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Elevating The College Library With Advanced Features And Security Measures

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ABSTRACT :

The traditional college library model frequently faces difficulties with manual cataloging, restricted accessibility, and ineffective resource management. Students' learning is hampered by the lack of current search capabilities and real-time data availability. Moreover, the library's potential to function as a dynamic hub for learning is hampered by its incapacity to utilize cutting-edge technologies. This project's main goal is to update the college library by incorporating web-based functionality and artificial intelligence (AI) elements. This entails utilizing web technology to create an online catalogue that is simple to use and intuitive. Using the open-source library management system KOHA to automate processes like cataloging, monitoring book availability, and maintaining user accounts; additionally, integrating an artificial intelligence (AI) recommendation engine, driven by TensorFlow in Python, which makes recommendations for pertinent books based on

Keywords: Book recommendation system, Web development, AI, KOHA, Python, PHP

Introduction :

Each year, the university library will be receiving a large number of new titles. The amount that is collected increases yearly. Users have to spend a lot of time choosing a book. Nevertheless, many books are underutilized, resulting in financial waste on materials that may be found in libraries. These incidents are caused by "information overload".In conventional libraries, an efficient information management system is extremely uncommon, and a lack of computerized systems often results in the loss of many records.In order to complete this project, we would like to construct a case study for the Government College OF Engineering and Research, Avasari Khurd (GCOEARA) library using a "WEB based Library Management Library System with Advanced Features and Security Measures."We are creating a web page for a library management system project that will solve the traditional problem using Python, Bootstrap, PHP, and MySQL. It will feature an easy-to-use user interface for straightforward navigation, powerful book search tools, a seamless policy for book issuance and return, automated activity tracking for the library, routine upkeep of book availability records, and safe login and access control that is managed by the administrator.

Recommendation System

The main purpose of a recommendation system is to connect consumers and items in order to alleviate the problem of information overload. Finding relevant information for users by helping them find interesting content among massive volumes of data is the main goal of a recommendation system.

B.KOHA

At the center of this ecosystem is an open-source library management system. Its broad plugin compatibility and modular design provide an ideal environment for smoothly incorporating AI-powered suggestions. We explore the opportunities and difficulties posed by KOHA's integration, laying the groundwork for a time when AI will be smoothly integrated into library systems to improve their basic functions.

Hypertext Preprocessor (PHP)

PHP (Hypertext Processor) is a free general-purpose programming language and interpreter that is commonly used in web development. The language is mostly used for server-side scripting, however it can also be used for desktop applications and, to a lesser extent, command-line programming.

D.Docker

A program called Docker was created to simplify the deployment and management of applications. By building containers—lightweight, discrete environments with all the components an application needs to run—it achieves this. Virtual machines serve as the foundation for Docker containers.

BACKGROUND

Most book transactions at the GCOEARA library these days are done by hand, which takes time away from activities like checking out, returning, and adding new members. There are several problems in the physical library as a result of this inefficient use of library administration. Errors in record-keeping, such as the destruction or loss of manually generated data due to inefficient use, are mostly caused by human error.The effort needed to look for books that might be deemed inadequate in terms of book management is a problem in manual libraries, even though it takes a lot of time and causes confusion in the space.Despite an increase in the necessity for physical file and record storage, there is a correspondingly restricted amount of space available for record keeping as more records are added to the library. The cost of books and documents will remain a significant obstacle if no digital system is implemented. These problems can also be solved by the newly created automated project approach, which eliminates the time-consuming manual library procedures.

An online library application that is accessible to everyone. The library staff uses and maintains the computerized system in a confidential manner. It enables librarians to maintain track of a variety of transactions, including the lending and returning of books, the addition of new eBooks, and the enrollment of new users. In addition, this website has modules for user and book preservation that help with user management and provide a detailed description of all the books the library has. The loss of books or member records can be avoided with an automated system, while missing records are more common with a non-automated system. Additionally useful resources for students on this page are the Virtual Bookshelf and Digital Storytelling.Students have the option to rate books as well.

LITERATURE REVIEW :

In their article [1]Zeng and Yang provide a comprehensive overview of the use of artificial intelligence (AI) in digital library systems. They begin by discussing the challenges and opportunities that AI presents for digital libraries.Zeng and Yang conclude their article by discussing the future of AI in digital libraries. They argue that AI has the potential to transform the way that digital libraries are used and managed. They call for further research and development in this area, so that AI can be used to create digital libraries that are more accessible, efficient, and user-friendly.

