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Knowza.io – Advanced Library Management System

Vinod Bhat [1], Rahul Gaikwad[2], Manjiri Tare[3], Dipali Gharate[4], Martina D'Souza[5]

[1,2,3,4]Students, Dept. of Information Technology, Xavier Institute of Engineering, Maharashtra, India
[5]Professor, Dept. of Information Technology, Xavier Institute of Engineering, Maharashtra, India

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Abstract – *A Library Management System (LMS) is an integrated software system designed to handle the many activities and operations of a library. It aids with the automation and streamlining of conventional manual library administration activities such as book procurement, cataloging, circulation, user management, and reporting.Knowza.io is an online gateway that allows users to access library resources, search for books, and request materials. It provides librarians with a variety of tools to manage the library's collection, track user activity, produce reports, and handle administrative responsibilities such as handling fines and fees.Knowza.io assists libraries in improving their services, improving the user experience, and optimizing resource use. It is an essential tool for all types and sizes of libraries, including academic, public, and special libraries, to properly manage their resources, engage their users, and encourage lifelong learning*

Key Words: **NodeJS, Express, MongoDB, Web Scrapping, Docker, GitHub Actions, React, Python**

1.INTRODUCTION

A Library Management System (LMS) is a software application that assists libraries in efficiently managing their operations and services. It provides a centralized platform for librarians to manage and organize library resources like books, magazines, newspapers, audio and video materials, and digital resources.

Cataloguing, circulation, acquisitions, serials management, and patron management are common features of an LMS. Cataloguing enables librarians to create and maintain a database of library resources, including metadata such as author, title, year of publication, and subject. Librarians can track the circulation of library materials, such as lending, renewing, and returning books, using circulation management.

Through acquisition management, librarians can manage the purchase and receipt of new library resources such as books, journals, and other materials. Librarians can manage patron accounts, including registration, borrowing privileges, and fines, using user management.

LMSs can also include features like search functionality, an online catalogue, and a reservation system, making it easier and more convenient for users to access library resources. LMSs can also provide librarians with analytical tools for tracking library usages, such as circulation statistics, resource usage, and user behaviour.

Overall, learning management systems (LMS) are critical tools for libraries to manage their operations efficiently, provide quality services to users, and improve the overall library experience.

2. BACKGROUND

For millennia, libraries have been an important aspect of human society, functioning as storehouses of knowledge and information. Libraries have developed and adapted to shifting societal requirements and technology breakthroughs over time. Before, libraries managed their holdings using manual methods such as paper-based catalogs, index cards, and circulation ledgers. These systems were inefficient and time-consuming, resulting in inefficiencies in library operations.

Libraries began to use automated methods to manage their collections with the development of computer technology in the twentieth century. The earliest library automation systems, which used mainframe computers and batch processing, were implemented in the 1960s and 1970s.

Library automation systems expanded to include client-server architectures and graphical user interfaces as personal computers became increasingly common in the 1980s and 1990s. These tools, known as Integrated Library Systems (ILS), enabled librarians to better manage their holdings and deliver services.

Web-based technology and the internet ushered in a new era of library automation systems in the early 2000s. These Library Management Systems (LMS) provided increased flexibility and accessibility, allowing consumers to search and access library materials from any location with an internet connection.

LMS systems nowadays are more complex and sophisticated, with capabilities like artificial intelligence, machine learning, and cloud-based architectures. In a fast-changing digital world, they provide libraries with significant tools for managing resources, engaging patrons, and promoting lifelong learning.

3. METHODOLOGY

3.1 Module Description

User Module: This module has the following functionality

- ***Login:*** Web page that lets the user log into their account to access the web page. This is done with the help of email and password combination and an error is thrown if these credentials are given incorrectly.
- ***Sign up:*** This page allows the user to create a new account with Knowza.io to access the web app.
- ***Search for Books:*** This functionality deals with the searching of books that are present in the library (database) to check for their availability as well as if the book is present in the library or not.
- ***Issue Books:*** Users can issue books (max of 3 at a time) by just scanning the barcode present on the back of the book for quick and easy issuing of books.
- ***Add to Watch list:*** If the book which the user wants is not present (available) in the library then they can add the book to the watch list so that they will be reminded when the book is available in the library.
- ***Pay Fine:*** If the user fails to return the book on time, then there will be a fine associated with every day the user fails to return the book. This fine can be paid by this web page. Uses Stripe as a payment gateway.

