact (a Paper has many Reviews, a User can be an Author or Reviewer). Below is the general class diagram of our system:

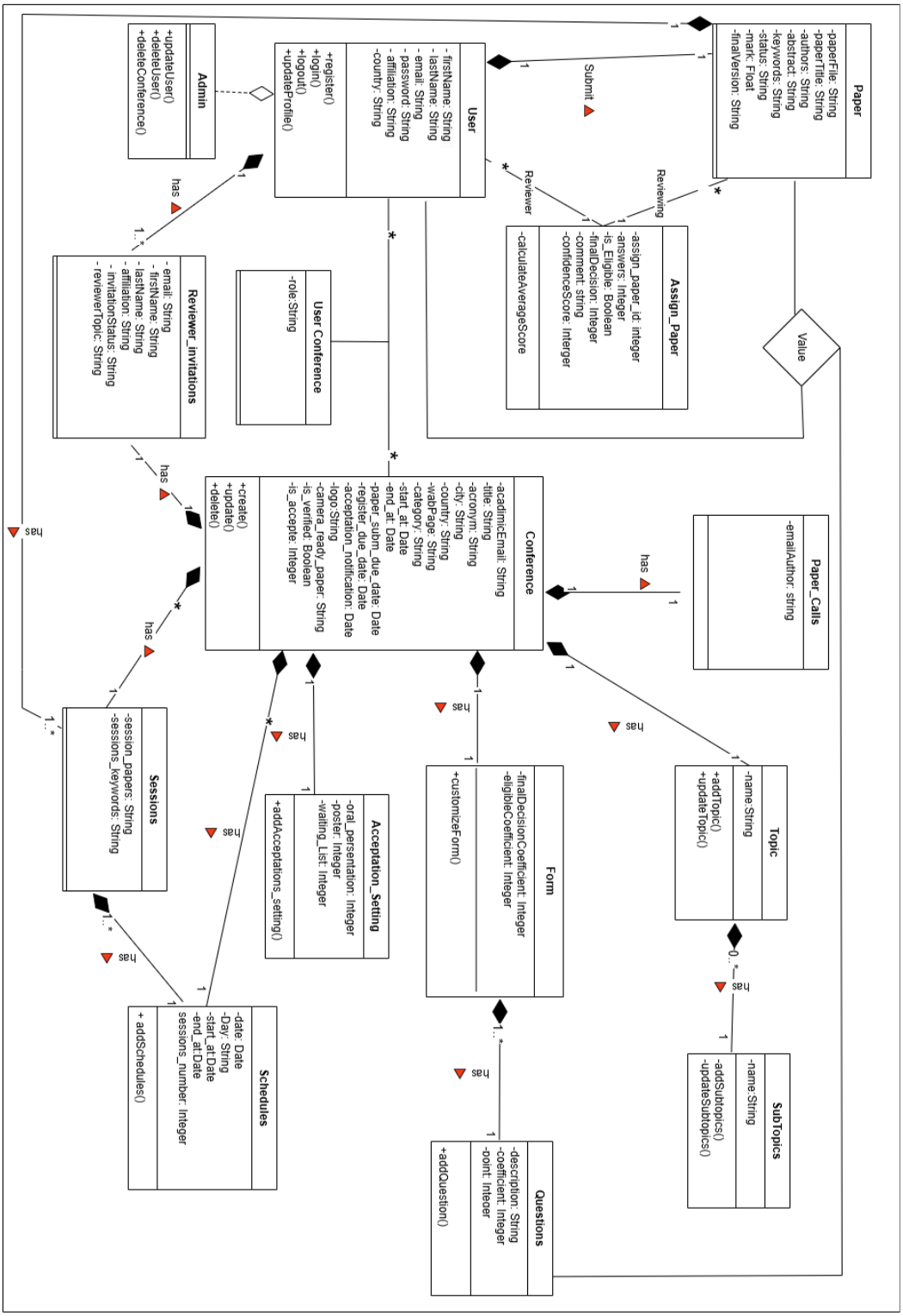

Figure 2.4: Class Diagram of ConfMan Platform

TRANSITION FROM OBJECT MODEL TO RELATIONAL MODEL

To facilitate the application's implementation, we translate the class diagram into a relational model.
This translation adheres to established principles:

- A class in the object model maps to a table in the relational model, each class attribute translates to a property (column) within the corresponding table,
- A one-to-many association translates to a foreign key constraint,
- A many-to-many association translates to a separate link table.

Through the application of established object-relational mapping principles to the class diagram, the resulting relational schema for the database is comprised of three normalized tables:

Table 2.1: Database Tables Part 1

Table Name	**Attributes**
Acceptations_setting	(accpet_id, conference_id, oral_presentations, poster, waiting_list)
Assign_paper	(assign_paper_id, paper_id, user_id, answers, finalDecision, isEligible, comments, confidenceScore)
Conferences	(Conference_id, userID, emailConf, title, acronym, city, country, webpage, category, start_at, end_at, paper_subm_due_date, register_due_date, acceptation_notification, review_due_date, camera_ready_paper, logo, is_verified, is_accept)
Conference_schedules	(Conf_Sche_id, day, date, start_time, end_time, conference_id, session_number)
Conference_user	(user_id, conference_id, role)
Forms	(form_id, conference_id, finalDecisionCoefficient, eligibleCoefficient)
Reviewer_invitations	(invit_id, conference_id, email, firstName, lastName, affiliation, invitationStatus, reviewerTopic)
Papers	(paper_id, custom_id, conference_id, user_id, paperTitle, paperFile, authors, abstract, keywords, submitted_at, mark, acceptations_setting, finalVersionFile)

Table 2.2: Database Tables Part 2

Table Name	Attributes
Paper_calls	(paperCall_id, conference_id, emailAuther)
Questions	(question_id, form_id, description, coefficient, point)
Sessions	(session_id, sessionPaper, sessionKeywords, conference_id, conference_schedules_id)
Subtopics	(suptopic_id, topic_id, name)
Topics	(topic_id, conference_id, name)
Users	(user_id, firstName, lastName, email, email_verified_at, password, country, affiliation)

4.3 DYNAMIC VIEW

The dynamic view delves deeper into the system's operational characteristics, providing insights into how data flows through the system and how information is presented to users. This analysis can further refine the system's design by identifying potential areas for optimization. Sequence diagrams and state diagrams are commonly used to explore the dynamic view. These diagrams depict the interactions between objects over time and how the system reacts to various events, providing a comprehensive understanding of the system's behavior [**?**].

4.3.1 STATE DIAGRAM

A State Diagram describes the behavior of a system considering all possible states of an object when events occur. It represents transitions between states and is often used to model finite-state machines. The ConfMan system's state diagram serves as a visual representation of the system's behavior throughout the paper review process [20]. It illustrates the transitions between key states, such as "submitted," "under review," and "accepted," triggered by specific events like paper submission and review completion. This diagram effectively depicts the lifecycle of a paper within the ConfMan system, showcasing its progression through various stages, from initial submission to final acceptance or rejection.

STATES

The states of this diagram are:

Unauthenticated: This state represents the initial condition for any user interacting with the ConfMan system. Users in this state haven't provided valid credentials (username and password) for access.

User Authenticating: This state indicates the user's attempt to gain access to the system's functionalities.

Conference Planning: This state signifies the creation and management of a conference. Users with appropriate permissions can define conference details and update information within this state.

Call for Papers (CFP): This state represents the period when Calls for Papers are sent to potential authors, inviting them to submit their research for the conference.

Submission Period Opened: This state marks the beginning of the paper submission window. Authors can submit their work during this period.

Submission Confirmed: This state indicates that an author has successfully uploaded their paper to the conference system.

Submission Period Closed: This state signifies the conclusion of the paper submission window. All authors intending to submit their work have done so by this point.

Inviting Reviewers: This state signifies the process of sending invitations to reviewers to participate in the paper evaluation process.

Reviewer Invitation Accepted: This state indicates that a reviewer has agreed to participate in the paper review process.

Reviewer Invitation Declined: This state indicates that a reviewer has declined the invitation to participate in the paper review process.

Under Review: This state represents the active phase of paper review. Reviewers assigned to papers within this state will assess the submissions and provide their evaluation and scores.
Reviewing Started: This state signifies that a reviewer has begun the process of evaluating an assigned paper.

Making Decision: This state can be removed, as the decision-making process likely occurs within the "Under Review" state.

Marks Selecting: This state represents the selection of evaluation scores or grades within the review form by a reviewer.

Final Decision Making: This state signifies the analysis of reviewers' scores and the determination of final paper acceptance decisions.

Notifying Authors: This state represents the process of sending notifications to authors regarding the review outcomes for their submitted papers.

Accepting Paper: This state represents the final decision to include a paper in the conference proceedings or program.

Rejecting Paper: This state represents the final decision to exclude a paper from the conference proceedings or program.

Session Clustering: This state signifies the process of grouping thematically related presentations to optimize the conference schedule.

Technical Event Programming: This state signifies the creation of the conference schedule.

TRANSITIONS:

The transitions of this diagram are:

- Register Event: Triggers a transition from Unauthenticated to User Authenticated.
- Create Conference Event: Triggers a transition from User Authenticated (with appropriate permissions) to Conference Planning (as a Chair).
- Announce Call for Papers Event: Triggers a transition from Conference Planning to Call for Papers Sending. During this state, Call for Papers (CFPs) are disseminated to potential authors.
- Open Submissions Event: Triggers a transition from Call for Papers Sending to Submission Period Opened. This state marks the beginning of the window when authors can submit their papers.
- Submit Event: Triggers a transition from Submission Period Opened to Under Review. Once submitted, papers are assigned to reviewers for evaluation.
- Close Submissions Event: Triggers a transition from Submission Period Opened to Submission Period Closed. This signifies the end of the paper submission window.
- Send Invitations Event: Triggers a transition from a conference Planning state to Inviting Reviewers. This state could represent the act of sending reviewer invitations.
- Accept Invitation Event: Triggers a transition from Inviting Reviewers to Under Review. This signifies that a reviewer has agreed to participate in the review process.
- Decline Invitation Event: Triggers a transition from Inviting Reviewers back to the ending state . This signifies that a reviewer has declined the invitation.
- Assign Reviewers Event: Triggers a transition from Submission Period Closed to Under Review. Reviewers are assigned to submitted papers within this state.
- Review Papers Event: While this action likely occurs within the Under Review state, it doesn't represent a separate state transition. Reviewers assess assigned papers within this state.
- Fill Form Event (or Submit Review): This action occurs within the Under Review state and doesn't represent a separate state transition. Reviewers submit their reviews within this state.

