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Design and Implementation of Internet-based Online Human Library for Learning Assistance Applications

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Abstract. With the growing demand for digital learning, traditional Human Libraries, constrained by geographical limitations and time costs, struggle to meet the needs of modern learners. This study proposes and implements an Internet-based online Human Library system aimed at providing immediate, personalized learning assistance. By integrating video communication technology and database management, the system efficiently connects human books (individuals with specific knowledge or experiences) with learners. The paper details the system's design architecture, technical implementation process, and preliminary testing results. Experiments demonstrate that this online platform not only enhances the accessibility of learning knowledge but also improves interaction efficiency between learners and knowledge providers (human books). This study offers new insights for the development of future digital education platforms and explores their potential applications in education.

Keywords: Online human library, Learning assistance system, Digital education.

1. Introduction

The advent of digital technologies has revolutionized education, shifting it from traditional, in-person instruction to flexible, technology-mediated environments that cater to diverse learners globally. Online learning platforms, such as Massive Open Online Courses (MOOCs) and Learning Management Systems (LMS), have significantly broadened access to educational resources. Shah (2022) reports that Coursera, a leading MOOC provider, reached over 100 million learners by 2021, underscoring the scale and impact of digital education [1]. However, despite their accessibility, these platforms often deliver standardized content with limited opportunities for personalized interaction, which is crucial for addressing individual learning needs [2]. This shortfall has prompted researchers and educators to explore innovative models that integrate human connection with digital scalability to enhance learning experiences.

One such model is the Human Library, an initiative launched in Denmark in 2000 to facilitate experiential learning through direct conversations with "human books", individuals who share their expertise or lived experiences [3]. Recent studies, such as those by Pope et al. [4], highlight the educational value of Human Libraries, showing how they foster critical thinking and empathy among university students through storytelling sessions. However, the traditional Human Library model is

constrained by significant limitations: it relies on physical venues, demands synchronous participation, and struggles to scale beyond localized events due to logistical and participant availability challenges [5]. These barriers hinder its potential to meet the needs of a digitally connected, geographically dispersed learner population seeking immediate and tailored learning assistance.

Recent advancements in Internet-based technologies provide a promising avenue to address these constraints. Real-time communication tools have enabled seamless, low-latency interactions across distances, as demonstrated in applications ranging from teleconferencing to remote education [6]. Concurrently, intelligent matching algorithms and cloud-based systems have enhanced the efficiency of connecting users with relevant resources or experts [7]. Yet, while digital tools such as these facilitate knowledge exchange, they rarely replicate the conversational richness and human-centered focus of the Human Library. This gap motivates the development of a new framework that combines the accessibility of online platforms with the interactive depth of the Human Library model.

The primary objective of this study is to design and implement an Internet-based Online Human Library tailored for learning assistance applications. By integrating selective software for real-time video communication, and a server-based database for data management, this platform aims to overcome the geographical and temporal limitations of traditional Human Libraries. The proposed system seeks to enhance the efficiency, scalability, and personalization of learning support, contributing a novel solution to the field of digital education. Through this study, we aim to demonstrate the feasibility and transformative potential of an online Human Library as a tool for learning assistance in the digital age.

This paper is structured as follows: Section 2 reviews the literature on Human Libraries, online learning technologies, and related systems, identifying key research gaps. Section 3 presents the system design and implementation, including its architecture, functionality, modules, and interface. Section 4 details the experimental evaluation and analysis of using the proposed human library system as a learning assistance system for student's learning. Section 5 gives a conclusion of the research.

2. Literature Review

The concept of the Human Library (HL) has evolved as a transformative approach to fostering dialogue, reducing prejudice, and enhancing understanding among diverse populations. This literature review examines the applications of HL, the development of online HL systems, and their role in learning assistance. Originating in Denmark in 2000, the HL initiative was designed to challenge stereotypes by facilitating conversations between "readers" and "human books", individuals who share their personal experiences of discrimination or social exclusion. A systematic review [8] by Lam et al. highlights that HL programs have been implemented globally, aiming to promote social inclusion and personal growth among participants. In educational settings, HL has been utilized to enhance cultural competence and empathy. For instance, a study [9] by Sen demonstrated that integrating HL into social work education helped students develop a deeper understanding of marginalized groups. Similarly, Bryan and Dobbins found that applying the HL concept to academic professional development fostered reflective dialogue and collegial connections among faculty members [10].