Admin Module: This module consists of the following functionality

- ***Login:*** Web page that lets the admin log into their account to access the web page. This is done with the help of email and password combination and an error is thrown if these credentials are given incorrectly.
- ***Sign Up:*** This page allows the admin to create a new account with Knowza.io to access the web app.
- ***Activate User Account:*** This is used to activate the user account that has just created a new account for Knowza.io.
- ***CRUD operation on books:*** Since the library is a place where books are constantly updated, added, or pulled down from the library. Admin can ADD, UPDATE, and DELETE books present in the database using this web page.
- ***Return Books:*** The books taken by the user need to be returned to the library this is done by the admin by just scanning the barcode on the back of the book and the return is successfully done.
- ***Get data like issues, returns, payments, etc.***: Admins can get data regarding the issues, returns, payments, and users so that they can create a report as well as a record of all the activities associated with the library.

Notification Module: This module consists of the following functionality

- ***Account Activation***: Users' account needs to be activated in order for them to issue books. This sends a mail to the user informing them about successful account activation. So that the user can use the website's functionality like issuing books.

- ***Password Reset and Update:*** This sends mail about the password reset link as well as mail about successful password updates.
- ***Book Available***: This is a mail telling the user that the book that they were interested in issues is available in the library.
- ***Payment Receipt***: After the successful payment procedure a receipt will be sent to the user informing them about their payment.
- ***Return Book:*** This tells the user about the successful return of a book that was issued by the user and handed over to the librarian.

Payment Module: This module consists of the following functionality

- ***Payment:*** This is the helper module that does all the hard work of collecting precious money as a fine from the user and depositing it to the library account using Stripe.