- End Reviewing Event (or Review Completed Event): As mentioned earlier, this event signifies the completion of the review process for a paper and triggers a transition to Final Decision Making.
- Send Notifications to Authors Event: Triggers a transition from Final Decision Making to a state Notifying Authors Sent). This state signifies that authors have been informed about the review outcomes for their submitted papers.
- Accept Papers As (Poster/Oral/etc.) Event: Triggers a transition from Final Decision Making to a state representing the specific acceptance category (Accepted as Poster). This signifies the final decision on paper acceptance and its designated presentation format.
- Cluster Papers Event: Triggers a transition from a state representing accepted papers (Accepted Papers) to Technical Event Programming. This state signifies the process of grouping thematically related presentations for scheduling purposes.
- Schedule Sessions Event: Triggers a transition from Technical Event Programming to a state representing a finalized schedule (Schedule Finalized). This signifies the completion of the conference schedule creation process.

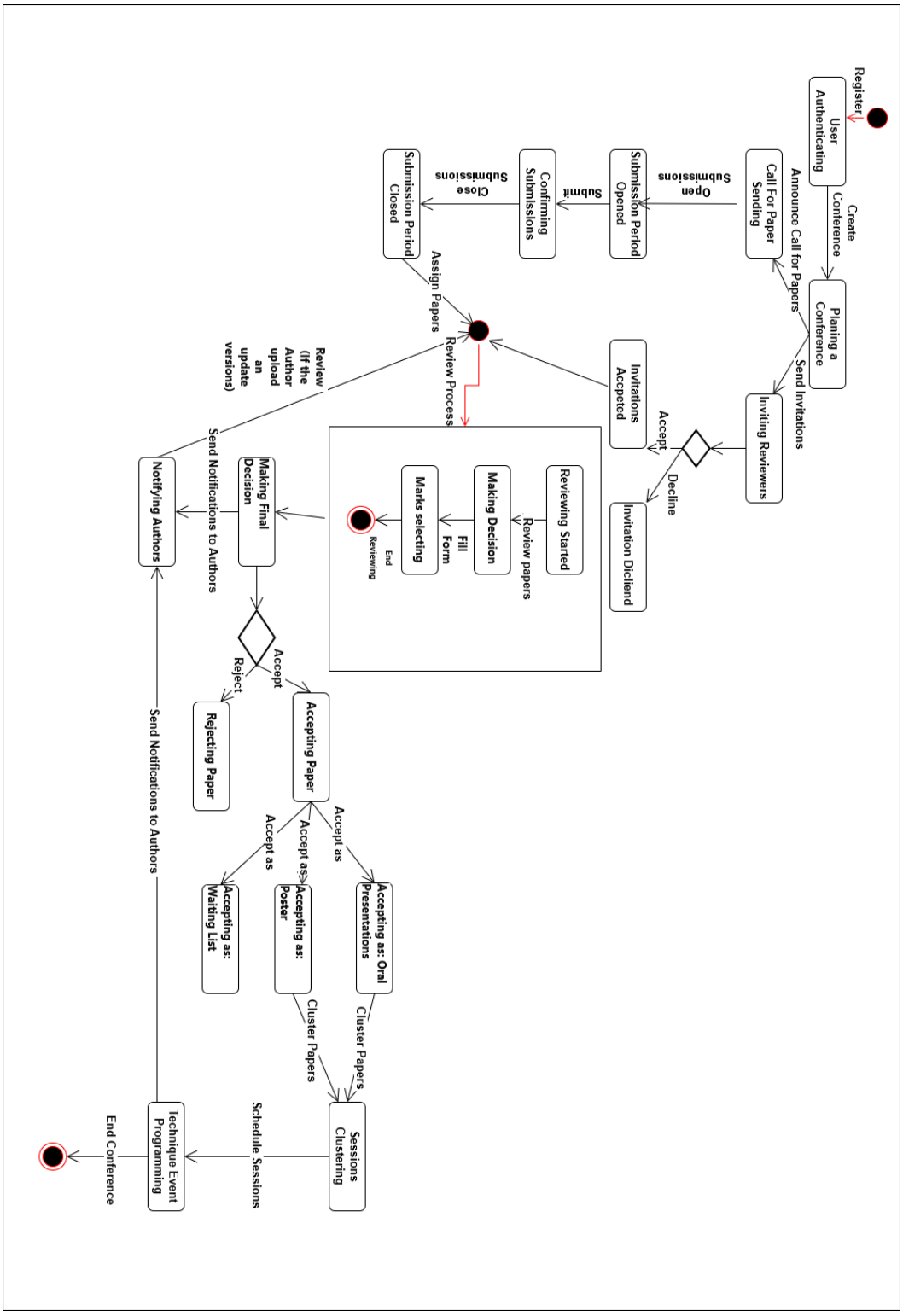

Figure 2.5: State Diagram of ConfMan Platform

4.3.2 SEQUENCE DIAGRAMS

Sequence Diagram is an interaction diagram that illustrates how operations are carried out—what messages are sent and when. These diagrams detail the interaction between objects within a system in the context of a collaboration. They are time-focused, using the vertical axis to represent the sequence of interactions over time, thereby showing the order in which interactions occur [21].

SEQUENCE DIAGRAM OF THE EVALUATION PROCESS

This sequence diagram depicts the paper submission and review process within the ConfMan system.

PARTICIPANTS

The actors and objects involved in the interaction are:

- Chair.
- Reviewer.
- ConfMan system.
- ConfMan DataBase.

MESSAGE FLOW

The sequence of messages exchanged between the actors and objects are:

- The conference chair customizes the evaluation form by adding relevant fields as needed.
- The chair inputs coefficients to the newly added fields.
- The ConfMan system receives the customized form, including the added fields and their corresponding coefficients, and stores them in the database.
- The ConfMan system retrieves papers and associated evaluation forms from the database.

- Based on predefined criteria, the ConfMan system assigns each paper (along with its corresponding evaluation form) to a reviewer with relevant expertise.
- Reviewers assess the assigned papers and complete their evaluations and scores within the ConfMan system.
- The ConfMan system receives the reviewer's completed evaluation and stores it within the database.
- The ConfMan system retrieves the reviewer scores and the corresponding coefficients, calculates the average score for each paper.
- The ConfMan system updates the average scores within the paper review lists.
- The ConfMan system automatically ranks the evaluated papers according to the acceptance criteria established by the conference chair.

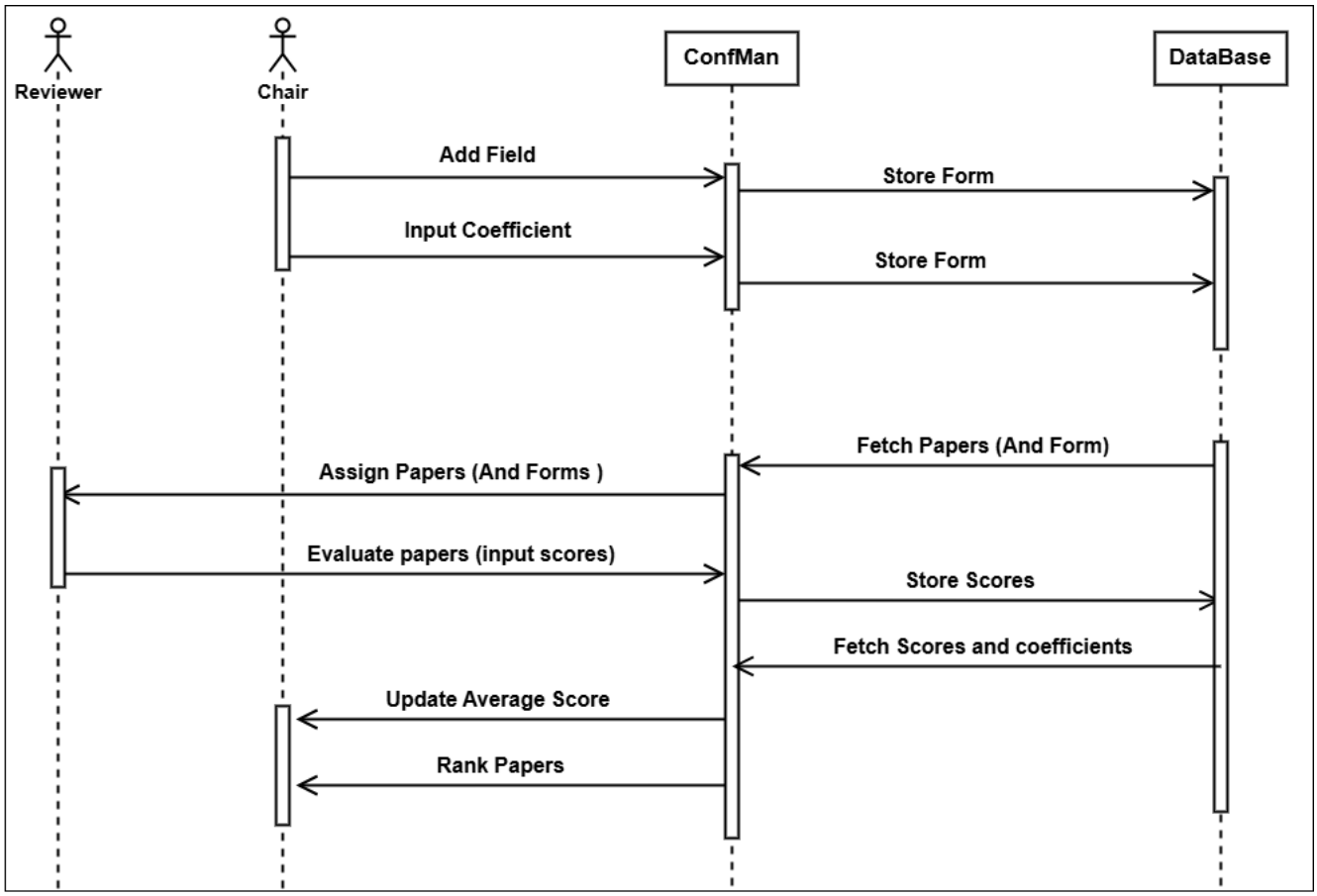

Figure 2.6: Sequence Diagram Of The Evaluation Process

SEQUENCE DIAGRAM OF THE CFP GENERATING

This sequence diagram depicts the automatic Call For Paper generating.