The digital transformation has led to the emergence of online HL systems, expanding the reach and accessibility of HL initiatives. A study [11] by Chan explored a digital HL project aimed at reducing prejudices against marginalized groups through storytelling and virtual interactions. The findings indicated that combining online narratives with face-to-face discussions significantly enhanced participants' perspective-taking attitudes. Furthermore, the integration of HL into mobile applications has been explored to bridge gaps between learners and educators. Irfan et al. [12] developed the "Go Together" mobile application, facilitating connections between students and mentors through HL principles, thereby promoting mental well-being and social engagement.

HL has been recognized as a valuable tool for learning assistance, particularly in enhancing mental health literacy (MHL) and reducing stigma. Chan et al. [13] conducted an experimental study demonstrating that HL interventions effectively improved MHL among young adults, reducing stigma and social distance towards individuals with mental illnesses. In the context of healthcare education, HL has been employed to develop cultural awareness and sensitivity. A mixed-method study by Pope et al. [4] revealed that incorporating HL into healthcare curricula significantly increased students' cultural competence, suggesting its efficacy as a cost-effective teaching method.

3. System Design and Implementation

3.1. Architecture

Most human library events are still organized on-site, wherein organizers announce event dates and venues in advance. Although beneficial in many respects, this approach places considerable logistical burdens on both organizers and participants. A shortage of online systems specifically tailored for human libraries further complicates the management of activities like scheduling, book reservations, and user interactions.

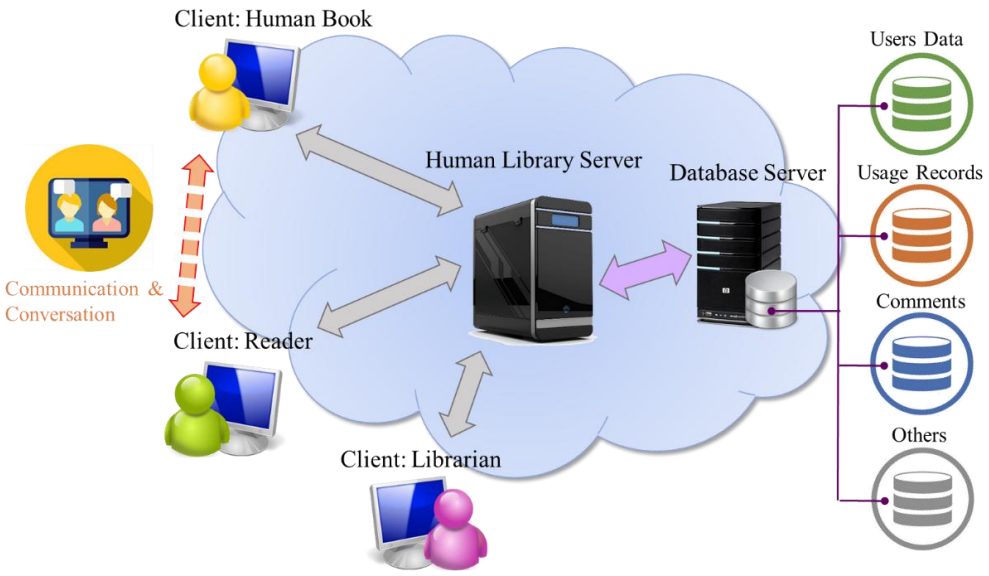

Figure 1. Three-tier architecture of the system.

To address these challenges, we propose an online human library architecture based on three tiers: client tier, application server tier, and database server tier. As illustrated in Figure 1, the entire platform runs on Internet-based infrastructure to facilitate communication among participants from various regions.

(1) Front-End Tier (User Interfaces)

This layer comprises client applications for three user roles: (human books, learners/readers, and librarians) accessible via web browsers or standalone software. Compatible with desktops, laptops, tablets, and smartphones, it ensures flexibility across devices. A key feature is real-time video/audio chat, enabling virtual face-to-face conversations akin to in-person events, critical for immersive learning experiences.

(2) Middle Tier (Application Server)

The central hub, this tier manages all operational services: user authentication, session scheduling, matching, and notifications. It interfaces with the front-end to process requests and relays data to the back end, ensuring smooth functionality. For example, it matches a learner seeking cultural insights with a human book from a relevant background.

(3) Back-End Tier (Database Server)

Positioned behind the application server, this layer stores critical data in three databases: user profiles (e.g., expertise, availability), interaction records (e.g., session details), and feedback/comments. Access is mediated through the application server to enhance security, preventing direct exposure to external threats.