3.2 System Architecture

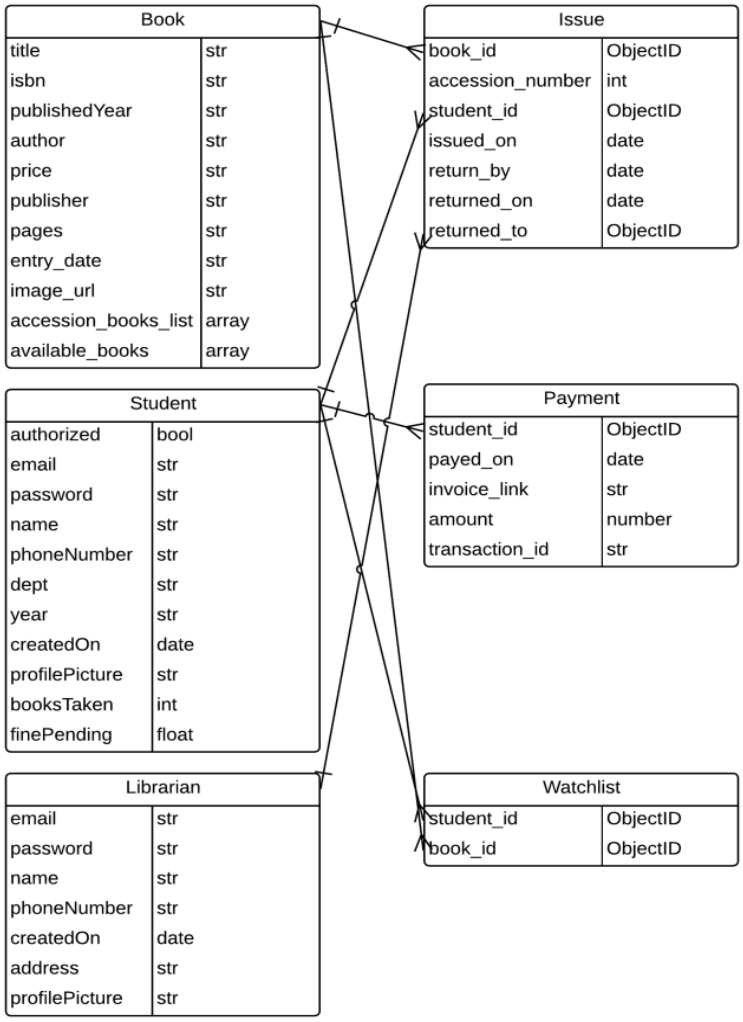

Fig -1: Entity Relationship Diagram

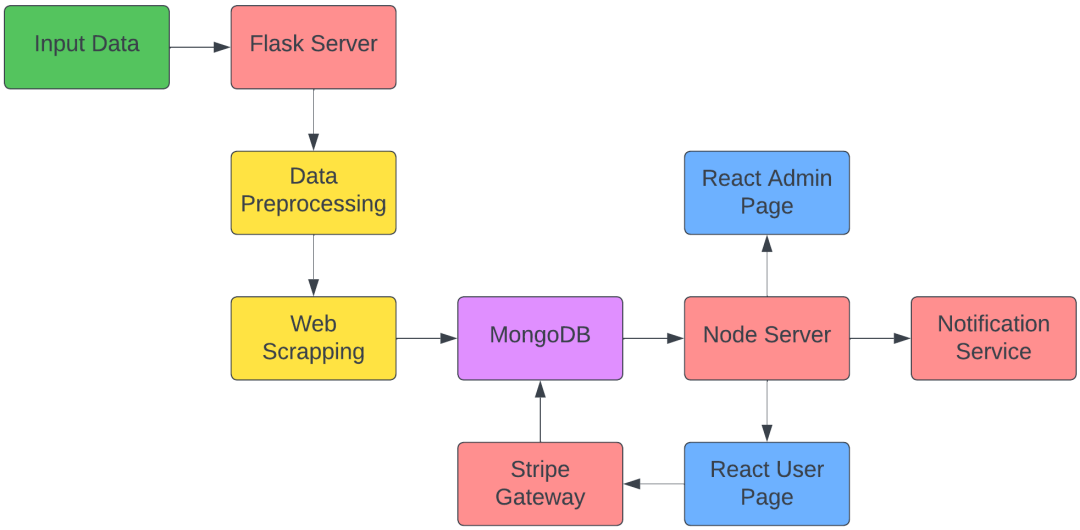

Fig -2: Proposed Methodology

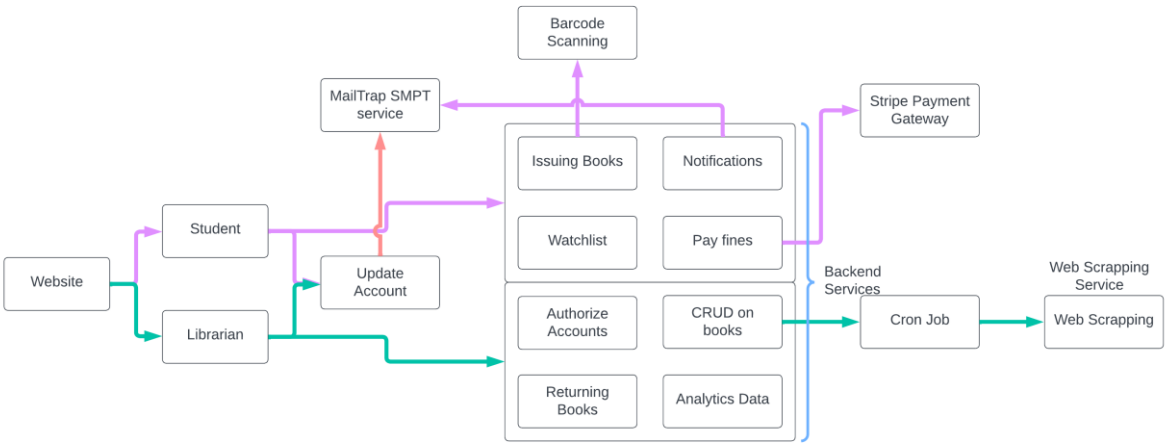

Fig -3: Flow Diagram

3.3 Evaluation Methods

Evaluation techniques are systematic processes used to examine a program's, product's, or service's efficacy, efficiency, and overall performance. Surveys, interviews, observation, testing, and data analysis are among the methods used to give feedback and insights that may be utilized to enhance the program, product, or service.

- ***Usability Testing:*** This entails watching how users engage with the system and gathering feedback on its usability, user interface, and overall user experience. This is very important as to ensure user the best experience.
- ***Performance testing:*** This approach evaluates the system's capacity to manage many users and transactions, such as book checkouts, returns, and payments. The system must handle large amount of load as in production.
- ***Security testing:*** This includes evaluating the system's security features, such as data encryption, access control, and authentication methods, to guarantee sensitive data is protected. No user may login into other user's account.
- ***Functionality testing:*** This approach entails evaluating the system's functioning to ensure that all features and modules are operational and fulfill the requirements of the library and their corresponding functions.