PARTICIPANTS

The actors and objects involved in the interaction are:

- Chair.
- ConfMan system.
- ConfMan DataBase.

MESSAGE FLOW

The sequence of messages exchanged between the actor and objects are:

- The chair updates the conference information by filling the Conference General Information Form.
- The ConfMan system stores the Conference's general information in the database.
- The ConfMan system retrieves the required information for the Call For Paper from the database.
- The ConfMan system automatically generates the CFP template of the conference and displays it in the chair console.

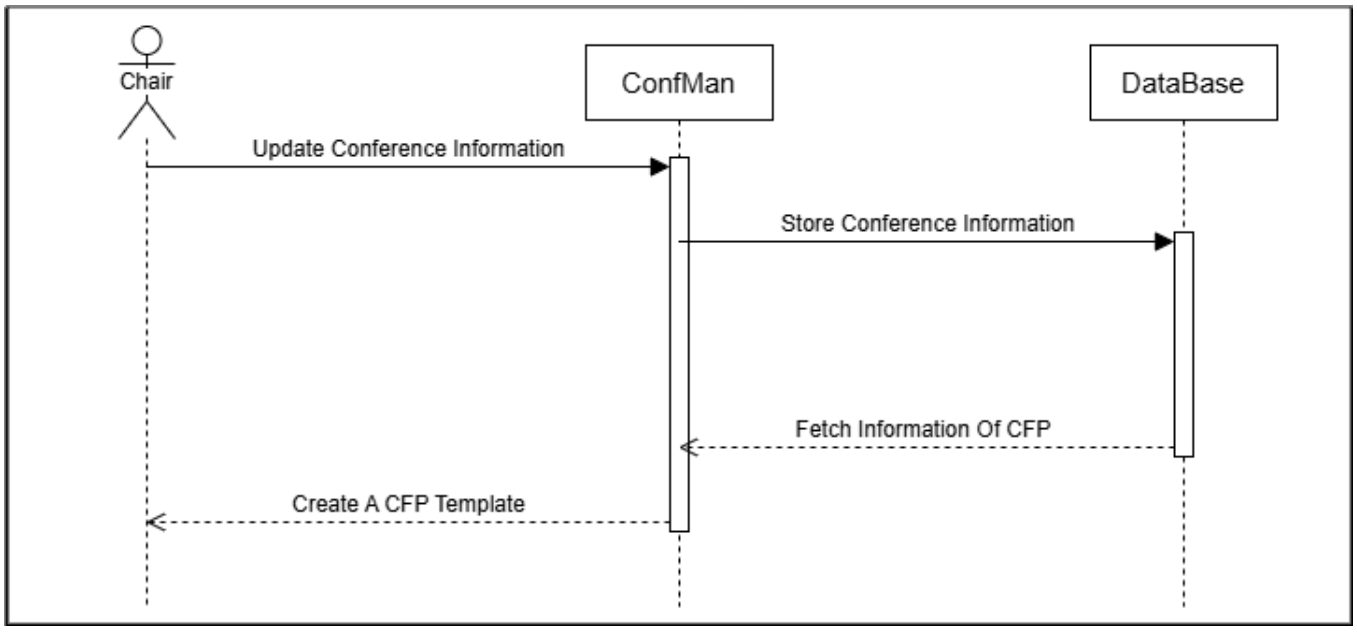

Figure 2.7: Sequence Diagram Of The CFP Generating

5 CONCLUSION

This chapter has laid the groundwork for the ConfMan system by outlining its conception and design. We began with an introduction highlighting the need for a streamlined paper review system and the features ConfMan aims to provide. Following this, the chapter delved into the detailed requirements of the system, considering both functional and non-functional aspects. These requirements ensure that ConfMan caters to user needs and delivers efficient performance.

Next, the system architecture was presented, showcasing the key components like the user interface, database, and AI tools. We also explored the data flow within the system, illustrating how information is exchanged between these components.

To further solidify the design, the chapter explored various system views, functional View, static View and dynamic View along with their corresponding UML diagrams.

With a comprehensive design established, the following chapter will explore the key features that make the ConfMan system both user-friendly and almost fully automated.

CHAPTER 3

MAIN FEATURES AND FUNCTIONALITIES OF CONFMAN

1 INTRODUCTION

This chapter elaborates focus on specific functionalities of ConfMan that are designed to improve user's experience. These features automate tedious tasks, enhance operational efficiency, and mitigate potential errors, thereby promoting a more transparent and easier tasks management.

The chapter is structured as follows; Section 2 discusses the development of a module for generating and disseminating the Call for Papers (CFP) document. Section 3 explains the functionality of a module that automatically identifies and flags potential duplicate submissions. Section 4 details the implementation of a system that ensures double-blind reviewing by concealing author and reviewer identities. Section 5 describes the development of a module for automatically calculating reviewing scores for submitted papers. Section 6 Explains the use of constraint programming to automate reviewer assignment, considering reviewer expertise and workload. Section 7 details a module designed to automatically schedule conference sessions while detecting and resolving potential conflicts. Finally, section 8 summarizes the key functionalities developed in this chapter and discusses

their potential impact on conference review processes.

2 AUTOMATIC CFP CREATION AND DIFFUSION

The paper call is automatically generated within the system based on conference information that was provided by the conference chair when creating the conference. This information includes topics, important dates, and conference location.
Once the CFP is ready, a diffusion list containing email addresses is automatically created. The system provides a list of the current system's users to select from. Additionally, the system offers the possibility to include other email addresses in the diffusion list. Once validated, the CFP is sent to the targeted people.

3 AUTOMATIC DETECTION OF DUPLICATED SUBMISSIONS

Before accepting a paper submission, the system performs a verification process to identify potential duplicate submissions within the current conference. This process leverages a combination of author information, abstract content, and keyword matching to ensure the submitted papers are unique to this conference and prevent redundancies.

4 AUTOMATIC DOUBLE-BLIND VERIFICATION

This functionality operates only when activated by the conference chair, safeguarding the integrity of the double-blind review process. To ensure a double-blind review process, our system employs an automated author unionization technique utilizing Optical Character Recognition (OCR). After paper submission, the model scans the first page for the presence of author identifiers. If detected, the system automatically rejects the manuscript submission and authors are notified that they should submit a name-free manuscript.

5 AUTOMATED AVERAGE SCORE CALCULATION

At the end of the review process, the score of each paper is calculated and papers are ranked according to their scores.

To automate the calculation of the score for submitted papers based on reviewer evaluations within our system, we define a function that computes the individual mark for each paper. This mark is dynamically updated upon confirmation of each reviewer's evaluation.

PAPER SCORE COMPUTATION

For a paper p, its score A_p is calculated according to the scores given by the reviewers and their respective confidence scores.
The score provided by each reviewer j is first computed as

$$s_j = \frac{\sum_{i=1}^{k} w_i c_i}{\sum_{i=1}^{k} w_i}$$

where $c_i, i = 1..k$ is the score given to the criterion C_i and w_i is its respective coefficient or weight that was previously set by the chair.
During the review, each reviewer j is asked to provide their confidence score r_j regarding the evaluated manuscript.
The Final score for the paper p over its t reviews is then the sum of scores provided by reviewers weighted by their confidence score. Formally:

$$A_p = \sum_{j=1}^{t} r_j s_j$$

6 PAPER REVIEWER ASSIGNMENT

While the traditional formulation of the reviewer assignment problem primarily focuses on maximizing the overall similarity between papers and reviewers [2], our work proposes an alternative approach to the paper reviewer assignment process.
In our formulation, we aim to minimize the workload of the reviewers while ensuring coverage constraints for papers. Given n papers and m reviewers, the objective is to find an assignment that minimizes the maximum number of reviews over reviewers.

VARIABLES

We define the binary variables $x_{ij}, \quad (i,j) \in [n] \times [m]$, indicating whether reviewer j is assigned to paper i (1 if assigned, 0 otherwise).

CONSTRAINTS

- **Paper Coverage** Each paper is reviewed by at least t reviewers.

$$\sum_{j=1}^{m} x_{ij} \geq t, \quad \forall i \in [n]$$

- **Expertise:** To enforce expertise matching for assignments. If the intersection of a paper's topics (topics(i)) and a reviewer's expertise areas (expertise(j)) is empty (no common topics), then the assignment variable x_{ij} is forced to be 0 (no assignment):

$$x_{ij} = 0 \quad \text{if topics}(i) \cap \text{expertise}(j) = \emptyset$$

- **Workload lower bound:** Each reviewer handles at least l paper

$$l \leq \sum_{i=1}^{n} x_{ij}, \quad \forall j \in [m]$$

- **Workload upper bound:** Each reviewer handles at most p_{max} manuscripts

$$\sum_{i=1}^{n} x_{ij} \leq P_{\text{max}}, \quad \forall j \in [m]$$

OBJECTIVE FUNCTION

The objective of our formulation is to minimize the maximum number of papers assigned to any reviewer. That is

$$\text{minimize} \quad P_{\text{max}}$$

After formulating the problem, we address it using constraint programming by seeking a feasible assignment for a specified value of P_{max}. If no feasible solution is found, P_{max} is increased by 1, and the process is repeated. Existing constraint programming solvers can be employed for this purpose.

