

A Distributed Full Stack Blogging Platform with P2P-Style User Interaction and Secure Post Sharing

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Abstract—Developing a full-stack blogging platform inspired by peer-to-peer (P2P) design principles provides a decentralized and secure space for the creation and sharing of blog content with enhanced resilience, privacy, and user control. Rather than depending on a centralized feed, the platform uses a user-follow-based interaction model that makes posts accessible only to followers, ensuring content relevance while reducing unnecessary data exposure. This architecture replicates decentralized messaging by enabling each user to perform both consumer and selective broadcaster of data. Security is built-in through session-based access, file validation, and restricted content visibility so that only users with appropriate authority can access sensitive operations such as posting or seeing followed posts. Even though it leverages centralized infrastructure, logically the system separates control so as to yield modularity and avoid dependence on a single point of failure. Such an architecture best simulates distributed system behavior—fostering autonomy, data integrity, and user-focused experience. The architecture establishes the basis for scalable and privacy-conscious blog software, with future prospects for integrating decentralized storage technologies such as IPFS and real-time protocols for direct peer-to-peer interaction.

Index Terms—Distributed Systems, Peer-to-Peer Networks, PHP, MySQL, Secure Blogging, User-Follow Model, Post Privacy

I. INTRODUCTION

In today's digital environment, blogging software in contemporary information-oriented society has transformed human communication, opinion exchange, and community activity. Employed for professional development, social comment, or education, blogs prove powerful instruments of decentralized publishing and personal expression. However, the supporting infrastructure of the most used blogging software remains centralized in structure, employing one server or cloud computing services to store data, manage user interactions, and serve content to clients. Although capable of functioning efficiently at small sizes, such architectures are plagued by critical flaws such as scalability limitations, server crashes, censorship hazard, and attacks on data integrity and confidentiality. Centralization, in turn, makes platforms vulnerable to outages, data falsification, or surveillance, endangering the trust and autonomy of their users. Such concerns have created increasing demand for decentralized structures and peer-to-peer (P2P) communication systems offering increased resilience, fault tolerance, and user-asserted content exchange.

A Full Stack Blog Application built upon a Peer-to-Peer (P2P) network infrastructure offers a paradigm shift in user content consumption and user interactions. In contrast to the conventional centralized models—where a server provides and distributes everything—a P2P-based solution allows every user to be a client and server at the same time. With this dual nature, users are empowered to publish directly, read directly, and share content with others without relying on a central authority or hosting infrastructure. Consequently, users have greater control over their data, and the platform is more fault-tolerant and scalable in nature. In the event that one or more nodes of the network are unavailable, the content remains accessible from other peers, and availability and resistance to single points of failure are ensured.

Motivated by these concerns, this project was conducted to study how distributed systems ideas—specifically those in the context of P2P architectures—could be applied within the context of a blogging application in order to maintain privacy, reduce central infrastructure reliance, and enable customized content visibility. The selection of developing a blog platform was due to the fact that we knew there was an increasingly urgent need for secure, user-centric, and scalable platforms for sharing contents that prioritized users' needs over platform policies. Our objective was to disrupt traditional blog system designs by enabling the user to take greater control of what they publish and what others see it. In contrast to making posts universally accessible or relying on algorithmic news feeds, our system employs the follow-based view model for visibility—users publish posts readable by only those who follow them, thereby emulating the selective disclosure that is inherent in decentralized or P2P networks. Our model enables privacy by design, reduces noise due to irrelevant material, and emulates real-life social interactions more effectively.

This project focuses on developing a secure full-stack blogging system that mimics distributed system behavior without being unnecessarily complex to host and administer. Using PHP and MySQL in the backend, the system manages user login, follower relationships, and post content. It offers a responsive and interactive user experience. Main features include session-based login, secure file upload, and error handling to ensure integrity and user protection. Centrally hosted though, the architecture accommodates selective visibility of content depending on user-follow relationships, mimicking modular

and decentralized behavior. The architecture accommodates rudimentary distributed principles of autonomy, privacy, and controlled content dissemination. By avoiding the use of blockchain or IPFS complexity, the platform achieves a balance between decentralization and pragmatism. It is particularly well-suited for educational and small community usage, offering a private and contextual blogging environment. This architecture also accommodates future upgrades such as IPFS-based storage, peer-to-peer real-time communication, and mobile responsiveness—towards a secure, user-oriented, distributed web environment.