- ***Compatibility testing:*** This approach assesses Knowza.io's compatibility with various operating systems, web browsers, and devices to ensure all users can access and utilize the system. So that the user can use website without issue.

- ***Acceptance testing:*** This process entails testing the system against the needs and specifications of the library to verify that it satisfies their expectations and is fit for usage. All the functionality is handled and issued in the website.

- ***Post-implementation review:*** This approach entails gathering feedback from library employees and users after the system has been installed in order to identify any difficulties or areas for development for smooth function of library.

3.4 Experimental Results

The outcomes or findings of an experiment or research are referred to as experimental results. The findings of an experiment are examined to develop conclusions regarding the impact of the independent variable(s) being researched on the dependent variable(s). Typically, experimental results are presented as quantitative data, such as statistical analyses or graphical representations. To summarize, experimental results give empirical data that may be used to support or invalidate hypotheses or ideas regarding the topic under investigation.

In this section, we will look into the implementation of the proposed system by performing certain experiments/tests to check whether the system provides accurate or expected results and can handle high loads and also if we get the outcomes that we expected before testing the system in the implementation phase.

Table -1: Explains the Test cases.

Test Case	Testing Purpose	Testing Condition	Expected Outcomes	Actual Results
Login	To check if the user can log in to their account	If the user provides invalid credentials, then the system will throw an error	Grant access to the website upon passing of correct info	User logs into the website successfully
Sign Up	To check if the user can create a new account	If the User provides with details that are not accepted by the system or in the wrong format then it will throw an error	Successfully create a new account with the given info	User gets access to the website by the newly created account
Search for Books	Check books based on ISBN, Author name or Book name	User provides unknown or wrong details	Provides the user with the correct info based upon the given info	Shows the book present in the library (database) by the parameters provided by the user
Issue Books	To test if the user can issue books by just scanning the barcode from the back of the book	User scans a barcode that is not valid	Book is issued to the user	User successfully issues the book which is scanned by the user
Add to Watch List	Check if a book can be added to watchlist	Book cannot be added to the watchlist	Book is added to the watchlist	The book provided by the user is successfully added to the watchlist queue
Pay Fine	To test if payment can be done	Payment cannot be done by the user	Payment is successfully done by the user	Fine is paid by the user using stripe payment gateway

Activate User Account	Admin can activate the users account which they have created	Account cannot be activated by the admin	User's account is activated successfully by the admin	The user accounts which have been accepted by the admin is activated successfully
CRUD operations on books	To check if the admin can perform CRUD operations on the books	If the admin provides invalid details, then the system will throw an error	Perform successful CRUD operations	Admin can create, update, delete, and read books from database
Return Books	To check if admin can return the issued books back to the library	Admin scans the invalid barcode	Successful return of books	Admin can successfully return the issued books from the user by scanning the barcode
Get data like issues, returns, payments, etc.	Get analytical data like issues, returns, payments, etc.	Check if the data given to the admin is accurate	Provides the admin with the correct info for analytics	Give the Admin the accurate and real-time data
Account Activation, Password Reset and Update, Book Available, Payment Receipt, Return Book	Send emails to the user	To check if the mails are sent to the users properly	Send email to the desired user	By given condition the emails are sent to the users
Payment	Check if payment microservice can handle multiple payment requests	Payment cannot be done	Payment is done successfully	Payment microservice can handle payment microservice