This architecture leverages Internet connectivity (via WiFi, 4G, or 5G) to enable global participation, eliminating the need for physical venues. It aligns with the vision while offering a scalable, adaptable model for educational applications, such as connecting a history student with a war veteran or a language learner with a native speaker.

3.2. Functionality

Transitioning the Human Library online requires distinct functionalities, diverging from traditional digital library systems (e.g., ebook repositories). Below are the essential requirements, tailored to support learning assistance:

(1) Virtual Shelves: Unlike physical books, human books are dynamic entities. The system presents them on electronic shelves within the user interface, organized for easy browsing.

(2) Human Books Classification: Traditional schemes (e.g., DDC-Dewey Decimal Classification, or CLC-Chinese Library Classification) are ill-suited for human books. A bespoke taxonomy based on expertise, experience, or topics is required.

(3) Human Book Profiles: Introductions feature biographies, professional backgrounds, or personal narratives, replacing conventional summaries or tables of contents, to aid learner selection.

(4) Search Capabilities: Search parameters focus on attributes like topic, language, or availability, rather than inapplicable fields (e.g., ISBN).

(5) Reservation System: Borrowing aligns with human books' predefined schedules, necessitating a reservation tool to book time slots, unlike static book lending.
(6) Real-Time Interaction: Core to the Human Library, this feature enables instant video, audio, or text conversations, replicating face-to-face engagement for learning.
(7) Feedback Mechanism: Post-session, learners and human books can submit comments, enhancing reflection and system improvement.
(8) Rating System: A scoring mechanism (e.g., 1-5 stars) encourages quality and provides learners with evaluation insights.
(9) Interaction Logs: Detailed records (date, duration, topics discussed, …) support tracking and analysis, exceeding typical book lending data.
(10) Bulletin Board: A public space shares updates, human book highlights, and educational resources, fostering a learning community.

These functionalities ensure the system supports educational goals, such as facilitating a student's history project through a veteran's narrative or a professional's skill-sharing session.

3.3. Modules

The proposed system comprises eight interconnected modules, providing a comprehensive modules for an Online Human Library tailored for learning assistance:

(1) Human Book Module

Supports registration (with profile submission), login/logout, availability scheduling (e.g., "Tuesdays, 2-4 PM"), booking responses, feedback, violation reporting, history viewing, and third-party conversation tools (Tencent Meeting, Microsoft Teams, Google Meet). An artificial intelligence expert, for instance, could set hours to discuss DeepSeek. For another instance, a computer programmer could set hours to discuss Python.

(2) Reader Module

Includes browsing/searching (e.g., by topic), reserving/canceling sessions, rating human books, and conversation tools (for reading). A learner might reserve an expert for a 30-minute chat.

(3) Librarian Module

Manages human book vetting (approving/rejecting registrations), removals (e.g., for misconduct), and system upkeep (e.g., database maintenance).

(4) Human Library Core Module

Oversees virtual shelves (listing available human books), data operations (recording, querying), notifications (e.g., session reminders), and a bulletin board (e.g., featuring top-rated human books).

(5) Database Module

Handles storage, processing (via stored procedures/triggers), and recovery, categorizing data into users, interactions, and system logs.

(6) Backup Module

Ensures data resilience with automated external storage, safeguarding educational content.