Araya and Mengstab [2] used the Java programming language, PHP, HTML, and MySQL database to study and design a web-based library management system. Results show that people are using this new technology to encourage consumers to read digitally and to increase their understanding of every facet of the technology. The age and professional backgrounds of the Asmara Community College of Education Library's patrons are varied. For various reasons, such as research projects, education, general knowledge, and leisure, they need diverse sorts of documents. The world will be able to create an infinite amount of digital material and access it simultaneously thanks to the Web-based Digital Library Management System (DLMS).

In their article [3] Tang and Zhang provide a comprehensive overview of the state of cloud-based digital library systems (CDLs). They begin by discussing the benefits of using cloud computing for digital libraries, such as scalability, flexibility, and cost-effectiveness. They then review the different types of CDLs that are available, including SaaS, PaaS, and IaaS systems.One of the key challenges that Tang and Zhang identify is the need to ensure the security and privacy of digital content in the cloud. They also highlight the need for CDLs to be interoperable with other systems, such as institutional repositories and library catalogues.Overall, Tang and Zhang provide a valuable overview of CDLs and the challenges and opportunities associated with this emerging technology. They conclude their article by calling for more research on CDLs and the development of best practices for their implementation.

In a paper published, Eraxiang et al. [4] outlined the drawbacks of the conventional library management systems. He offered a workaround for the drawback by leveraging the MVC architecture's struts and hibernate framework. Another name for the MVC design is a multilayer tier, which includes the database layer, presentation, business, and data persistence layers. These additional characteristics increase the system's reusability and maintainability.

Despite the fact that the authors [5] of this study provide a quick explanation of how to develop a digital system that is more likely to be adopted and accepted by users. Their goal was to reduce the discrepancies between the realities of local users and system design. A web-based system that is easy to use is being implemented to meet the demands of both the library staff and users.

In their paper[6] Smith highlighted the challenges faced by traditional library systems in adapting to the digital age. These challenges include:

- The shift from physical to digital collections: Traditional library systems were designed to manage physical collections of books, journals, and other media. However, the increasing popularity of digital content has made it difficult for these systems to keep up.
- The need for new skills and expertise: Librarians who are responsible for managing digital library systems need to have new skills and expertise in areas such as metadata management, digital preservation, and information security.

- The need for new partnerships: Traditional libraries is increasingly partnering with other organizations, such as universities, businesses, and government agencies, to develop and manage digital library systems.

Proposed System :

An online library management system is one potential solution to the issues with the current traditional library system. It's basically a Windows program that was made mainly with Python and relational databases. Moreover, comparable apps can be made by combining web technologies like HTML, CSS, and JavaScript. By entering the book's allocated book ID, the librarian can use this application program to swiftly search any book. He can also add new students and books to the library database, issue and return books, and make the necessary changes to the database section using the application user interface. The application is divided into sections based on how each is used. Each part is explained in the section on architecture in this article.with a corresponding database, which could be a relational database like SQL, Oracle, or MongoDB or a no-SQL database like MongoDB.

A. Advantages

The advantages of our system are as follows:
1) Cut down on paperwork and strengthen data security at libraries.
2) Digital Narration
3) A virtual bookshelf is an app or website that accesses a digital copy of a physical bookshelf.
4) Evaluation of the books
5) Docker virtualization
6) The cost of management is lower
7) Web apps with features like bookmarking, annotation, online reading, and citation management can boost output and enhance user experience.
8) Creating a customized report for fines, inventories, and library items is straightforward when utilizing KOHA.
9) By reducing the need for physical transportation and the amount of paper consumed, digital libraries contribute to the creation of a more sustainable environment.
10) Digitization preserves rare and delicate assets for a wider audience while making them more accessible.

B. Requirements for Deployment

For the "Modernization of College Library" project to be implemented successfully, a wide range of hardware, software, and network infrastructure criteria must be met. These components are essential to guaranteeing the system's effective operation and user accessibility. The following are the requirements for deployment:

Server Hardware: The project's database, AI recommendation system, and web-based interface all require a dedicated server. For the server to efficiently manage concurrent user interactions, it must meet minimum hardware requirements for CPU, RAM, and storage capacity. A server with the specifications shown below would work.