7 AUTOMATED SESSION SCHEDULING WITH CONFLICT DETECTION

This section describes the automated technique employed for scheduling conference sessions, considering both session content similarity and efficient time slot allocation.

SESSION SIMILARITY ANALYSIS

- Let n represent the number of sessions (session clustering output).
- The conference chair predefines the maximum number of sessions allowed per time slot.
- For each session S_i, keywords associated with its papers are extracted and denoted as $Keyword_i$
- To assess the thematic similarity between each pair of sessions S_i and S_j, we compute the Jaccard similarity coefficient ($\alpha_{i,j}$), defined as:

$$\alpha_{i,j} = \frac{|K_i \cap K_j|}{|K_i \cup K_j|} \tag{3.1}$$

THRESHOLD DETERMINATION AND WEIGHTED GRAPH CONSTRUCTION

- A threshold (θ) is established based on the mean (μ_α) and standard deviation (σ_α) of ($\alpha_{i,j}$). This threshold helps identify the degree of thematic similarity considered acceptable for co-scheduling sessions.
- A weighted graph G is constructed, represented by the tuple (V, E). The vertex set V encompasses all sessions $(S_1, S_2, \ldots, S_k)$, while the edge set E consists of edges connecting session pairs (S_i, S_j) where their Jaccard similarity coefficient ($\alpha_{i,j}$) exceeds the threshold (θ):

$$G = (V, E), \quad V = \{S_1, S_2, \ldots, S_k\}, E = \{(s_i, s_j) \mid \alpha_{i,j} > \theta\} \tag{3.2}$$

CONFLICT-FREE SESSION ALLOCATION

Employing a well-established graph coloring technique known as "Greedy Coloring," sessions are assigned to time slots while ensuring no co-scheduled sessions share excessive thematic overlap (as defined by the threshold θ). This approach minimizes scheduling conflicts by prioritizing sessions with a lower Jaccard similarity coefficient ($\alpha_{i,j}$) for co-scheduling. Formally:

$$coloring : V \rightarrow \mathcal{C} \tag{3.3}$$

where:
* V represents the set of all sessions (same as previously defined).
* $\mathcal{C}$ represents a set of colors (representing the time slots).
* The coloring function $coloring(S_i)$ assigns a time slot (color) to each session S_i such that $coloring(S_i) \neq coloring(S_j)$ for any pair of connected sessions S_i and S_j in the graph (i.e., $\alpha_{i,j} > \theta$).

In scenarios where the number of required time slots exceeds the available slots (i.e., the size of $\mathcal{C}$ is insufficient to color all vertices in V), a strategy is implemented to identify an available slot with the minimum Jaccard similarity value. This slot is then designated for accommodating additional sessions. Here, a slot $t_k \in \mathcal{C}$ is chosen such that:

$$t_k = \arg\min_{t \in \mathcal{C}} \max_{i \in V : coloring(S_i) = t} \{\alpha_{i,j} \mid S_j \in V\} \tag{3.4}$$

This equation selects the time slot (color) t_k that minimizes the maximum Jaccard similarity coefficient between any session assigned to t_k and all other sessions in the graph. In simpler terms, it prioritizes placing sessions with lower thematic overlap within the same time slot when extra slots are needed.

8 CONCLUSION

This chapter presented a comprehensive suite of modules and functions designed to automate various aspects of the conference review process. These functionalities aim to reduce administrative burden by automating repetitive tasks, such as CFP creation and score calculation, so reviewers can focus on the quality of their assessments. Improve efficiency by automating processes significantly reduces the time required to complete the review process. Minimizing human error by automating tasks minimizes the risk of errors associated with manual data entry and processing. Enhance fairness, Double-blind verification and automated reviewer assignment to promote impartiality in the review process.

With a comprehensive suite of modules and functions designed to automate various aspects of conference management, the next chapter will delve into the actual development and testing of the ConfMan system that will be transformed from a concept into a tangible solution for streamlined paper reviews.

CHAPTER 4

IMPLEMENTATION AND EVALUATION OF CONFMAN

1 INTRODUCTION

The preceding chapter presented a comprehensive suite of modules and functions designed to automate various features of the ConfMan system. This chapter embarks on the next crucial stage, realising the system. We will delve into the practical aspects of transforming the detailed design into a functional software application.

The implementation process will involve a series of well-defined steps. Section 2 delves into the selection of suitable programming languages, frameworks, and tools for constructing the ConfMan system. Section 3 discusses the strategy used to test the system's functionality and performance. The user interface and core features are detailed in section 4, while section 5 outlines the system's benefits and limitations, offering a complete understanding of its capabilities.

2 TECHNOLOGY STACK

The development of the ConfMan system relied on a curated selection of programming languages, frameworks, and tools. This section outlines the specific technologies employed to achieve the system's functionalities and ensure its efficient operation.

2.1 FRAMEWORKS AND PROGRAMMING LANGUAGES

Programming languages and frameworks used for developing the ConfMan system are:

2.1.1 LARAVEL

Laravel is a free, open-source PHP web application framework. It follows the Model-View-Controller (MVC) architectural pattern and provides a robust foundation for building complex web applications [8].

2.1.2 VUEJS

Vue.js is a progressive JavaScript framework for building user interfaces, designed to be incrementally adoptable. It's known for its ease of use, flexibility, and performance [22].

WHY LARAVEL API AND VUE JS?

Laravel API and Vue.js are commonly used together for web development due to their complementary features and benefits:

- Laravel API Efficient Back-end Development: Laravel provides a robust back-end framework for building APIs with features like authentication, database interactions using Eloquent ORM, and routing capabilities [8, 22].
- Security: Laravel offers built-in security features like hashed passwords, middleware for authentication, and model policies for authorization, ensuring secure API development.
- Database Interaction: Laravel's Eloquent ORM simplifies database interactions, making it easy to work with data models, relationships, and migrations.
- Scalability: Laravel's structure and features support scalability, allowing APIs to handle increasing loads and complex operations efficiently.
- Vue.js Dynamic Front-end: Vue.js is a popular front-end framework known for its simplicity and reactivity, enabling the creation of dynamic user interfaces with ease.

- Interactive UIs: Vue.js allows for the creation of interactive user interfaces with components, data binding, and reactivity, enhancing user experience.
- Client-Side Routing: Vue Router enables client-side routing, enhancing the user experience by providing seamless navigation within the application.
- Composition API: Vue 3's Composition API offers a more flexible and organized way to manage component logic, making code more maintainable and reusable.
- Integration Benefits Full-Stack Development: Combining Laravel API with Vue.js allows for full-stack development, where Laravel handles back-end logic and data management, while Vue.js manages the dynamic front-end interactions.
- Efficient CRUD Operations: Vue.js simplifies the implementation of CRUD operations (Create, Read, Update, Delete) on the front-end, while Laravel API facilitates data handling and storage on the backend.
- Seamless Communication: Vue.js can easily communicate with Laravel APIs through HTTP requests, enabling smooth data exchange between the front-end and back-end.

The combination of Laravel API and Vue.js offers a powerful and efficient solution for developing modern web applications with secure back-end functionality and dynamic front-end interactivity.

2.1.3 BLADE: LARAVEL'S TEMPLATING ENGINE

BLADE is the built-in templating engine that comes with the Laravel web application framework. It offers a concise and expressive way to structure the application's views, separating presentation logic (HTML, CSS) from business logic (PHP). Blade templates are compiled into plain PHP code during the request cycle, ensuring efficient execution [8].

2.1.4 PYTHON

Python is a high-level, general-purpose programming language known for its readability and ease of use. Python is chosen for its main features [15]:

- Extensive Standard Library: Provides a rich set of built-in modules for various tasks.

- Strong Data Science Libraries: Offers powerful tools like NumPy, Pandas, and Scikit-learn for data analysis, machine learning, and scientific computing.
- Scripting Language: Popular for automating tasks and system administration.
- Built-in Data Structures: Lists, dictionaries, sets, and more.
- Integration Capabilities: Can be integrated with other languages and tools.
- Embeddable: Can be embedded within applications as a scripting interface.

2.2 AI AND OPTIMIZATION TOOLS

2.2.1 OCR (TESSERACT)

Optical character recognition (OCR) is the process of converting scanned images of handwritten, typewritten, or printed text into machine-encoded text, either mechanically or electronically. Tesseract, an OCR engine that is open-source and maintained by Google, can recognize text in more than 100 languages and supports multiple output formats. It employs techniques like character segmentation, feature extraction, and pattern recognition to transform text from images into a machine-readable format. Tesseract is chosen for its power, widespread use as an OCR engine, and its open-source accessibility, which contributes to its accuracy and adaptability [1, 16].

2.2.2 OR-TOOLS

OR-Tools (Operations Research Tools)[1] is an open-source software suite developed by Google, designed to solve a wide range of optimization problems including linear programming, mixed-integer programming, constraint programming, and routing problems. Its ability to handle different types of problems, combined with robust performance and ease of integration, positions it as a good choice in the optimization domain.
We utilize the OR-Tools Constraint Programming Solver to assign papers to reviewers, aiming to minimize their workload while considering coverage and expertise constraints.

[1] https://developers.google.com/optimization

3 SYSTEM TESTING

A rigorous manual testing process was conducted to ensure the system's conformance to functional and validation requirements. This comprehensive evaluation encompassed all functionalities, including data exchange through the application programming interface (API). The testing strategy incorporated unrealistic data scenarios to assess system robustness under edge cases. Furthermore, browser developer tools were utilized to evaluate performance metrics such as response times and loading speeds, while also scrutinizing security aspects like authorization and authentication mechanisms.

4 USER INTERFACE (UI) DESIGN AND FUNCTIONALITY

ConfMan system prioritizes user experience by offering a meticulously designed UI and robust functionality. This section explores how the system's interface elements and functionalities work in tandem to empower users to create and manage academic conferences.

WELCOME PAGE

Opening the ConfMan system greets you with a welcome page showcasing all the active conferences currently in the system. This page allows guests (individuals who haven't signed in or created an organizer account) to view all conferences on the system and some basic information about them. However, to access detailed information, the guest must register.

