Sustainable Development of Libraries in AI Era

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E-mail: devyanipublishers1982@gmail.com

First Published 2025

ISBN 978-93-93751-92-8

PRINTED IN INDIA

Published by Devyani Publishers and Distributors, 781, Ground Floor, Bagwan Apartment Sector-28, Rohini, Delhi-110042. Typeset by Rudra Computers, Delhi 110093 and Printed at Milan Enterprises, New Delhi

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A Strategic Blueprint for Designing an Academic Library Website (Portal) with Drupal Content Management System

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ABSTRACT

Drupal, is an open-source CMS which has gained popularity for its flexibility, robust security features, and cost-effectiveness, making it an ideal choice for designing academic library websites/portals. It is known for being secure CMS website builder platform and protects against hackers, SQL injection, and cross-site scripting-like web vulnerabilities. The authors provide a blueprint prototype model of the Academic Library Website/Portal. It enables library professionals to quickly manage and update their daily content management work on the website/portal The paper help the library professionals understanding and demonstrating the potential of using the Drupal Content Management System (CMS) for Academic Library Website including the site building operations, theme selections, menu building, and data content management using taxonomy tools and taking the backup,. The study aims to equip library professionals with the knowledge and skills to develop, design, and maintain a dynamic and sustainable academic library website.

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Keywords: Drupal, CMS, Content Management, LIS, Library Website

Introduction

Academic libraries have long been central to educational institutions, serving as repositories of knowledge in various formats, including print, electronic, and online. They play a critical role in preserving and disseminating scholarly information to meet the needs of academic communities across generations. With the rapid advancement of information and communication technologies (ICTs), the internet, and web technologies, libraries have undergone significant transformations. Modern libraries now leverage ICT tools, such as computing systems, web-based applications, and internet networks, to enhance their functions and services. Among these tools, the library website or portal has emerged as a vital platform for accessing resources and services, serving as a gateway for users to explore and utilize library offerings.

Despite the growing importance of academic library websites, many higher educational institutions in India still rely on static, HTML-based websites that are often outdated, lack functionality, and fail to represent library resources and services. These static websites require technical expertise for maintenance, making them costly and time-consuming to manage. In contrast, content management systems (CMS) offer a more efficient, flexible, and user-friendly alternative. CMS platforms, particularly open-source solutions such as Drupal, enable the creation of dynamic, customizable, and secure websites without the need for advanced technical skills. It is a ideal choice for designing academic library website or portal due to its cost-effectiveness, flexibility and robust security features.

Scope of the study

The scope of the present study is confined to making a prototype model of an academic library website using CMS DRUPAL. It will be a guiding tool for library authorities and library information science (LIS) professionals to help design the library website for their institutions via an open-source content management system, particularly the DRUPAL application.

Objective of the study

The following key objectives guided the study:

- ➢ Empowering library professionals to learn CMS and gain skills for developing, designing, and managing websites;
- ➢ Enhancing the user experience by enabling a user-friendly interactive web interface;
- ➢ Building a comprehensive and flexible library website with customizable layouts facilitates a wide range of supports and functionalities.
- ➢ Integrating with the latest Web 2.0/3.0 technological applications and
- ➢ Ensuring long-term accessibility and preservation of content with enhanced security.

Open-source CMS application for the academic library websites

Content management systems (CMS) are powerful digital tools designed to work in four key areas: **content creation, content management, content publishing, and content presentation.** It is a database-driven application with multiple functionalities and multiple access mechanisms. In addition to website management, it offers numerous works such as digital asset management, documentation, customization, integration with advanced technologies, and publishing web content, making them versatile and user-friendly.

Open-source CMS platforms provide significant advantages for building academic library websites. The key considerations for choosing an open-source CMS, particularly DRUPAL, include the following:

- **Ease of Use**: Intuitive interfaces and user-friendly tools simplify content creation, management, and delivery.
- **Scalability**: The ability to handle growing content volumes and user access ensures that the website can evolve with the library's needs.
- **Customization**: Flexible themes, plug-ins, and extensions allow libraries to tailor the website to their specific requirements.
- **Integration**: Support for third-party tools, APIs, and services enhances functionality and interoperability.
- **Security**: Robust security features protect against threats such as viruses and hackers, with regular updates to ensure data safety.
- **Multilingual Support**: Essential for catering to diverse user

groups in academic settings.