- CPU: Dual-core 2.0 GHz or higher
- RAM: 4 GB (recommended: 8 GB)
- Disk Space: 20 GB free space

Database Server: For effective data storage and retrieval, a stable database server that is compatible with MySQL is needed. To handle the anticipated data load, enough processing power and storage capacity should be set aside. The server has to be able to execute MySQL 8.0.35, the most recent version. The server must also be able to run the following software:

Network Infrastructure:: In order for users to access the system, both internal and external, a dependable internet connection is essential. Enough bandwidth and high-speed internet are necessary to enable smooth user interactions and data transfer.

Software Components: A number of software components, including web server software (like Apache), database management systems (like MySQL), the open-source library management system KOHA, and Python with TensorFlow for the AI-driven recommendation engine, will need to be installed and configured as part of the deployment. The requirements for the software components are as follows:

- KOHA 23.05
- Python 3.11
- PHP 8.2
- Docker 24.0

Backup and Recovery Systems: Establishing strong backup and recovery mechanisms is necessary to guarantee data integrity. It is imperative to have regular automated backups of the system setup and database

User Training: To guarantee that users can effectively navigate the new system and fully utilize its features, deployment requirements include providing enough training for end users and library personnel.

.3.1 Methodology :

A.Database Structure

The process of developing a comprehensive data model for a database and controlling data duplication is known as database design. The data model contains all of the conceptual, logical, and physical storage factors required to create a design in a Data Definition Language (DDL). DDL is used to create databases. In a completely attributed data model, each entity possesses all of its properties. A variety of tasks that are frequently included in the database design process are assisted by database designers.

- Conceptual Layout

  The ERD Fig. 1 that is shown below shows the entities in the LMS, their relationships, and the attributes of both entities and their relationships. The ERD contains descriptions of every piece of data that the system creates, saves, transforms, and receives.

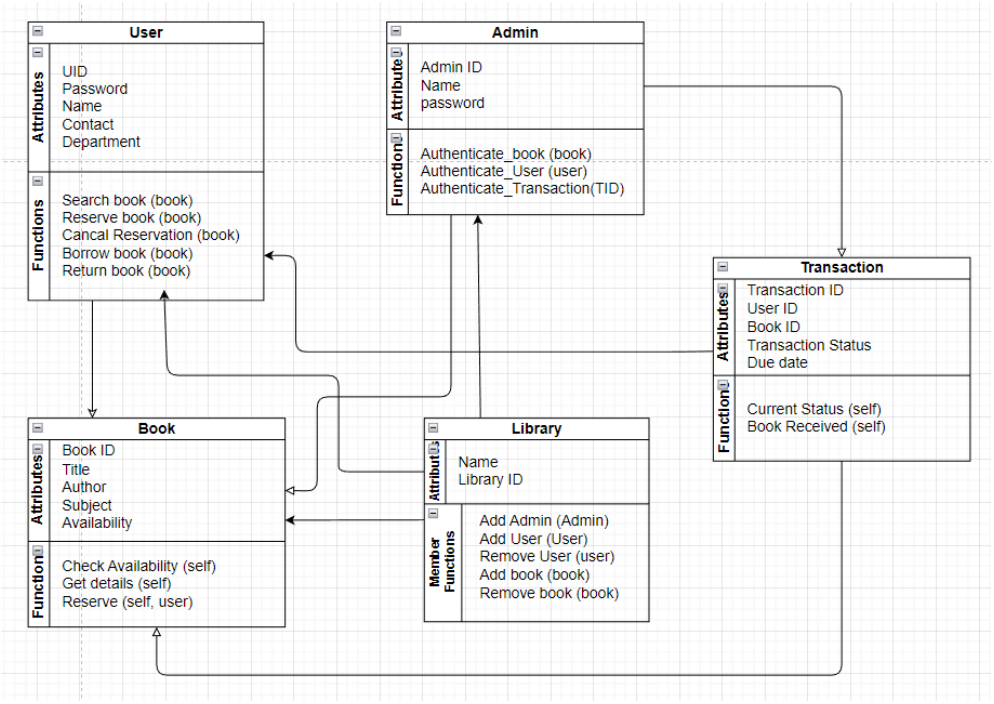


***Fig* 1. Entity Relationship Diagram**

- Logical Design

Logical design is created by organizing data into a set of logical relationships known as entities and attributes. An entity represents a piece of information.In a relational database, a table and an entity always match. A module that aids in defining what makes an entity unique is called an attribute. In relational databases, an attribute maps to a column, while an entity maps to raw data.