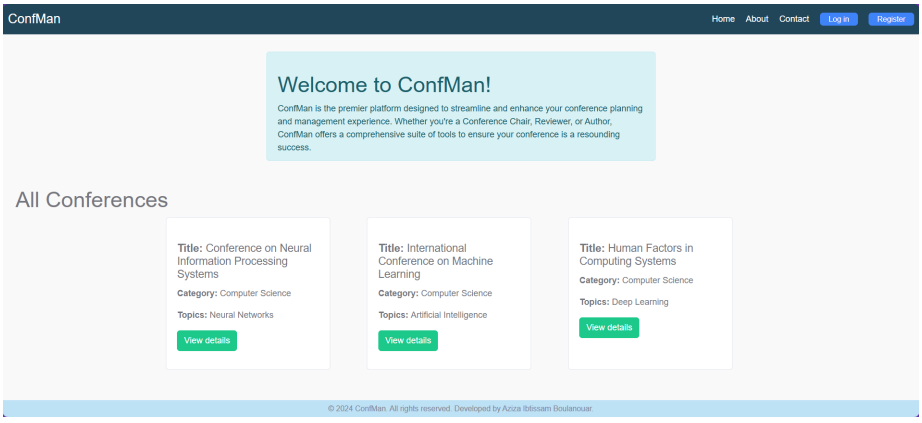

Figure 4.1: Welcome Page of ConfMan system

REGISTRATION/AUTHENTICATION

New users can register through a simple form, providing basic personal information like Fisrt name, last name, and email address, etc. This creates the user account allowing them to access ConfMan's features. Once registered, users simply use their email address and chosen password to sign in through the designated sign in form.

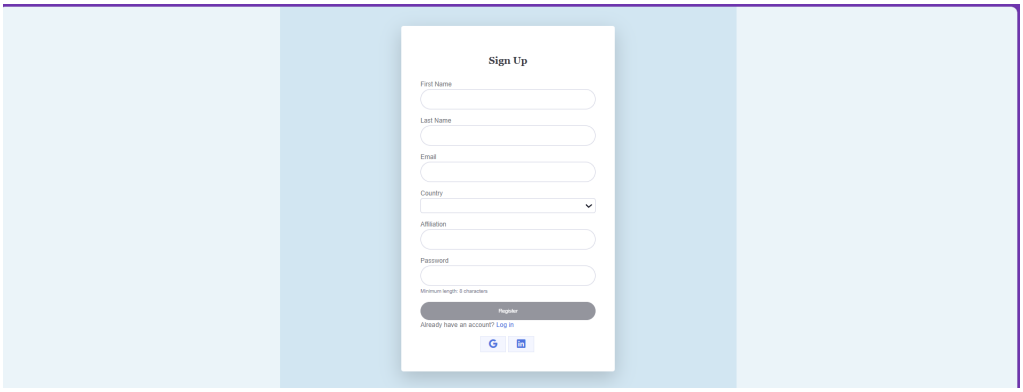

Figure 4.2: Registration Page of ConfMan Platform

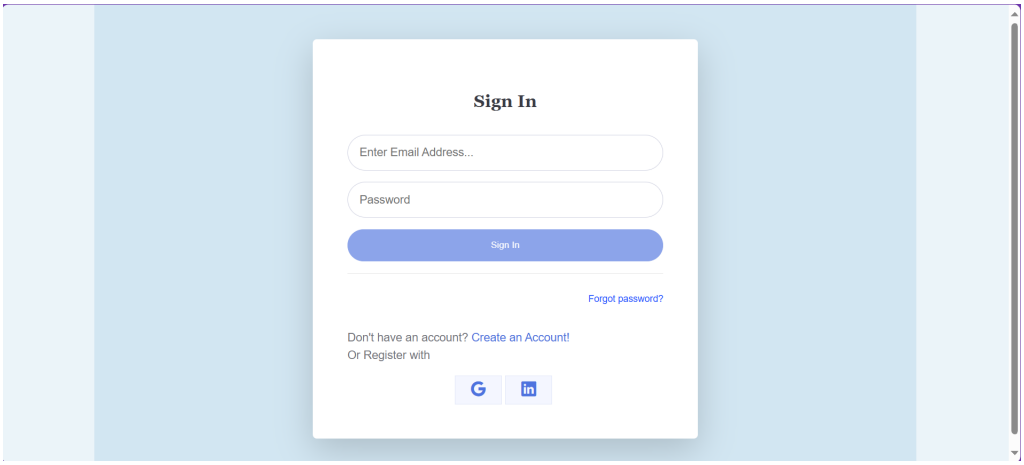

Figure 4.3: Authentication Page of ConfMan system

HOME PAGE

After registering in ConfMan system, Home page presents the existing Conferences in the system, allowing user to attend to any one of them as an author. user can also create a new conference request.

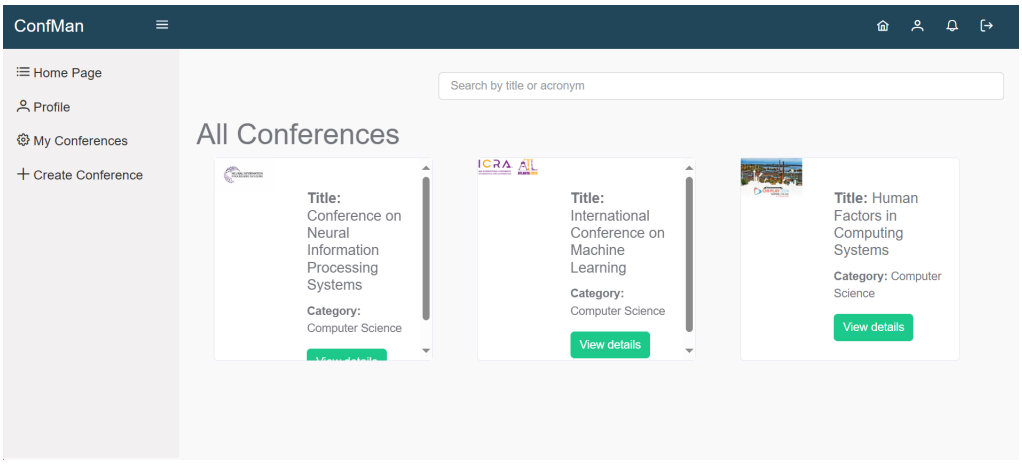

Figure 4.4: Home Page of ConfMan Platform

CONFERENCE CREATION

Conference creation involves submitting a request with validated fields. These fields include: a valid academic email address; a title that should be written in English; acronyms that cannot be spaces or special characters; and unique.

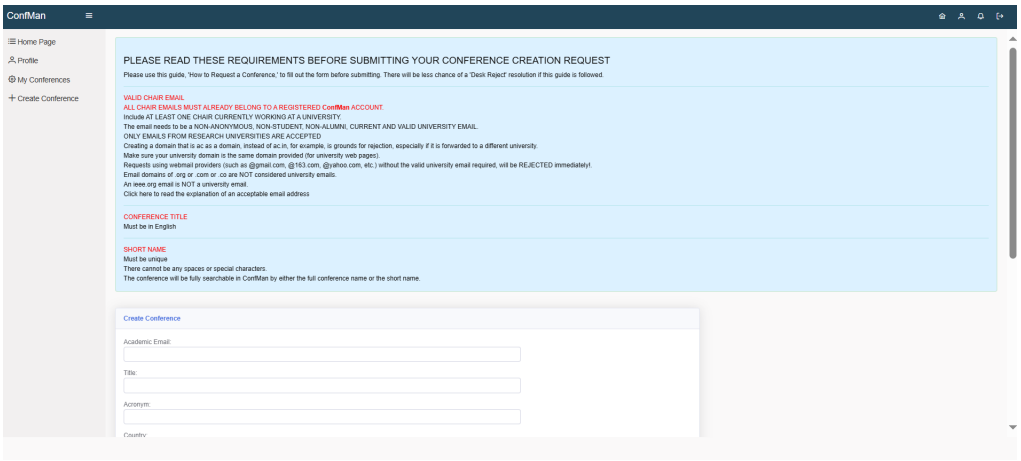

Figure 4.5: Create Conference

Following the successful creation and acceptance of a conference, the conference chair's responsibilities can be broadly divided into two stages: the pre-submission phase and the post-submission phase.

CHAIR CONSOLE/PRE-SUBMISSION PHASE

The user becomes chair of this conference and has the ability to:

- Chairs can update conference information, including activating double-blind review, specifying deadlines for registration and reviewer evaluations, and setting the notification date for acceptance decisions.

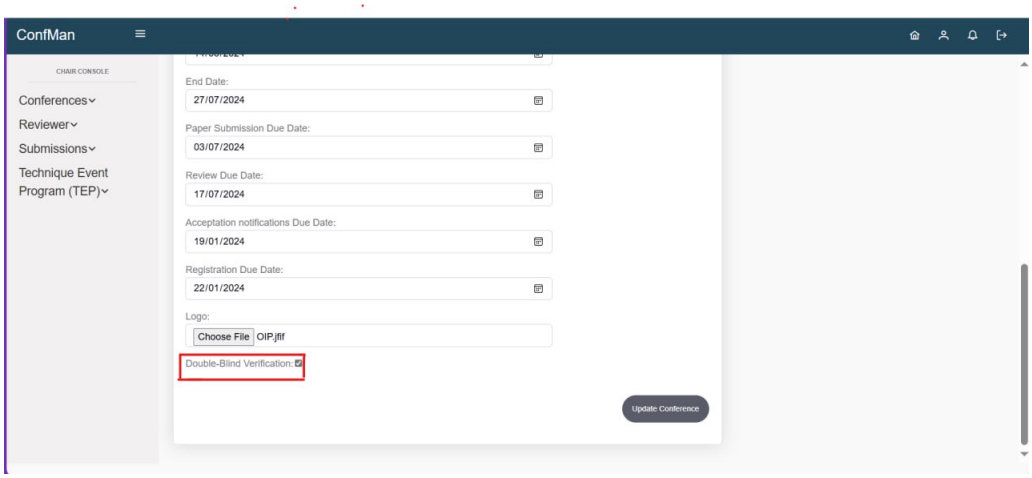

Figure 4.6: Update Conference Information Form

- Invitation creation: Invitations for participating in the conference review process are automatically generated by the system based on the provided conference information.