- **Community Support**: Active open-source communities provide resources, troubleshooting, and update, ensuring the platform remains reliable and up-to-date.

Considering these features and functions, Drupal CMS has become a cost-effective, flexible, and sustainable solution for creating dynamic, user-friendly library websites. This eliminates the technical barriers associated with traditional HTML-based websites, reduces maintenance costs, and ensures scalability, long-term viability, and continuous improvement.

Drupal: Overview

Since DRUPAL's inception in early 2001 by Dries Buytaert, it has become increasingly popular among web development media because of its free-to-use (open source GNU public license) application and provision of support from vast communities of users and developers. It provides a graphical user (GUI) interface with advanced features and functionality to interact with web users. Statistics on drupal.org state that 71% to 80% of the top 100 universities use the Drupal website for their academic operations in the last few years. The following features and functions make Drupal a unique platform for websites:

- ➢ **Open source CMS** – The source code is open and shared under a GNU public license, which is maintained and developed by both open-source and commercial teams to support development and troubleshooting;
- ➢ **More flexible** – Drupal offers a GUI platform to create, edit, reuse, and share web content in multilingual languages and carry out various complex jobs such as providing inter-linking of all content and web pages, importing/exporting formats of data, and intuitive search mechanisms are unique;
- ➢ **More scalable** – It is fast and responsive, handles vast amounts of data traffic, and has a better caching clearance that protects it from phishing and hacking issues;
- ➢ **Web 2.0 tool incorporation** – It facilitates the integration of Web 2.0 applications such as blogs, media wikis, Twitter, Facebook, aggregators, tagging, bookmarks, and cloud computing;
- ➢ **Alert service provider** – Facilities of the core RSS aggregator modules help to publish and subscribe to RSS feeds of any kind.

Users can quickly provide alert services on current news and events, forums, polls, comments, etc.;

- ➢ **Reader participation** – Facilities for commenting and discussing the topic through the forum;
- ➢ **Performance** – A superior mechanism of a performance evaluation system is used to carry out different functions and check out error logs. The press flow variant of Drupal and the Auth cache module help to accelerate user performance, and APC availability increases PHP performance;
- ➢ **Data migrations** – Facilities of any format of data migration into Drupal sites;
- ➢ **Back up** – Back up Drupal-based sites, databases, and contents are easy.

Drupal: Architecture

Drupal CMS offers a structural platform and framework for building dynamic websites. Learning an architectural overview of the Drupal application is essential. Figure.1 provides an architectural overview of the Drupal platform. It governs the following essential layer of work.

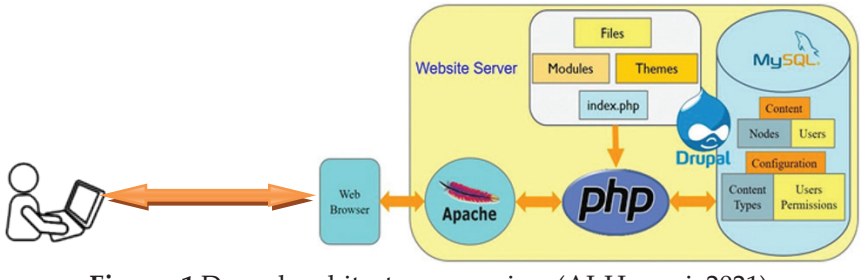

Figure: 1 Drupal architecture overview (AI-Hawari, 2021)

i. **User (web browser):** The user communicates with the Drupal web server through the web browser and obtains the desired information from Drupal's website.

ii. **Administrator:** Manages the website and controls all permission-related work. It assigns users roles for creating, editing, accessing, and using content.

iii. **Web server:** This service helps the user interaction process. When the user sends the query to the server (Apache) via HTTP (hypertext transfer protocol), the HTTP communicates between the server files and the user.

iv. **PHP:** This helps to fetch data from the database and throws back the information to the web server. Therefore, the PHP memory limit is an integral part of the Drupal architecture, which determines how quickly or delayed the information delivery, would be from the Drupal website.

v. **Database:** The database stores all the information, including user, content, and other website data. The Drupal database tracks websites, module settings, user information, access information, logging information, permissions, user roles, system paths, and content and content metadata. It also enables functions such as modifying, deleting, and updating the data content.