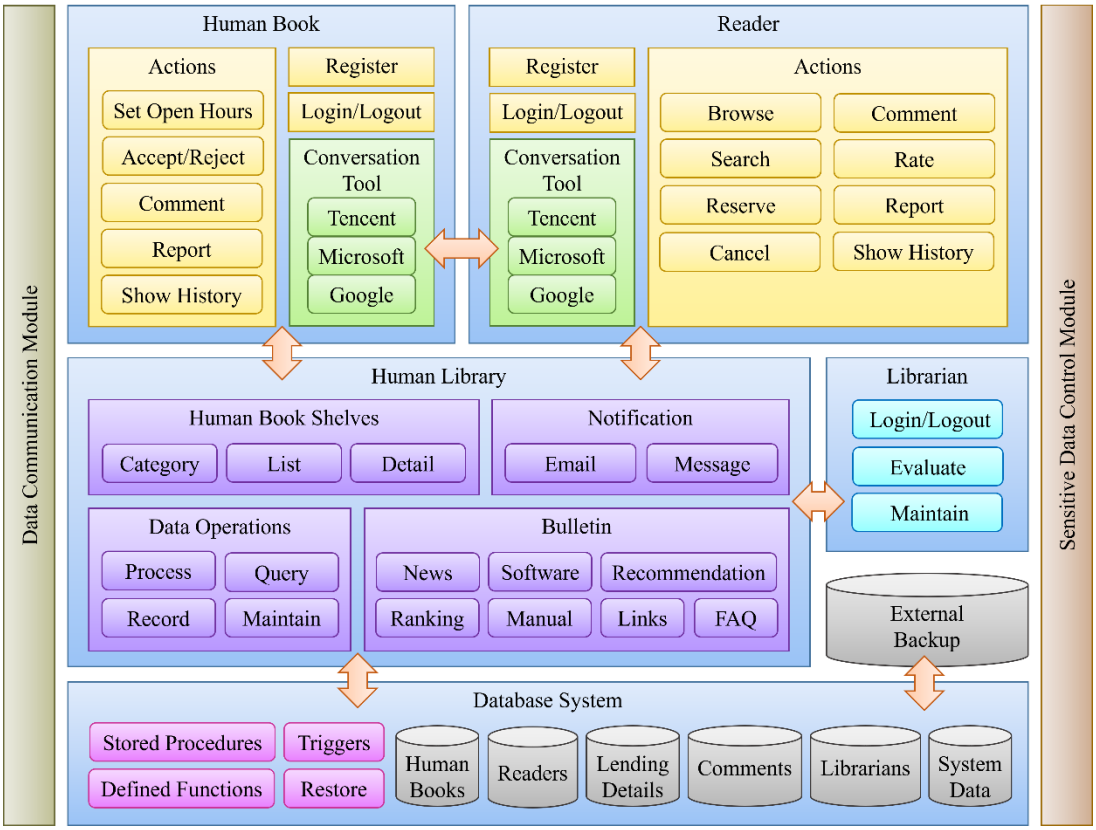

Figure 2. System modules and components.

(7) Data Communication Module

Responsible for data transmission between various modules within the human library system. Employs Internet, WiFi, and 4G infrastructure for reliable connectivity, supporting global learning exchanges.

(8) Sensitive Data Control Module

Protects personal sensitive data (e.g., personal information of human books and readers) with access controls to ensure confidentiality.

The above modules enable the human library system to provide a functional platform that supports real-time learning interactions (human book reading). For example, a student (reader) exploring a topic of Game-base English Learning with an expert (human book) familiar with Computer-Assisted Language Learning (CALL) and Game-based Learning (GBL).

3.4. User Interface

Figure 3 presents an instance of the user interfaces (user role: reader) for the Human Library system that supports readers in reserving a Human Book. The layout is divided into three functional regions: (1) function navigation; (2) human book profile; and (3) operations for reservation changes. The function navigation offers four options about human books: Keyword Search, Category Browse, Reserved Human Books, and Reading History. The Reserved Human Books item is highlighted, indicating that

the human book the reader has already booked. This design underscores the system's conceptualization of the Human Book as an expert who can be "borrowed" in a manner analogous to traditional library holdings, thereby facilitating knowledge exchange through scheduled consultations. The central panel renders the information of a specific Human Book (ID is lily). Core metadata comprise of occupation (Teacher), title (Professor), knowledge domain (Digital Learning), and areas of expertise (Computer-Assisted Language Learning and Game-Based Learning). A Details button beneath the avatar can expand the record to reveal additional information of the human book, such as e-mail address, available time slots, and cumulative borrowing frequency, indicating support for rich, selectively disclosed professional profiles. Below the profile, the system lists reservation particulars: topic (Game-based English Learning), date (4 December 2024), time (15:30), and communication tool (Tencent Meeting, Room ID 527-283-925). The status label Reservation Successful confirms that the session has been booked and logged, meaning that the system has the function of borrowing records and tracking, which can record the time, tool and participant information of each reservation in detail. The bottom action panel provides three post-reservation controls: Message, Reschedule, and Cancel. These afford the reader asynchronous communication with the Human Book, flexible adjustment of the appointment time, and the option to withdraw the booking, respectively, thereby enhancing user experience through dynamic interaction management. The interface also shows the user's ID (kevin) and the function button for maintaining the user's Personal Information.

Figure 3. An instance of the system interfaces.

4. Experimental Results

This study randomly divided an undergraduate class into two groups: an experimental group and a control group. The experimental group used an online Human Library as the channel for acquiring

extracurricular knowledge, while the control group relied on printed extracurricular books. Both groups completed a professional-course quiz consisting of ten questions. After excluding students who withdrew for unrelated reasons, the valid sample sizes were 21 for the experimental group and 23 for the control group.