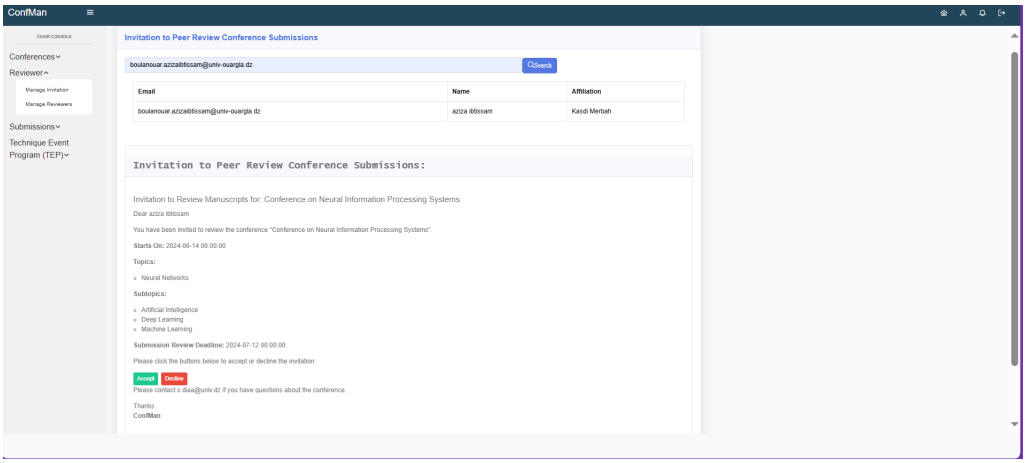

Figure 4.7: Invitation Template

- CFP template creation: Automatic Call for Papers (CFP) template generation feature. This template is filled with relevant information extracted from the conference details.

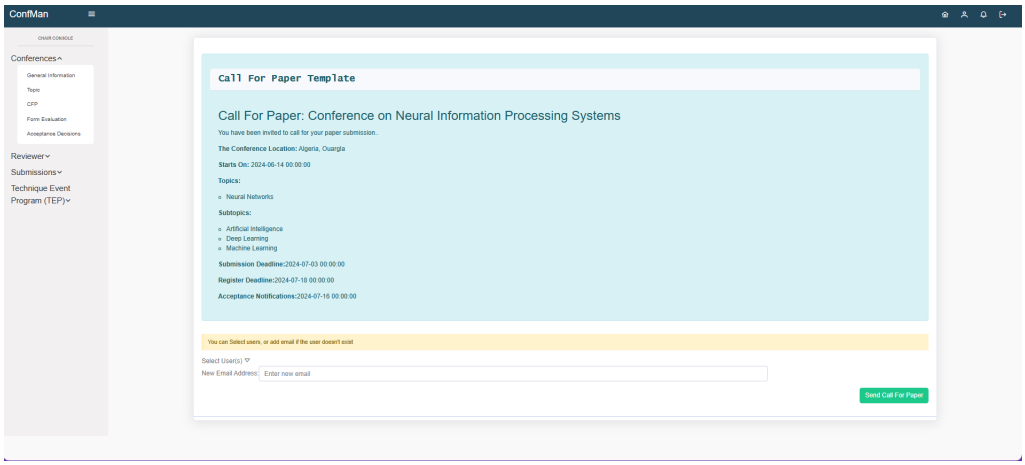

Figure 4.8: CFP Template

- Customize evaluation form: Chair customize the evaluation form to meet academic specifications.

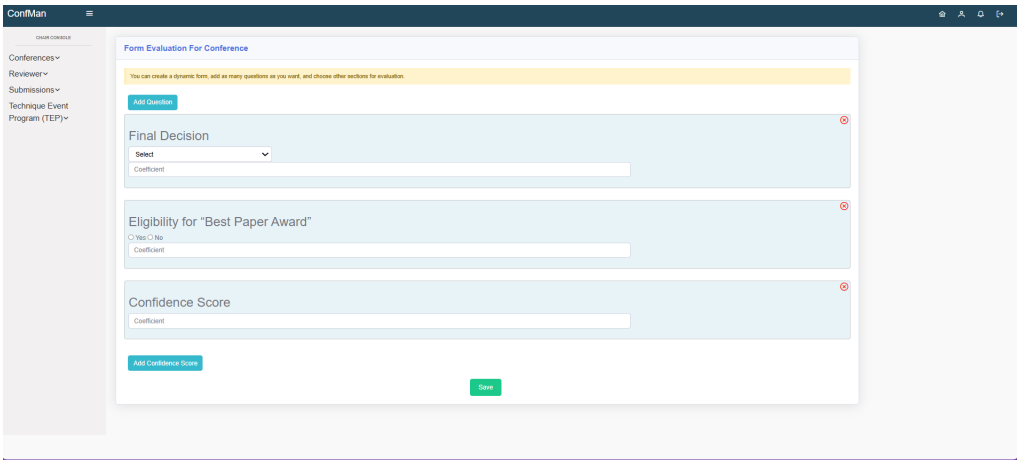

Figure 4.9: Customize Evaluation Form

- Reviewer paper assignment: The assignment of reviewers to papers, which follows the submission stage, is a crucial step in the conference review process. This stage guarantees that submissions are evaluated by reviewers who possess the necessary expertise and qualifications. ConfMan offers two approaches to facilitate this crucial step: automated assignment and manual assignment.

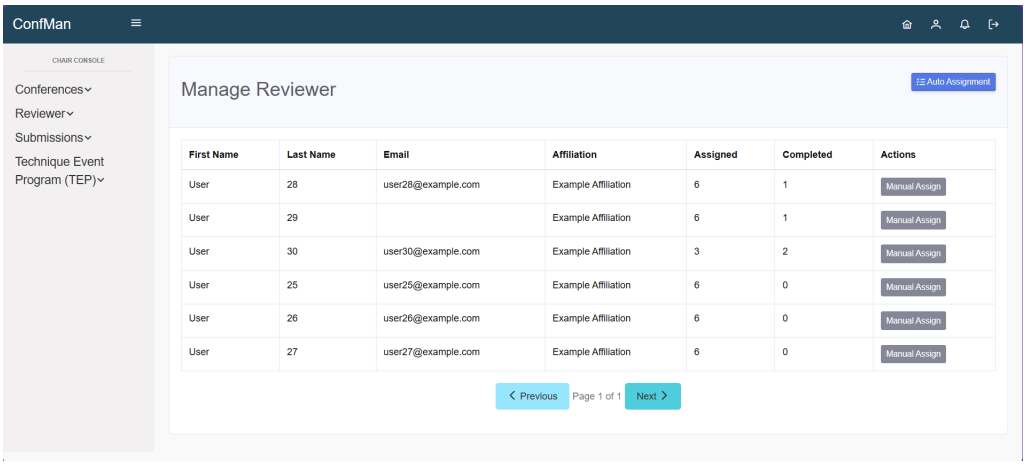

Figure 4.10: Reviewer Paper Assignment: Automated/Manual Assignment

PAPER SUBMISSIONS

Authors submit their papers to the conference through the submission form. If chair activates the Double-Blind review, an alert will be displayed on the submission form instructing the author to submit an anonymous version of the paper:

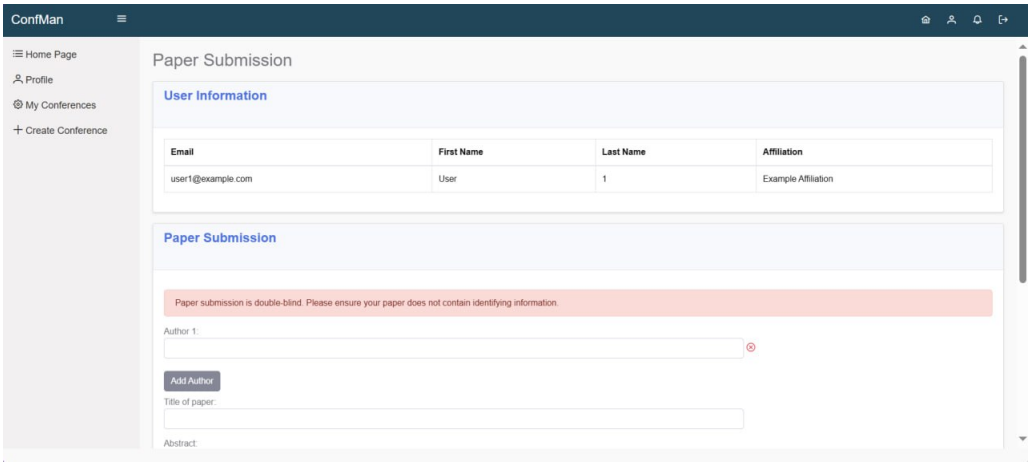

Figure 4.11: Paper Submission Form

PAPER ASSIGNMENTS IN THE REVIEWER CONSOLE

Once the paper submission deadline has passed, Conference Chairs utilize the ConfMan system to assign papers to reviewers. The assigned papers to each reviewer are displayed via the Reviewer Console.