- Physical Design

At this stage of the design, the pertinent data, types, field widths, attribute domains, and indexes are specified together with the table creation strategy. For anyone to be able to use the plan to establish a database, it must contain enough information about the relevant fields

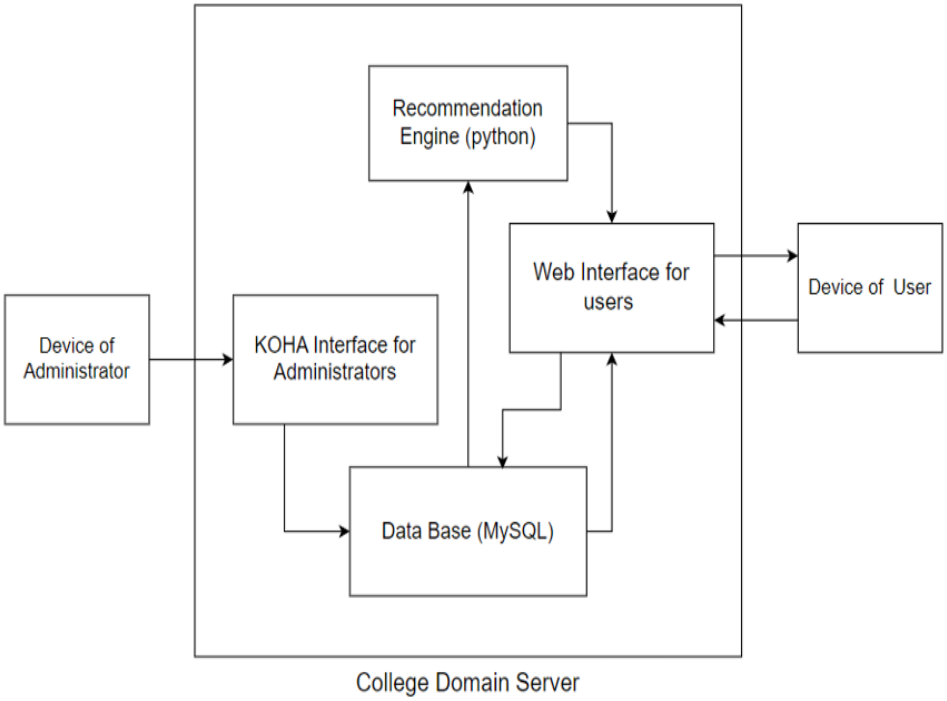
The intellectual and logical designs were unaffected by physical considerations. Even though those physical limitations are our main concern, we are also working on relational models and developing MySQL-based database management systems (DBMS).

B.Architecture Design

Fig 2 show the architecture design of our proposed system

1. A user uses their device (computer, phone, etc.) to access the library system.
2. After verifying the user's identity, the device administrator makes sure they are authorized to access the system.

3. To retrieve or update library data, the device administrator (or user interface) communicates with the KOHA Enterprises link.
4. To retrieve or update library data, the device administrator (or user interface) communicates with the KOHA Enterprises link



1.Recommendation System

I.Recommendation system is made of three subsystems.
1.Content based filtering:
Content-based filtering is a recommendation system technique that suggests items to users based on the features and characteristics of the items they have previously shown interest in or consumed. This approach relies on analyzing the content or attributes of items, such as text, metadata, or features, to understand their nature and match them to users' preferences. In application, the content-based filtering finds the books that are most recently read by the user and based on that information, generates the list of books that have not been read by the user, but they are like books recently read by user

2.Collaborative filtering:

Collaborative filtering is a recommendation system technique that makes predictions about a user's interests or preferences by collecting preferences from many users (collaborating). This method assumes that if target user has similar preferences to certain other user on certain items, target user is likely to have similar preferences to its similar user on other items as well. In this subsystem, the users whose behavior is like target user are found and certain books read by those users which are not yet read by the target user are recommended to the target user.