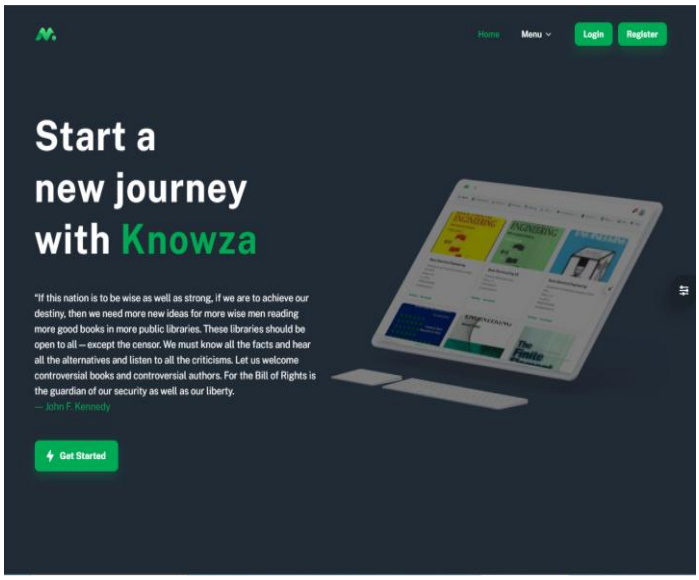

Fig -4: Home Page

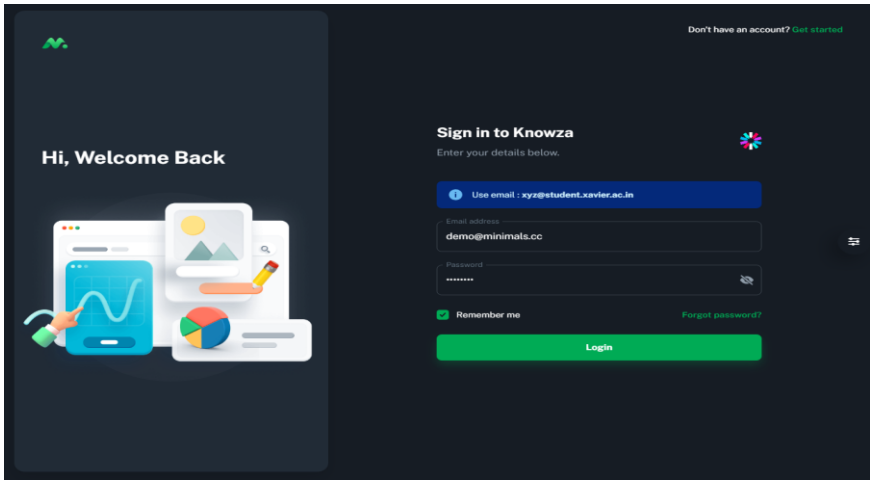

Fig -5: Log in / Sign up page

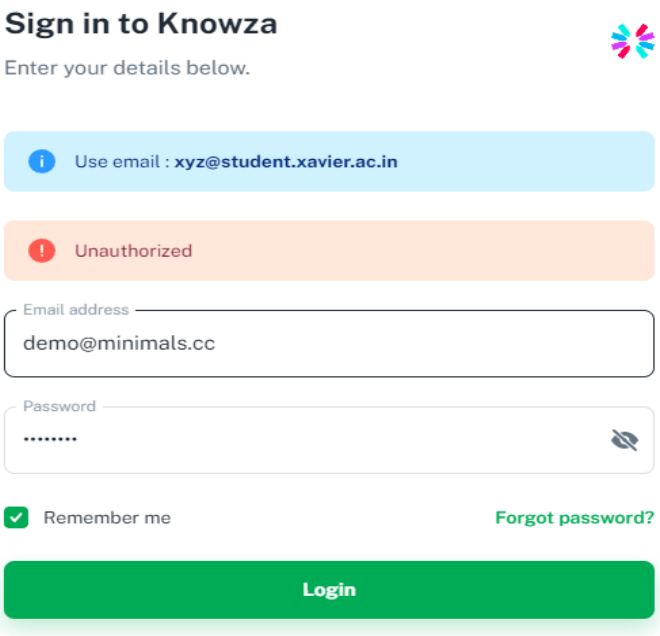

Fig -6: Invalid Credentials

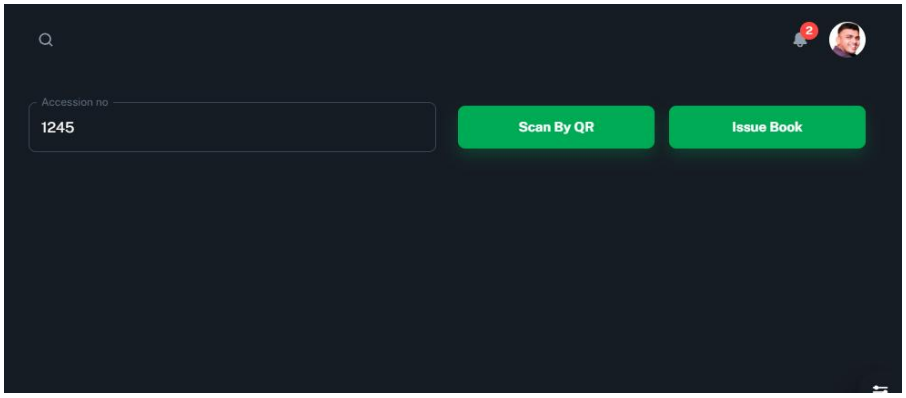

Fig -7: Issue Books

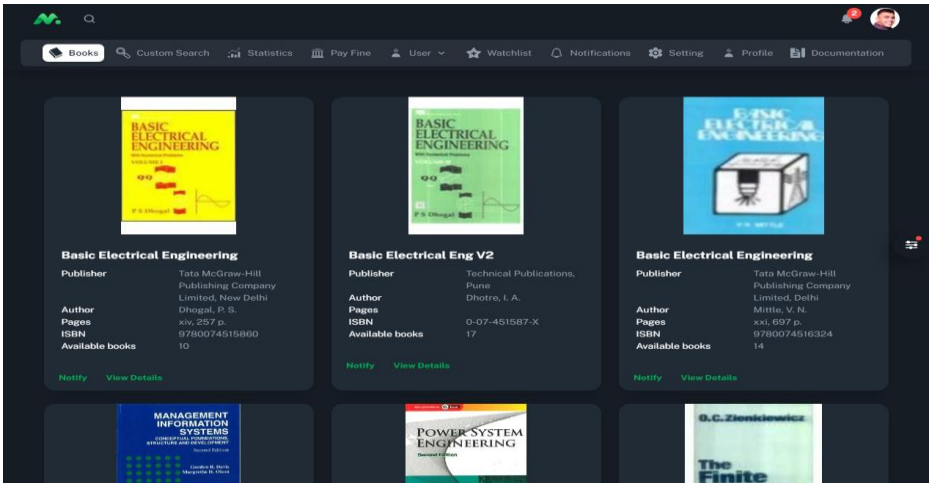

Fig -8: View Books

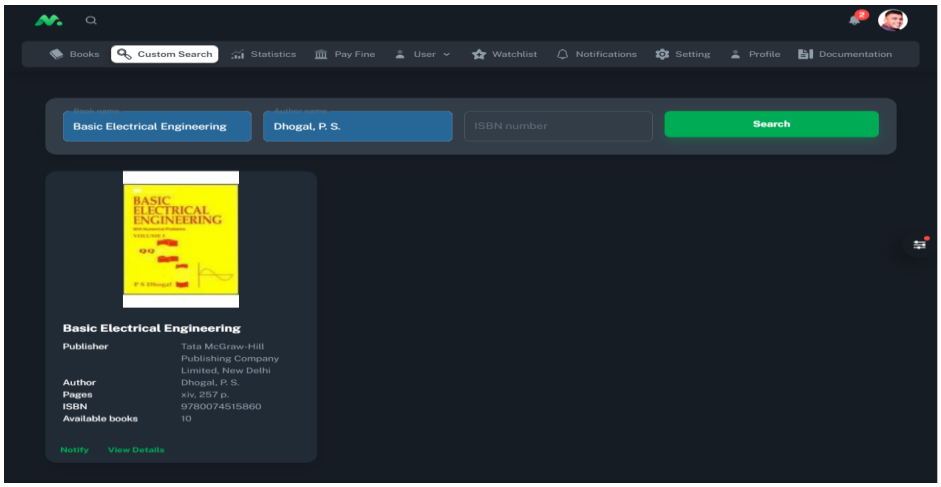

Fig -9: Search Books

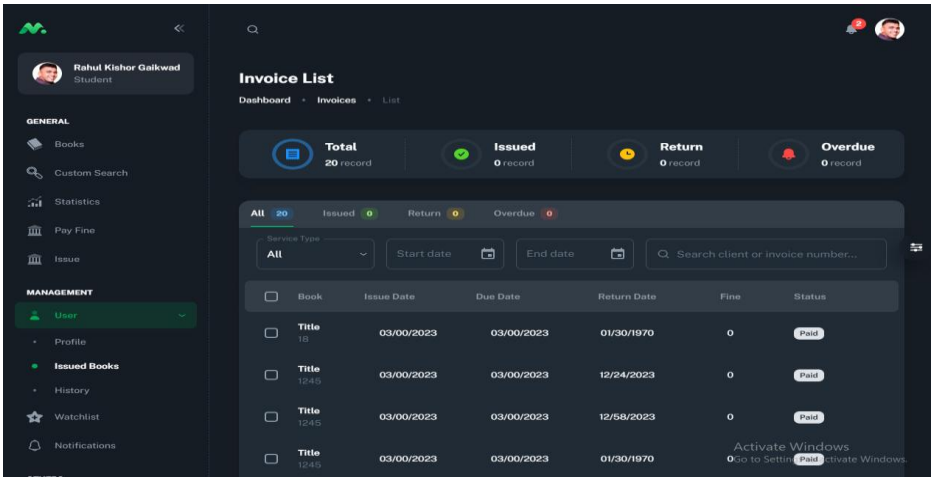

Fig -10: Issued Books

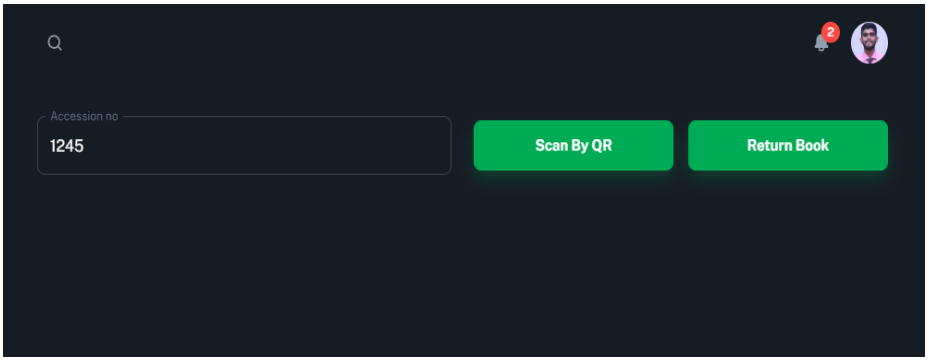

Fig -11: Return Book

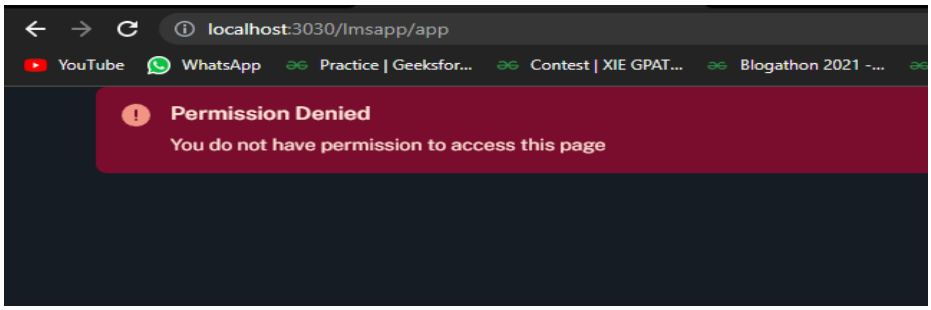