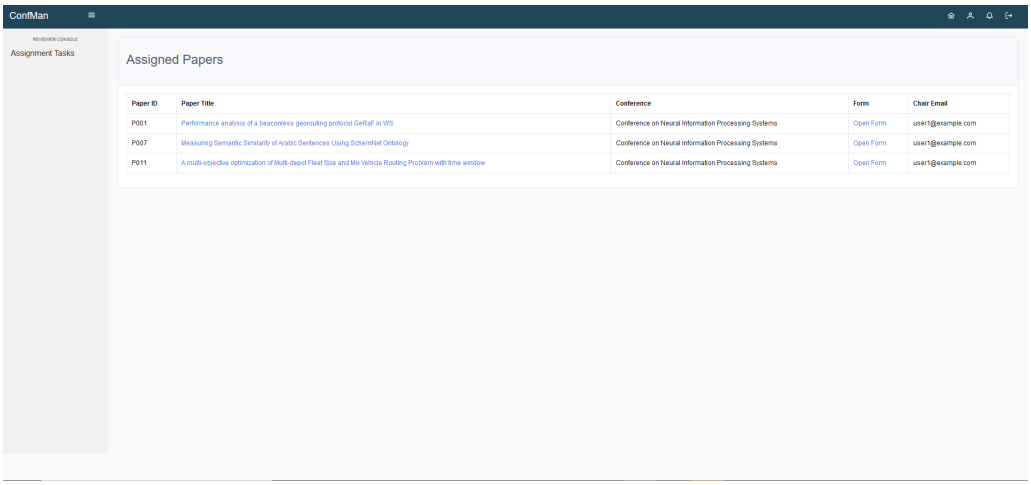

Figure 4.12: Reviewer console

The Reviewer Console equips Reviewers with functionalities to streamline paper assignment and ensure a fair and efficient review process.

- Paper Access and Downloading:

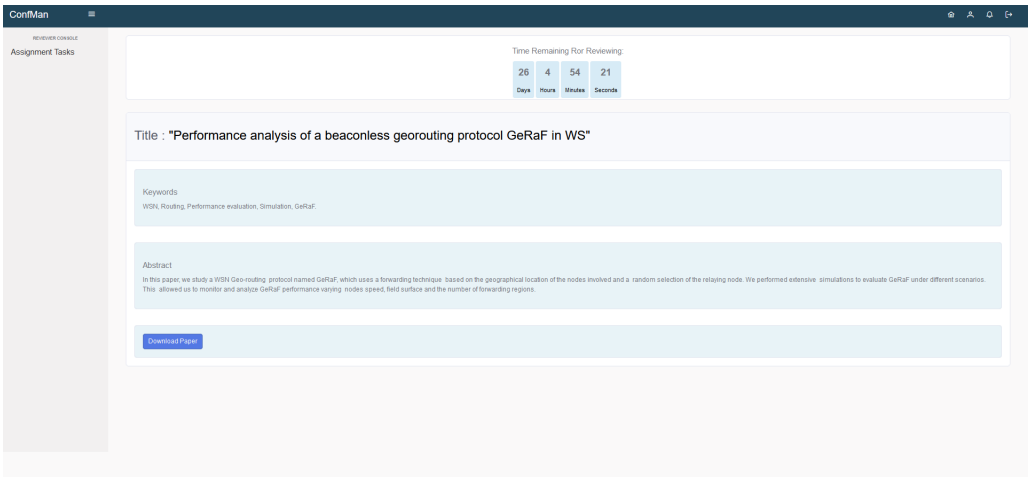

Figure 4.13: Paper Details for Reviewer

- Reviewer Evaluation: The Evaluation form customized by the chair, is presented to reviewers, prompting them to assign marks within the range established by the chair:

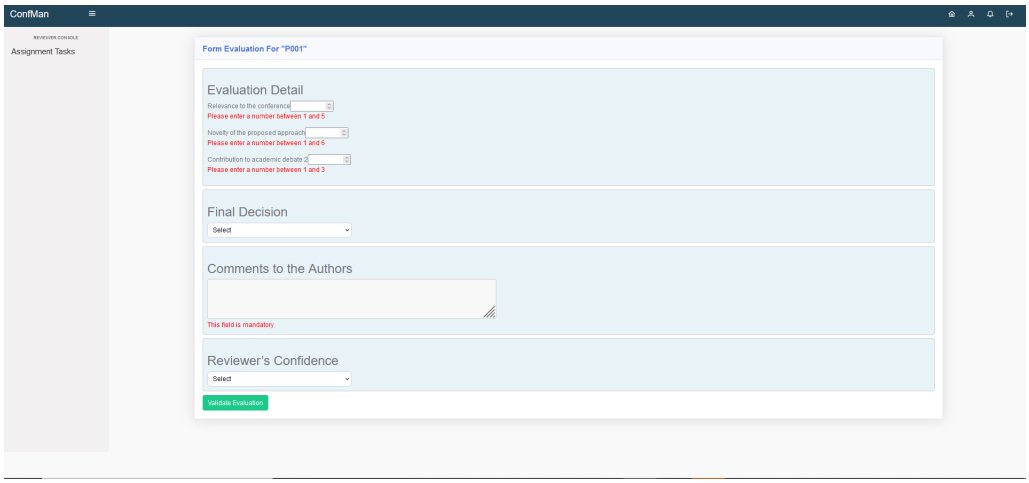

Figure 4.14: Reviewer Evaluation Form

AUTHOR CONSOLE

Authors can upload a final version of their paper incorporating reviewer feedback.

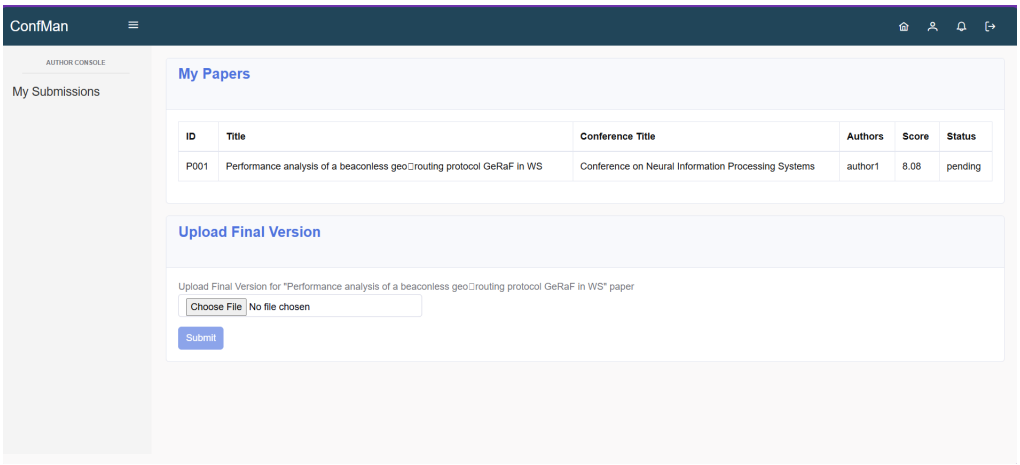

Figure 4.15: Upload a final versions of paper

CHAIR CONSOLE/POST-SUBMISSION PHASE

After the paper submission deadline and reviewer evaluations, conference Chairs utilize the ConfMan system's Chair Console to manage various aspects of the post-submission phase.

- Determining Paper Acceptance Numbers: Chairs have the authority to set the total

number of papers to be accepted for the conference. and can adjust the acceptance number.

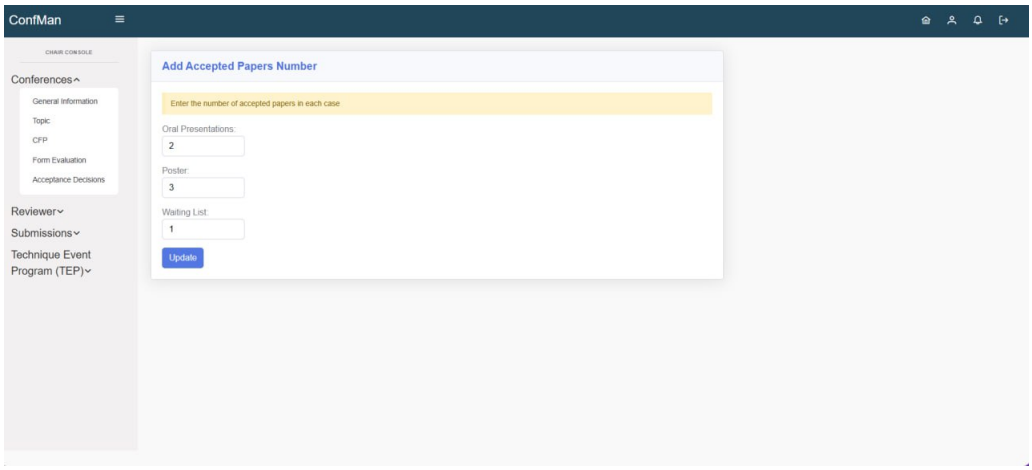

Figure 4.16: Accepted Papers Setting

- Paper ranking and final score updating (Mark): The ranking process help identify the top-ranked submissions for potential acceptance

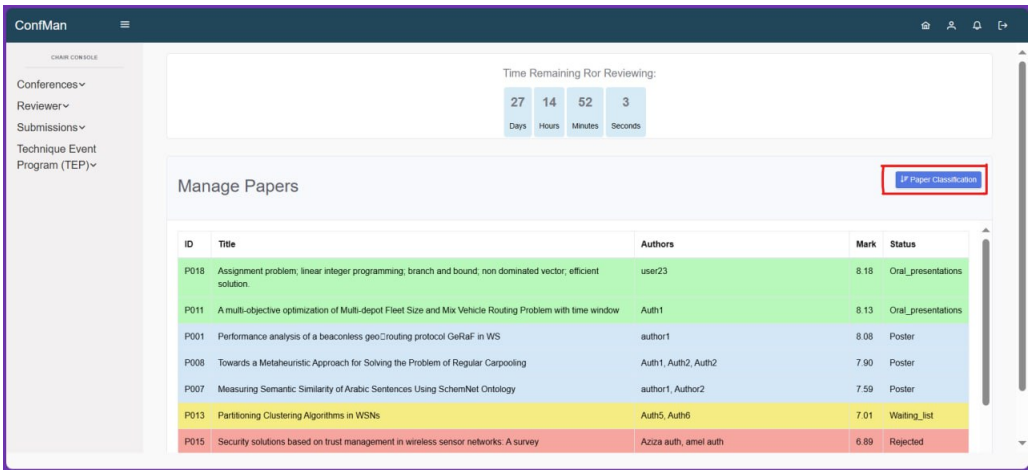

Figure 4.17: Accepted Papers List

- Set the TEP schedule slots: Define the available time slots for TEP sessions within the conference program