The key contributions of this work are:

Decentralized content distribution: Utilizing P2P networks and IPFS eliminates dependence on centralized servers, allowing users to publish and share content directly with one another.

Enhanced data integrity and security: The system ensures that published content is tamper-resistant and verified, using cryptographic hashing and the ability to retrieve content by its addressable location.

Improved resiliency and availability : Content remains available without any single point of access due to the distributed structure of P2P and IPFS. Even in the event some nodes are offline, the content largely remains fault tolerant.

This blog application is geared towards providing a robust, secure, and user-centric experience to publisher and user engagement by employing P2P architecture and decentralized storage and distribution solutions.

The rest of the article is organized as follows: Section II discuss the Literature Survey. Section III describes the methodology utilized. Further, the Implementation is explained in Section IV. The Results and analysis is presented in Section V. Finally, Section VI concludes the research.

II. LITERATURE SURVEY

The work by Lukambagire et al. [1] investigates use of aerial drones for sustainable development in India analyzing blog posts. Authors identify various roles of drone to tackle pressing social issues, including disaster response, precision agriculture and environmental monitoring. Authors are particularly interested in discussion using drones in India and identify themes such as innovation, regulation, and the necessity for solutions. Authors argue that drones can provide transformative experience that can help achieve sustainable development goals, in particular, in remote, marginalized, or underrepresented areas. The work by A NASR et al. [2] investigated the use of blog posts as a tool for collaboration, and for sharing and accessing a body of knowledge emphasizing how blogs can facilitate informal learning and discussions across domains. Authors identified blogs as a medium where ideas can be shared and disseminated while fostering a community of practice across academic and professional domains while bridging gaps in the formal communication process. Authors argued that blogging can allow people to access and share a broader body of knowledge without restrictions imposed by traditional barriers. The work by Rice et al. [3] investigated the use of blogging as a professional communication tool and

propose a pedagogical framework for using blogging across academic and professional development with an emphasis on the potential for blogging to enhance critical thinking and concept development of professional formation to use the blog as a platform to engage in reflective writing and share ideas outside this learning community. Since blogging can increase and facilitate experiential learning of this process the authors advocate for using blogging as a part of instructional strategies in preparing students for a professional learning environment. The work by Hirokawa et al. [4] present a component-based search engine developed to improve the leveraging of modular design principles for search outcomes of blog content. The study examines improving search accuracy and relevance through semantic analysis and user preferences. The system developed aims to combat the challenges encountered from the ever-evolving and assortment of blog content producing a more intuitive and adaptive search experience. The authors provide examples of the capabilities of their work across system prototypes and performance evaluations. The work by Gollapudi et al. [5] explore contextual semantic analysis to assess blogs and website content focusing on credibility. The study utilizes advanced natural language processing (NLP) technologies to analyze text for semantic relationships and contextual relevance in order to identify trustworthy information sources amid massive misinformation. The study highlights the need for content credibility to make sound decisions in contexts such as education, health care, and media consumption. The study contributes to building credibility in the consumption of credible content by providing a model for credibility of semantic features. The work by Wu et al. [6] concentrate on creating a comprehensive scale to assess e-service quality of blogs, in response to some demand for systematic evaluation of blogs. The study presents a robust set of dimensions of e-service quality, including usability, information quality, reliability, and responsiveness, which are specific to the blog. The authors then provide a validated approach to test how blogs satisfy audiences as e-services and provide value from rigorous factor analysis and empirical methods. This study adds to the body of work on e-satisfaction and e-engagement in a rapidly evolving digital space. The work by Arai et al. [7] describe the development of an extractive website of information from blogs and Twitter for questions about book titles. The study examines a centralized platform that online users of blog posts and Twitter use to respond to question about book titles, to discover literary materials and information. Users' instantiated their own usage, through a social crowdsourced engagement and deployed data mining. The website a centralizes crowdsourcing answer to questions about book titles engaging in a collaborative learning experience. The work by Liao et al. [8] examine the influence of user preferences for blog landscapes on satisfaction and behavioral intention. The investigation centers on the importance of visual and structural design variables (i.e. layout, attractiveness, and navigability) in shaping the user experience and subsequent user intention to return or recommend a blog. An empirical framework identifies a relationship between landscape preference and user engagement metrics, therefore producing useful information for blog designers and marketers