3.Randomized recommender:

It is possible that for some reason both of above recommendation modules are unable to generate any recommendations in certain situation. This happens often when the target user is newer or the library is newly opened or some new books has been added into the library roaster. To deal with this, user is given some random recommendation for books, as user interacts with those books, it might generate data for above two models. In addition, the randomized selection of books can be made limited to the carrier path of the user or any other available information available about the user.
The first two subsystems are dependent on finding similarity between two objects. To find that similarity, a similarity metric is used. The Recommendation system for the library is based on the similarity metric called “Cosine similarity”.
The cosine similarity is a metric used to measure the similarity between two vectors in a multidimensional space. It calculates the cosine of angles between the vectors, providing a measure of their orientation and similarity, irrespective of their magnitude. This metric is used is relatively less complex recommendation systems and unsupervised machine learning models.The value of Cosine similarity metric ranges between -1 and 1

1 indicates that the direction of two vectors is same (cosine of 0 degrees). This implies that the objects that are compared are similar.
2 2)0 indicates that both the vectors are perpendicular to each other (cosine of 90 degrees). This implies that the objects that are getting compared are not related with each significantly.

3 -1 indicates the directions of vectors is opposite (cosine of 180 degrees). This implies that the objects are completely dissimilar.

I.Algorithm outline:

1.Collaborative filtering:

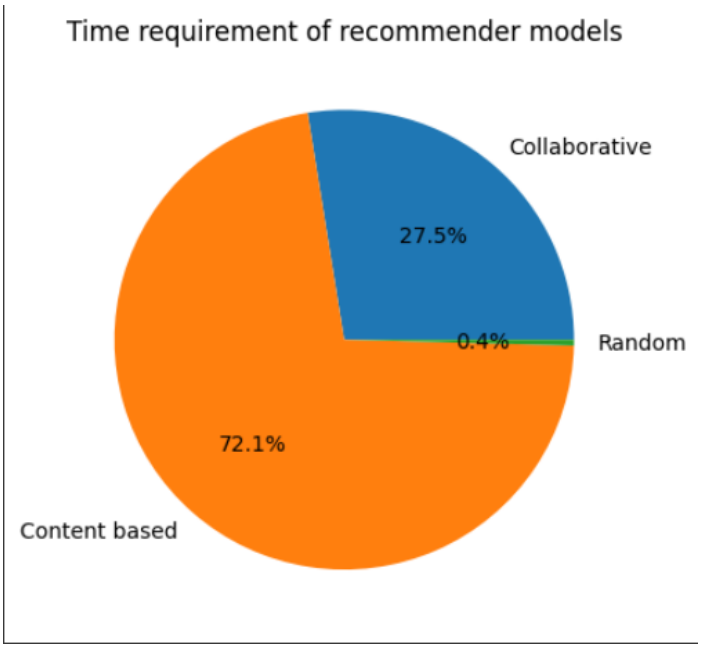
1 Find similarity between target user and each other user
2 Select top K users that are most like target user.
3 For each selected user, find the books that the user has read but target user has not.
4 If the books have been read by multiple users, rank it above others.
5 Recommend top x number of books that the similar users have read.

2.Content based filtering:

1 Select K number of books that have read by target user.
2 Find the books that are most like those books but have not been read by target user.
3 Sort them according to similarity
4 Recommend top x number of books that are like books that have been read by target user.

II.Time requirement

The pie chart you sent me shows the time required to train different recommender models. The recommender models are split into three categories: collaborative, content-based, and random. Collaborative filtering takes the most time to train, at 72.1%. Content-based filtering takes 27.5% of the time to train. Random filtering takes the least amount of time, at only 0.4%



III.Memory

The bar chart show the memory required by different predictor components. The x-axis labels the different predictor components, which include collaborative, content-based, and random. The y-axis shows the memory usage in megabytes (MB).

Here's a breakdown of the memory required by each component:

Collaborative: This component requires the most memory, at 8 MB.

Content-based: This component requires 6 MB of memory.

Random: This component requires the least memory, at 2 MB.

It appears that collaborative and content-based predictors use more memory because they likely consider more complex relationships between data points. Random predictors may use simpler algorithms and thus require less memory.