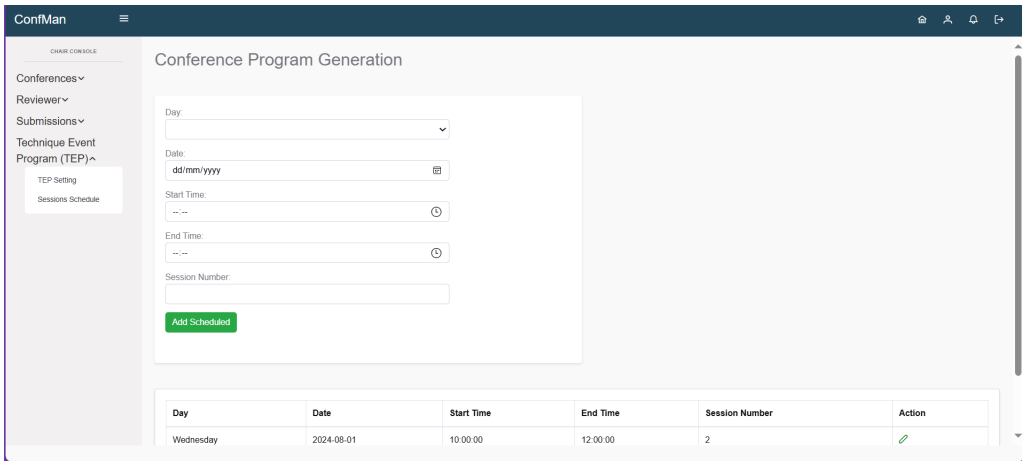

Figure 4.18: TEP Schedule Setting

- Scheduling the TEP: Assign specific sessions to designated TEP slots within the defined schedule

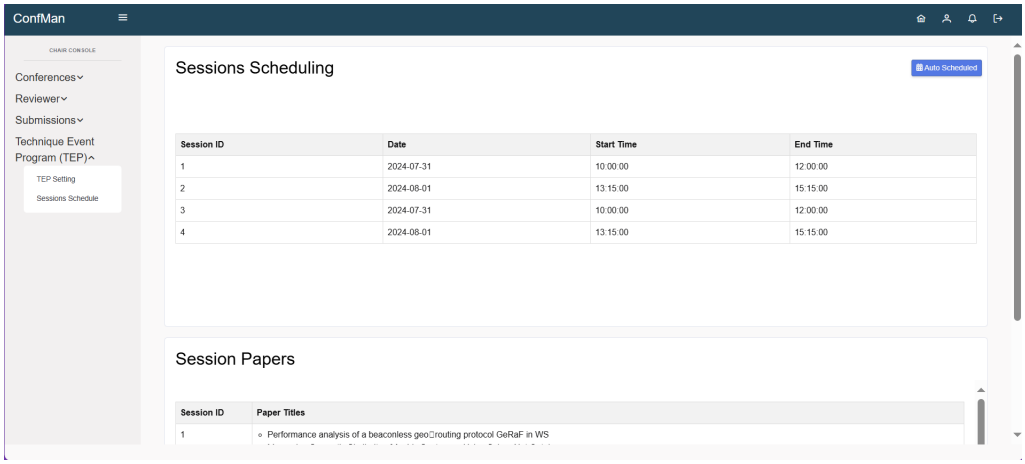

Figure 4.19: TEP Schedule

5 BENEFITS AND LIMITATIONS

ConfMan system is developed to offer a range of advantages for Academic Conference Management, it's essential to acknowledge its limitations to ensure realistic expectations and continued development. This section will explore both the benefits and limitations of the system, providing a comprehensive understanding of its potential and areas for improvement.

5.1 BENEFITS

The core benefits of ConfMan system are:

- **Enhanced Anonymous Paper Verification and Duplication Detection:**
  - In case of activating Double-Blind reviewing option, the system automatically verifies the papers anonymity at the moment of submission and immediately alerts the authors to submit an anonymous paper.
  - Automatically check for duplicated submissions through similarity checks with existing paper.
- **Automatic Templates Generation:**
  - Upon updating conference information, the system automates the generation of a CFP (Call for Papers) template. This template dynamically populates with the latest conference details, ensuring accuracy and streamlining the CFP creation process.
  - Upon updating conference information, the system automates the generation of the invitation template. This template dynamically populates with the latest conference details, ensuring accuracy and streamlining the invitation creation process.
- **Flexible Paper Assignment:**
  - The system automatically assigns papers based on reviewer expertise and workload, while allowing the Committee Chair to adjust assignments as needed.
- **Customizable Reviewer Evaluation Forms:**
  - Empower conference chairs with the ability to customize evaluation forms. This customization cater to the conference's specific needs, thereby facilitating focused and pertinent reviews from evaluators.
- **Automated Paper Scoring Assistance:**

  - Enhance the review process by incorporating a preliminary score. This score, generated based on pre-defined criteria established by the conference chair, serves as a helpful starting point for reviewers' assessments. This approach can improve consistency and efficiency in the evaluation process.
  - The chair console automatically reflects updates to final scores within the papers list following each completed review.

- **Streamlined Review Process:**
  - Eliminate the need for external forms by offering an all-in-one review platform where detailed feedback and evaluations can be provided directly within the system, simplifying data organization.

- **Automated Conference Scheduling:**
  - The system automatically generates a conference schedule considering existing sessions and time slots.

- **Clear Assignment Notifications:**
  - Clear email notifications about assigned papers and their corresponding authors, ensuring timely communication and a clarity.

5.2 LIMITATIONS

Limitations in ConfMan system:

- **Limited Data Export Capabilities:** While some export functionality might exist, the inability to generate a comprehensive final conference report or download all reviewed papers could hinder post-conference analysis and decision-making.

- **Device Compatibility Issues:** Incompatibility with a wide range of devices (desktops, laptops, tablets, smartphones) could create accessibility challenges for conference stakeholders and participants.

- **Restricted Reviewer Invitation Options:** The inability to invite reviewers in bulk or through automated processes might necessitate time-consuming individual invitations, potentially delaying the review process.
- **Limited Plagiarism Detection Features:** The absence of robust plagiarism detection tools within ConfMan could leave the responsibility of identifying potential plagiarism to manual reviewer efforts.
- **Lack of In-Platform Notifications:** ConfMan's inability to send real-time notifications within the system (e.g., when an author reloads a revised paper) could lead to communication delays and missed updates for reviewers and organizers.
- **Limited Post-Conference Data Analysis and Reporting:** The current version of ConfMan lacks functionalities to generate a comprehensive final conference report. This report should ideally include key metrics such as:
  - The total number of submitted papers.
  - The number of reviewers involved in the review process.
  - A breakdown of paper classifications (e.g., accepted, rejected, revisions required).

  The inability to generate such a report hinders post-conference analysis and evaluation efforts. Conference organizers wouldn't be able to effectively assess the conference's reach, reviewer effectiveness, or identify areas for improvement in future iterations.

6 CONCLUSION

This chapter has successfully bridged the gap between the meticulously designed ConfMan system and its real-world manifestation. We delved into the intricacies of the implementation process, exploring the selection of programming languages, frameworks, and tools utilised. The development methodologies employed, along with the coding techniques, were also mentioned, providing a clear picture of the construction process.

Following the development phase, the chapter explored the crucial testing strategy. By meticulously implementing the design and conducting rigorous testing, we have transformed ConfMan from a theoretical concept into a tangible solution.

General Conclusion

This thesis has explored the complexities of academic conference management and proposed a novel Conference Management System (CMS) designed to address identified limitations and enhance the overall conference experience.

Chapter 2 provided a comprehensive background on academic conferences, outlining the typical workflow and challenges associated with organizing and managing these events. Additionally, this chapter explored existing research in conference management systems and identified the motivation for this work.

Chapter 2 focused on the design and conception of the proposed CMS. This chapter outlined the system's requirements, both functional and non-functional, and explored the system architecture, providing a high-level overview of the key components and their interactions. Furthermore, it delved into the intricate details of system design using UML diagrams, visually depicting the functionalities, core components, and message flows within the proposed CMS.

Chapter 3 detailed the development of key modules and functionalities of ConfMan. This chapter delves into the system's core components, detailing how each functionality contributes to streamlining the conference management process.

Chapter 4 embarked on the implementation and evaluation phases of the proposed CMS. This chapter explored the technology stack utilized in the development process. Following development, the chapter outlined the testing methodology employed to assess the system's effectiveness, highlighting the benefits and limitations of the proposed CMS.

The proposed CMS offers a comprehensive suite of features designed to automate the conference management process. This includes functionalities such as automated average score calculation, originality verification, automated session scheduling with conflict detection, and paper reviewer assignment using constraint programming. By leveraging these features, conference organizers can significantly improve efficiency, reduce administrative burden, and enhance the overall experience for both organizers and participants. This CMS has the potential to streamline workflows, minimize manual tasks, and foster a more effective and rewarding conference experience for all stakeholders.

Future research directions involve the refinement and professionalization of existing features. By leveraging user data, past user performance ratings and a "reviewer recommendation" tool, this can provide conference chairs with more informed suggestions for reviewer selection.

Furthermore, deeper integration of artificial intelligence (AI) tools presents a significant opportunity. By incorporating tools and functionalities explored in the previous work "A Framework for Managing the Scientific Aspect of a Conference", we can strive towards a comprehensive platform that seamlessly manages both the logistical and scientific aspects of conferences. This would create a one-stop solution for conference organizers, streamlining the entire process.

Additionally, enhanced user interface (UI) design remains an important area for future research. A user-entered approach can significantly improve user experience, making the platform more intuitive and efficient for all stakeholders. The development of mobile applications presents a compelling opportunity to enhance accessibility and user convenience. By offering mobile access to key functionalities, the platform can cater to users on the go, further increasing its flexibility and user-friendliness. Finally, the ultimate objective of this

research is to implement the proposed Conference Management System (CMS) within a real-world academic conference setting. This option emphasizes the research objective and the practical application of the platform.

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