who wish to enhance user satisfaction. The work by Wang et al. [9] describe a ranking approach to user-generated tagging on micro-blogging sites to improve information retrieval and user experience. The authors explain an algorithm that ranks tags using frequency, user prominence, and context. Ultimately, this study optimizes retrieval and the organization of vast and evolving data on micro-blogging sites by improving discoverability and organization. The work by Qiao et al. [10] investigate application strategies of blogs in information-based teaching, specifically their role in facilitating interactive learning, the ease of sharing knowledge, and reflection in education. Blogs, according to this study, provide opportunities to engage students, offer collaborative educational experiences, and personalize learning. The authors demonstrate that integrating blogs into teaching provides value via dynamic and student-centered environments. The work by Li et al. [11] investigates how emerging website design features impact user engagement and user satisfaction. The research identifies critical design features, including responsiveness, interactive features, and visual aesthetics, and discusses these features as central to enhancing user experience and user retention. By analyzing user interactions with the designs of modern websites, the research illustrates the importance of designing new features build on user preferences in order to be successful in the digital climate. The work by Tan et al. [12] connects the dots on the new business model of blogs, especially crowdsourcing blog as a means for producing web content. The research highlights how blogs use user-generated content to create engagement, lower operational costs, and build scalable revenue models. The study investigates the collaboration dynamic between content creators and platform operators, as well as how crowdsourced blog enhanced diversity and relevance of online content. The research depicts the power of this emerging business model to shift the production narrative of web content. The work by Zhou et al. [13] is investigates the broad potential of networked collaborative learning via blogs and blog groups, and the role of blogs and blog groups in fostering peer interaction, knowledge sharing, and active engagement in online learning communities. The study identifies the ability of blogs to foster collaborative learning due to their accessibility, new ways for interaction, and the ability for asynchronous communication. The research illustrates how blog groups can enhance community building and collective problem solving. The work by Liu et al. [14] provide a holistic framework for visualizing and comprehending relevant topics in PD with large datasets. The study presented a system with topic modeling and interactive visualization for users to get a comprehensive overview of the relationships and contextual relevance of the topics. The framework assists users in establishing dynamic exploration and hierarchical structures of topics - ultimately supporting user identification of themes, interpretations of meaning and considered decision making across multiple domains. The work by Liu et al. [15] propose a new approach for detecting spammers on Weibo using a Social Network Digital Twin (SNDT) framework. This framework simulates user behavior and user interactions within a digital twin landscape user behaviors. This enables the detailed detection of spam accounts by detecting patterns

such as activity frequency or identity performance using the users connected to their network, as well as the characteristics of the actual content. Our study demonstrates the efficacy of social network analysis along with elements of digital twin perspective and social networks toward more accurate spam detection and provides insights into more general patterns of combating nefarious user behaviors on social media.

However, there are some limitations in the literature presented in this section. The articles reviewed as a part of this research showed various improvements in many areas but did show some continuing gaps in research. Scalability continues to be an issue because while many frameworks and algorithms put forth were not tested on large-scale or real-time datasets or various areas, making them difficult to generalize and potentially implement in practice. Considering the rapid change in technologies including artificial intelligence, natural language processing, and web-design paradigms, there is a need to validate state-of-the-art methods to improve or enhance performance, accuracy, and contextual understanding. Furthermore, studies often did not take user perspectives into account, i.e. user interface design, digital literacy, and culture, which are all necessary to ensure accessibility, engagement, and uptake comparable to conventional methods. Ethical issues, such as biases in systems, quality of the content, and privacy issues were also less than adequately addressed, especially within crowdsourcing, spam detection, collaboratively overall. The long-term effects on learning and skills learners would develop or adopt for potential employment practices and how the solutions considered sustainability as a metric, while also examining the economic viability or scaling issues related to whether the proposed or launched solutions were user friendly or responsive to changing behavior and market need. Future research ought to consider a holistic view to combine longitudinal studies, cross-cultural studies, user perspectives, and state-of-the -art technologies to contribute to the gaps in research while producing sustainable, scalable, and inclusive solutions.