Analysis of the post-test scores revealed no significant difference between the two groups. However, significant differences emerged in terms of enhanced learning motivation and interest: students in the experimental group, who accessed the online Human Library, showed higher levels of motivation and interest.

Tables 1 and 2 display the analytical data from the ARCS questionnaire administered to both groups before and after the experiment. The questionnaire was adapted from the Instructional Materials Motivation Survey (IMMS) based on the ARCS motivation model [14] to fit the needs of this study. The scale comprises four categories: Attention, Relevance, Confidence, and Satisfaction. and uses a six-point Likert scale ("strongly agree," "agree," "somewhat agree," "somewhat disagree," "disagree," "strongly disagree"). The results were analyzed with a one-sample t-test.

Table 1. Analysis of learning motivation.

	Group	N	Mean	SD	*t*	*p*
Pre-questionnaire	Experimental group	21	4.97	0.689	0.842	0.202
	Control group	23	4.74	1.035		
Post-questionnaire	Experimental group	21	4.95	0.736	1.996	0.026*
	Control group	23	4.46	0.88		

*$p < 0.05$

Table 2. Analysis of learning interest.

	Group	N	Mean	SD	*t*	*p*
Pre-questionnaire	Experimental group	21	4.6	1.065	1.641	0.054
	Control group	23	4.13	0.859		
Post-questionnaire	Experimental group	21	4.75	1.092	2.12	0.02*
	Control group	23	4.05	1.081		

*$p < 0.05$

The evaluation of results was divided into three parts: (1) performance on the extracurricular quiz; (2) learning motivation; and (3) learning interest.

(1) Extracurricular-quiz Performance

No significant difference was found between the two groups. A likely explanation is that the quiz questions were provided in advance, so both the experimental and control groups, despite using different channels to obtain extracurricular knowledge, were able to answer the assigned items equally well.

(2) Learning Motivation

Motivation was measured with pre- and post-experiment questionnaires (Cronbach's $\alpha = 0.826$).

- *Pre-questionnaire*: The experimental group's mean was 4.97 (SD = 0.689) and the control group's mean was also 4.97 (SD = 1.035). The comparison yielded $t = 0.842$, $p = 0.202$, indicating no significant difference before the intervention.
- *Post-questionnaire*: The experimental group's mean was 4.95 (SD = 0.736) and the control group's mean was 4.46 (SD = 0.88). The analysis produced $t = 1.996$, $p = 0.026$ ($p < 0.05$), demonstrating a significant difference after the experiment.

These findings suggest that using the online Human Library, a markedly different, technology-driven and more convenient resource than traditional books, enhanced students' motivation and fostered a more proactive learning attitude.

(3) Learning Interest.

Interest was likewise assessed with pre- and post-experiment questionnaires (Cronbach's $\alpha = 0.875$).

- *Pre-questionnaire:* The experimental group's mean was 4.6 (SD = 1.065) and the control group's mean was 4.13 (SD = 0.859), with $t = 1.641$, $p = 0.054$; thus, no significant difference existed prior to the intervention.
- *Post-questionnaire:* The experimental group's mean rose to 4.75 (SD = 1.092), while the control group's mean was 4.05 (SD = 1.081). The comparison yielded $t = 2.12$, $p = 0.02$ ($p < 0.05$), indicating a significant post-experiment difference.

It can therefore be inferred that students found the online Human Library more novel, convenient, and engaging, which boosted their learning interest compared with the traditional book-based approach.

5. Conclusion

This study designed and implemented an Internet-based Online Human Library to address the limitations of traditional Human Libraries, such as geographical constraints and logistical challenges. By integrating real-time video communication tools and a robust database system, the proposed human library platform facilitates personalized, scalable learning assistance for a global reader. Experimental results demonstrated that students using the online Human Library exhibited significantly higher learning motivation and interest compared to those relying on traditional resources, although no significant difference was observed in quiz performance. These findings underscore the system's ability to enhance engagement and foster proactive learning attitudes, contributing a framework to digital education. The proposed architecture and functionalities, including virtual shelves, human book profiles, and real-time interaction tools, offer a scalable model for connecting learners with knowledge providers. Future work will focus on refining the matching algorithms, expanding the system to support diverse educational contexts, and conducting longitudinal studies to assess long-term impacts on learning outcomes. This research paves the way for innovative, human-centered digital learning platforms that bridge the gap between technology and personalized education.

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