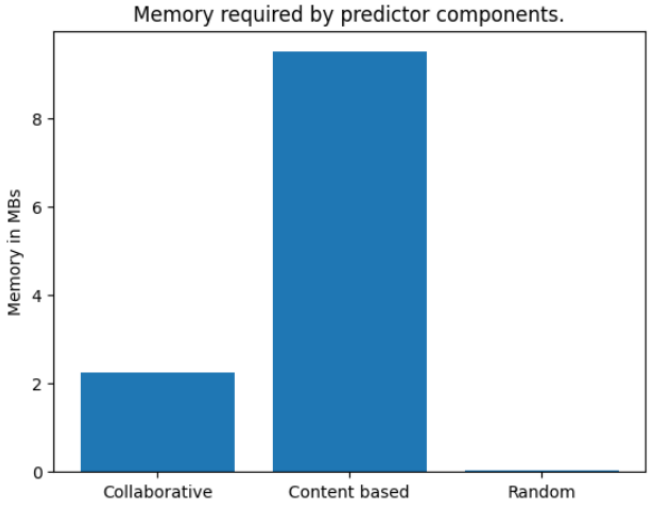


Fig 2

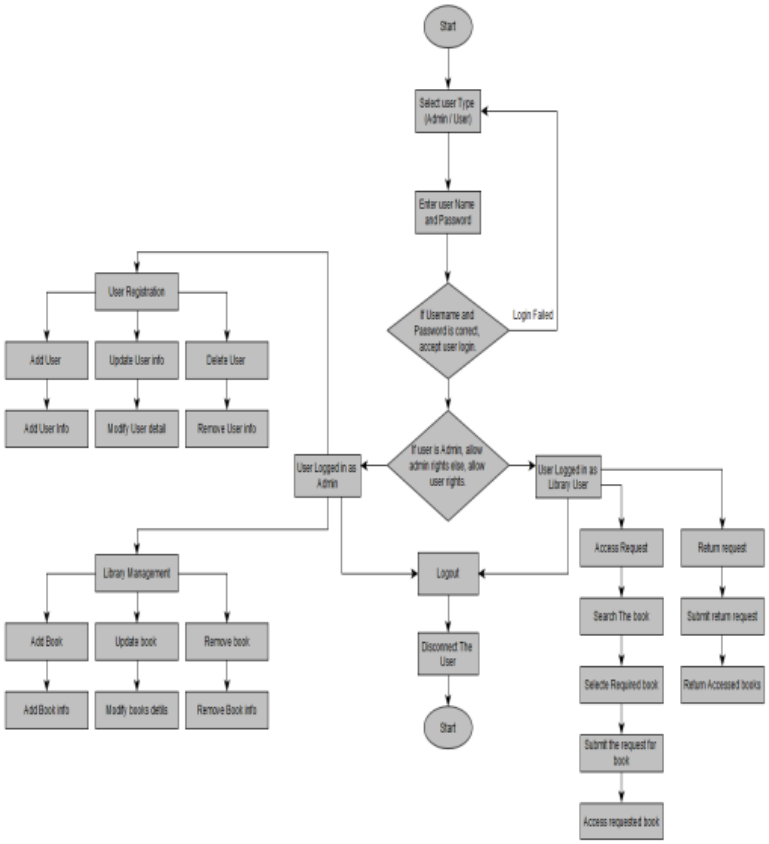


Fig 3 . Flowchart of the Proposed System

D..Module design

The system's flowchart, which consists of low-level design program specifications with the module's complete functional logic expressed in pseudo-code, was explained in Fig.3

4. Conclusion :

The need to simplify life and speed up processing has led to the computerization of numerous processes. Among the many industries that computer technology has revolutionized is education. To encourage technology-driven teaching, a Web-based LMS has been developed to manage all library operations, including the insertion of new books, updating user information, and overseeing the loaning process.

Based on a careful examination and assessment of the system that was developed, it is reasonable to conclude that it is an efficient, useful, and trustworthy LMS. The first minimal expectations are sufficiently satisfied, and it operates correctly. The new approach is expected to increase staff and user productivity when utilizing the library system. This system not only overcomes all physical library constraints, but it also provides instantaneous member report generation, rapid database storing of member information, and anytime file addition, alteration, or deletion using this database.

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