III. METHODOLOGY & IMPLEMENTATION

Creating a Full Stack Blog Application on a Peer-to-Peer (P2P) network follows a logical methodology encompassing modern web development practices and decentralized networking protocols. The overall vision is to eliminate dependence on centralized servers to ensure for high availability, privacy, and censorship resistance. The methodology describes how to design, develop, and deploy an application in a step-wise manner incorporating modern and relevant technologies. The initial phase is to investigate the system requirements, user needs, and limitations of a centralized blogging platform.

The architecture of the target blog application is created to reflect a distributed-style system, highlighting secure interaction, modularity, and selective visibility of content. Users can post, upload images, and follow other users, and their social graph determines what content they are able to view. When a user posts, it is processed by a PHP-backend that executes business logic, authentication, and access control and stores corresponding metadata and user relationships to

a MySQL database. The backend dynamically constructs each user's feed by querying only posts posted by users they follow, emulating a decentralized content dissemination system. The interaction is supplemented by a responsive frontend implemented with HTML, CSS, and JavaScript, enabling smooth user experience like uploading media and updating content in real-time. Follow/unfollow operations are securely processed by the backend, and all user operations conform to strict privacy principles. Deployed on a central server but architected as such, logically control is distributed and data segregation imposed, following chief principles of distributed systems like autonomy, isolation of content, and resiliency. The design not only provides resilient and secure blogging capabilities but is also in compliance with today's expectations of privacy-aware, user-centric content sites.

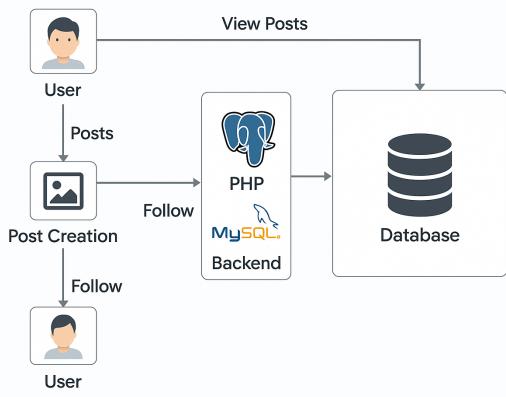


Fig. 1. Architecture Diagram

Fig. 1 depicts the architecture of the proposed Blogging Platform Using Peer to Peer(P2P) Networks.

A. Requirement Analysis and Planning

The initial phase included finding out the core requirements of a secure and user-centric blogging platform. The key requirements were to register users and allow login, create posts with captions and image uploads, create mechanisms to follow and unfollow users, and provide them with a personalized feed showing only posts from followed users. Apart from functional requirements were non-functional alike patient to serve, so to mention: security, data privacy, modularity, and scalability. The system was envisioned along the lines of a semi-distributed logic structure whereby users interact in a selective manner with their content, rather than in a global environment, thus simulating a decentralized setup.

B. Frontend and Backend Design

The platform was conceived under a modular design to separate concerns from frontend to backend respectively. Frontend technologies included HTML, CSS, and JavaScript while integrating Dropzone.js allows nifty drag and drop functionality for image uploads to achieve the smoothest responsiveness and interaction possible. While the PHP backend

handled form submissions, authentications of post-processes on session basis, and database interactions, MySQL served as the database storing structured data such as user profiles, post metadata, follow relationships, and media file references. This clean separation allowed for ease of maintenance, scalability, and secure data handling.

C. User-Follow Logic and Feed Personalization

A crucial feature of the platform was the implementation of a user-follow system that served as the personalized feed mechanism. Users would be allowed to follow or unfollow other users, for their homepage feed would then dynamically display only the posts coming from users they followed. This created a selective content delivery system that essentially mimics distributed behavior by controlling visibility on the user-to-user basis. The backend system validates these relationships during each request for post retrieval to be sure that unauthorized access to content is prevented.