Fig -12: Permission Denied

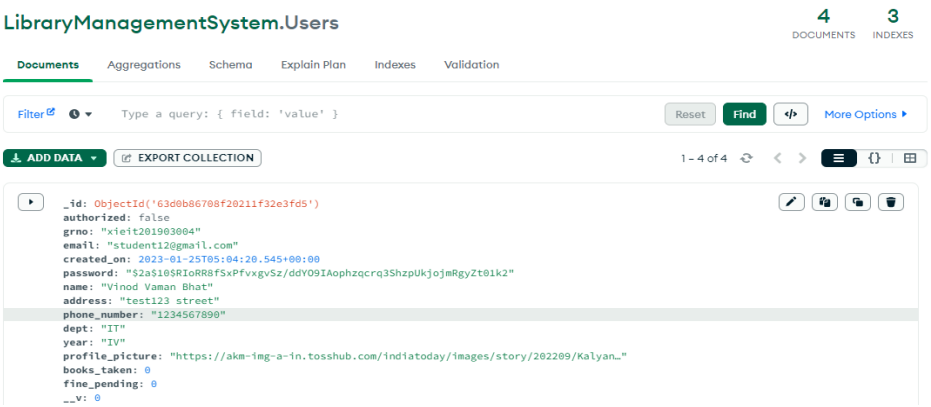

Fig -13: User Database

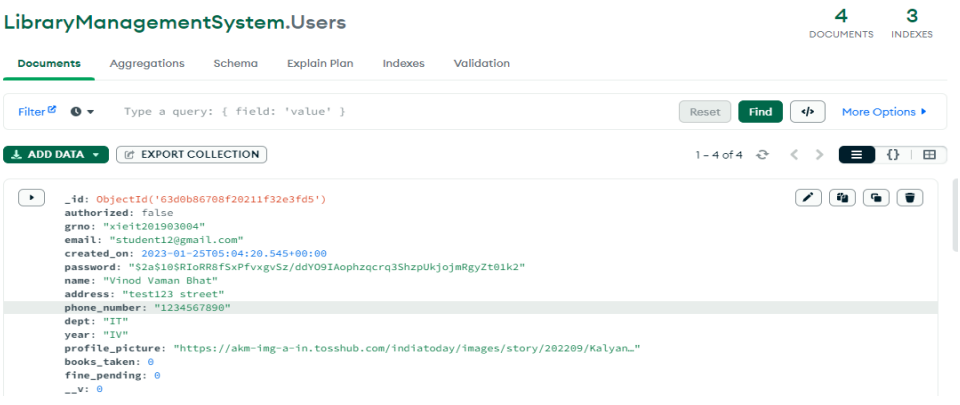

Fig -14: Books Database

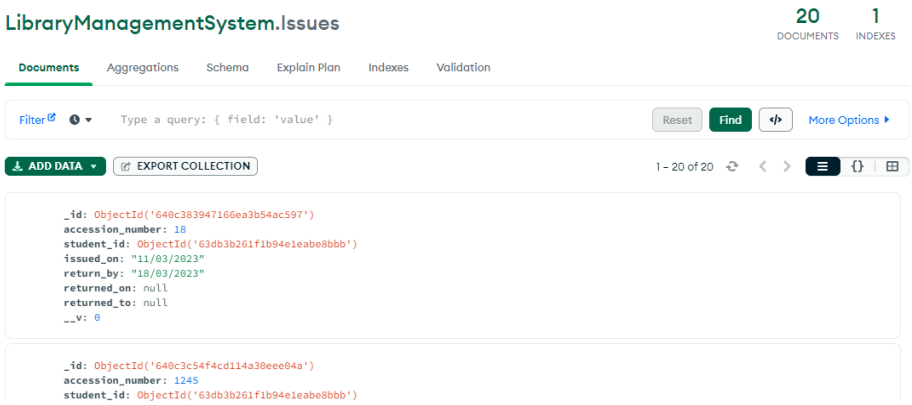

Fig -15: Issues Database

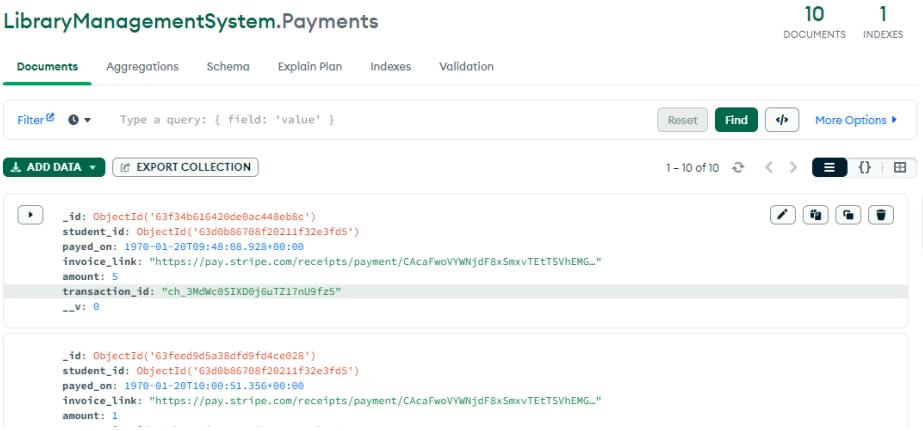

Fig -16: Payments Database

3. CONCLUSIONS

Knowza.io systems are essential tools for modern libraries to effectively manage resources, engage users, and encourage lifelong learning. They provide increased efficiency and accuracy in library operations, greater resource use, improved user experience, and data-driven decision-making. However, they also require careful design, implementation, and continuing maintenance. To ensure the success of Knowza.io, libraries must ensure that the system is linked with their objectives and goals, that staff members are educated to use it successfully, and that it is updated and maintained on a regular basis to guarantee its dependability and security. Additionally, users must be able to access library resources, browse for books, request materials, and renew borrowed things using online portals.

In conclusion, Knowza.io systems are critical tools for modern libraries in order to manage materials, engage patrons, and encourage lifelong learning. They provide a number of advantages, including increased efficiency, a better customer experience, and data-driven decision-making. However, to ensure the success of Knowza.io, proper design, and continuing maintenance are required. Knowza.io systems, with proper planning and implementation, may help libraries survive in the digital era and continue to serve as valuable community resources.

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