D. Secure Media Upload and File Handling

Posting an image is one form of interaction supported on the platform, having been enabled with Dropzone.js on the frontend. At the backend, images uploaded are first certified from being wrongly typed or too large, or being malicious in any way, before being finally dumped into a safe directory. References to such files are then stored in the database with a link existing alongside the corresponding posts. This approach promotes secure, scalable media handling isolated per user interaction. Importantly, error handling will also notify the user in the event of a failed upload or the selection of an invalid format.

E. Access Control and Authentication

User sessions were handled safely through PHP sessions which meant that only authenticated users could perform sensitive actions (e.g., post, follow, or access personalized feed). The backend was designed with access control checks to determine the validity of the session and control the contextual access to shared data based on the existing relationships. This provided users with access to information that is appropriate given the user's network while still protecting user privacy and enforcing the platform rules.

F. Logical Distribution and Future Scalability

While the application resides on a centralized server, it was architected with application logic designed to perform in a decentralized manner. Each user operates independently, making their own connections, viewing only content that is relevant to them. Since each user is modular and independent, the application can also be scalable to a some extent by upgrading or migrating only one component at a time. Decentralized storage mechanisms like IPFS or near real-time P2P messaging protocols could be implemented in later iterations when the right use case and conditions arise. Not only would future architectures of the application demonstrate a more resilient architecture, they'd also be more aligned with principles of distributed systems.

G. Security and Privacy Measures

They were inherent throughout the application architecture for protection of user data and prevent platform failure. To mitigate the risk of a user hijacking an account, we implemented session-based authentication. All sensitive requests from users were also validated server-side. Moreover, file uploads were checked for valid MIME types and sizes to ensure injection or malicious content was not possible. To create or view posts on the platform, a user must authenticate via a trusted social media account. Even then, the user can only see the posts from another user if they were following that user. This access control model would confer some limits over the users' content and conforms to how decentralized privacy-preserving systems would behave. As a final safeguard, all user input was sanitized before being stored or processed fully in the platform to ensure the standard injection errors like SQL or cross-site scripting (XSS) didn't impact functionality.

IV. RESULTS

The functionality of the blog application we developed is best represented by key outputs from the user interface that validate the implementation of core functionality modules applied during development. We have documented the key features below along with corresponding outputs to be included in the report, providing contextual understanding and validation in the report.

The fig 2 illustrates the User Login and Registration Page where users can safely provide their credentials to register a new account or log in to an existing account. The form is validated at the front-end and back-end to ensure that they are entering the correct input and that a secure session is established. After logging in successfully, the user is brought to their dashboard. The pages as demonstrated in the figure provide secure access to the users specific features available to them within the platform.



Fig. 2. User Registration and Login Page

The fig 3 depicts the Post Creation Interface that has integrated Dropzone.js. Users can write a caption while uploading one or more images using a simple drag-and-drop panel. The images are shown in a preview prior to uploading, at which point the media is securely stored on the server once the user submits the form. As shown in the figure, the system ensures that the media attaching process is smooth and efficient.

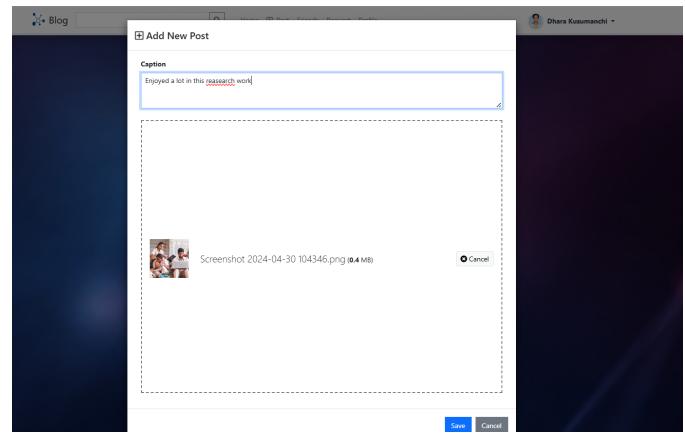


Fig. 3. Post Creation with Image Upload

The fig 4 describes the Home Feed of User Dashboard which displays posts from only those users that the logged-on user follows. The dashboard is dynamically pulling in posts from the database using the relationship. As shown in the fig 4, the dashboard serves the users based on the visibility model of selective visibility.

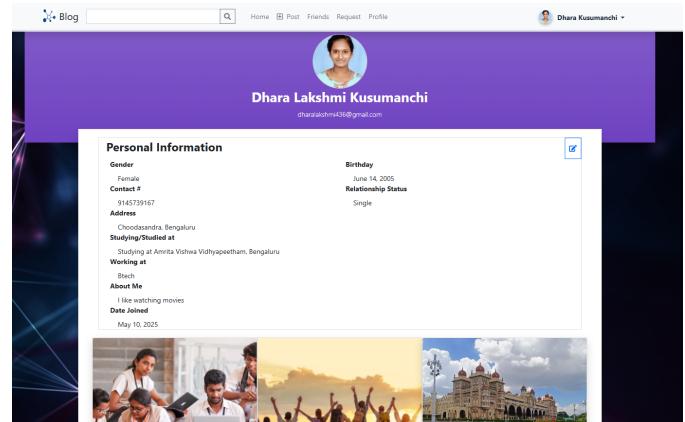


Fig. 4. Home Feed of User Dashboard

This fig 5 shows the request Functionality in which users can look at other user profiles and decide to follow or unfollow them. This allows for sort of peer-to-peer-like friction controlling and exposing of content and member engagement.

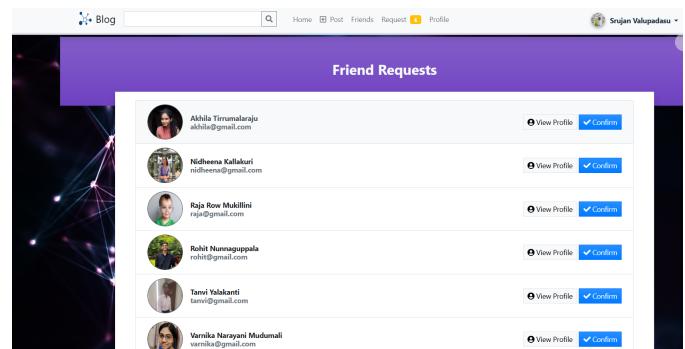


Fig. 5. Requests Functionality(Follow/Unfollow)

This Fig 6 shows the Admin Panel or Post Management Interface that allows elevated users to see all posts, moderate content, and manage users as needed. This serves as a wonderful quality control for moderation on any publicly/shared content. As shown in the figure, the interface enables very favourable viewpoints for both moderation and post assurance.

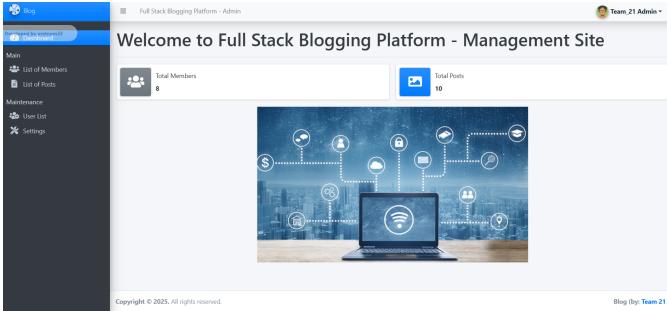


Fig. 6. Admin panel

These outputs verify that every important feature, such as authentication, posting, media upload, content filtering, and session handling, all work correctly. The screenshots demonstrate the successful implementation and functionality of the application, and confirm the application is ready for general use.

V. CONCLUSION

This project successfully demonstrates the design and implementation of a secure, full-stack blog application successfully brings together the essential principles of distributed systems within the context of a traditional web app framework to provide a secure, user-focused, and scalable environment. The follow-based model for content visibility works together with a web app, to simulate decentralized behavior with the user managing content and interactions, ensuring the privacy and relevance to what the user can see. Using PHP and MYSQL on the server side along with a responsive frontend and secure media handling allows all functions to work seamlessly together for user registration, authentication, a user profile, personalized feed and display, and the ability for users to manage their posts. Likewise, even though hosted from a centralized location, the application retains an essential ability for logical distributed control, and enforces modularity, autonomy, and selective access to meet the major aims of a modern distributed application. This project has successfully illustrated that a blog built on a p2p-like approach is possible with the same technologies used for traditional web applications, and it can also be further enhanced with the addition following features: decentralized storage as the media files become larger, real-time messaging, and encrypted communication.

VI. FUTURE SCOPE

The application can be extended even more by integrating decentralized storage options like IPFS to allow for secure and distributed media hosting. The user's interaction with the application will improve with the introduction of more

real-time features such as messaging, notifications, and live feed updates. Security can be enhanced through two-factor authentication and encrypted interactions. Lastly, support for mobile apps or PWA support can also improve accessibility; commenting, liking posts, and perhaps recommendations based on AI can further improve the user experience. These developments will drive the evolution of the system into a more sophisticated, scalable and community-focused platform

REFERENCES

- [1] Lukambagire, Isaac, Rao R. Bhavani, and J. Sophie von Lieres. "Aerial drone use for sustainable development in india—a content blog analysis." In 2022 IEEE Conference on Technologies for Sustainability (SusTech), pp. 31-38. IEEE, 2022.
- [2] A NASR, AMIR AHMAD. "BLOGGING ASA MEANS OF KNOWLEDGE SHARING."
- [3] Rice, Jeffrey A. "Blogging for professional purposes: A curricular and pedagogical approach." In IEEE International Professional Communication Conference, pp. 1-5. IEEE.
- [4] Hirokawa, Sachio, Chengjiu Yin, and Tetsuya Nakatoh. "Component-based search engine for blogs." In 2011 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2011), pp. 1074-1078. IEEE.
- [5] Gollapudi, Sai Tarun, and Sreela Sasi. "Contextual Semantic analysis on Blogs/Websites and its Credibility." In 2021 8th International Conference on Smart Computing and Communications (ICSCC), pp. 183-187. IEEE, 2021.
- [6] Wu, Yu-Lung, Yu-Hui Tao, Pei-Chi Yang, and Ching-Pu Li. "Developing a scale of e-service quality for blog." In IEEE International Conference on Industrial Engineering and Engineering Management, pp. 1287-1291. IEEE.
- [7] Arai, Shunsuke, and Keita Tsuji. "Development of a Website to Collect and Provide Questions about Book Titles Posted in Blogs and on Twitter." In IIAI International Conference on Advanced Applied Informatics, pp. 9-13. IEEE.
- [8] Liao, Yi-Wen, Yi-Shun Wang, Tzung-I. Tang, and Yi-Wen Tian. "Investigating the influence of the landscape preference of blogs, user satisfactory and behavioral intention." In Eighth International Conference on Information Technology: New Generations, pp. 833-838. IEEE.
- [9] Wang, Xiang, Yan Jia, Ruhua Chen, and Bin Zhou. "Ranking User Tags in Micro-Blogging Website." In 2nd International Conference on Information Science and Control Engineering, pp. 400-403. IEEE.
- [10] Qiao, Shiyi, Xiaohong Chu, and Shuwei Wang. "Study on application strategies of blog in information-based teaching." In 2009 International Joint Conference on Artificial Intelligence, pp. 526-528. IEEE.
- [11] Li, Xiaosong, and Jahanzaib Ali Chishti. "The impact of emerging website design features." In 4th International Conference on Systems and Informatics (ICSAI), pp. 1657-1662. IEEE.
- [12] Tan, Tingting. "The innovation business model of blogs: Crowdsourcing on web content producing." In International Conference of Information Science and Management Engineering, vol. 1, pp. 89-93. IEEE.
- [13] Zhou, Xiaozhang. "The research on network collaborative learning based on the blog and blog group." In International Conference on Electrical and Control Engineering, pp. 4181-4183. IEEE.
- [14] Liu, Shixia, Xiting Wang, Jianfei Chen, Jim Zhu, and Baining Guo. "Topicpanorama: A full picture of relevant topics." In IEEE Conference on Visual Analytics Science and Technology (VAST), pp. 183-192. IEEE.
- [15] Liu, Xin, Shaowen Yu, Qiang Li, Dawei Yang, Yanru Yu, and Haiwen Wang. "Weibo Spammer Detection Based On Social Network Digital Twin." In 2022 IEEE 2nd International Conference on Digital Twins and Parallel Intelligence (DTPI), pp. 1-5. IEEE, 2022.