Additionally, the following core components are installed with Drupal to boost the various website operations and help incorporate other add-on features and functionalities. They can be discussed under the following components:

a) **Content:** The content in Drupal is flexible. It efficiently manages various types of content (create/edit/delete/update), such as pages, articles, blogs, polls, audio, video, images, etc. Further categorization or classification of content can be performed through taxonomy tools.

b) **Nodes:** Drupal treats everything as a node, except for the user account and taxonomy. When you have created a content page, Drupal automatically counts it as a node, and it continues as a sequential numeric value for the next created page. For example, page 1 = http://localhost/node/1; page 2 =./node/2;

c) **User:** Drupal has a user login system; users have a username/password. Users can be defined according to their user roles in Drupal, such as authorized users and anonymous users. The administrator of the Drupal website has the authority to assign different roles to the user by providing different permissions for editing, updating, and viewing the contents of Drupal.

d) **Blocks:** Drupal websites are customizable to any extent. The visual layouts and design can be defined under various blocks. Different themes have different layout blocks. Each block helps place the other content menu in different regions, such as the header, main menu, sub-menu, views, widgets, left/right panel, and footer;

e) **Theme:** In Drupal, themes are either built-in or added via third-party theme modules. All the visual appearance and design can be

governed through this theme module. The theme helps enhance the look and feel of your Drupal academic library website. It can be easily changed in the user interface.

f) **Modules:** Drupal architecture is modular. All content management functions can be governed through either a core module (shipped with the Drupal installer) or a contributed module (adding new functionality) to Drupal.

g) **API:** Drupal developers can use various Application Programming Interfaces (APIs) for the advanced development of certain functions and features—for example, changes in system configuration, user management, and access to the content.

h) **Cache mechanism:** It uses caching mechanisms to increase the Drupal website performance. It helps reduce the server load, increase the PHP memory limits, and improve the site running. It is also easy to track the logs of pages, blocks, databases, etc., through this caching query mechanism.

i) **Security feature:** Drupal is the most secure CMS website builder platform. It protects against hackers, SQL injection, and cross-site scripting-like web vulnerabilities.

Blueprint prototype model of the Academic Library Website/ Portal

The prime focus of this prototype model of academic library website implementation is to educate and raise awareness among library professionals about using open-source CMS Drupal. Also, the topic entirely covered the detailed steps involved in its operations. As mentioned above, if your library plans to set up a robust database-driven academic library website to enhance its services, Drupal CMS is one of the best alternatives. The initial operations or steps involved in setting up the library site using Drupal follow the following steps;

Step-1: Installation of Drupal CMS (includes server and database setup) and setting up the library homepage

Step-2: Customization of Drupal CMS library website (which includes advanced features and functions such as content creation, content management, content access, administration role, and customization of Dashboard, Content, structure, appearance, people, modules, configuration, site backup and report)

Step-3: Development and design of Drupal CMS Library website

(prototype model of academic library website)

Installation of Drupal CMS

There are two approaches to developing a Drupal CMS academic library website. Firstly, you may make a Drupal library website by setting up a local host server on your local machine, and later, you may launch it into the live institutional hosted website. Second, is you buy the cloud server space and plan to develop and launch the library website over the web and the internet. Creating the website on your local machine is always recommended, and after completing all jobs, you may export it to the institution's live website. The systematic steps for making a local machine for the Drupal installation are elaborated here. Remember, the local host website is vulnerable to a security feature that can be hacked if you run the same website online, so make sure the configuration changes are made to export it into the live cloud server space to run the website. The following system requirements are to be installed or set up for the Drupal installation they are;

- **Apache Web Server 2.4.7 + (XAMPP/ WAMPP for Windows server configuration)**
- **Mysql Database**
- **PHP setup**
- **DRUPAL Installer**

The XAMPP (X-operating system, Apache, Mysql, Php, Perl) is an integrated software package for the above server setup and configuration. The installation setup and configuration process are simple and easy. Remember, you can use the XAMPP server only for website development and testing, as it lacks security features. Download the XAMPP for window from Apache friends web and run the installer into the following path to your computer, e.g. **C:\XAMPP**. After installation, test the installation by opening a web browser and running the following **http://localhost//** in the address field. Further, check on the Apache server and MySql database services before creating a database for Drupal through the PHP-Myadmin setup.

As shown in Figure 2 below, you can now download the latest version of the DRUPAL installer (for example, Drupal 7 zips) from http://drupal.org/project/drupal. Export or unzip all data content into the following directory **C:\xampp\htdocs\..;** you may rename the folder as your library website name (e.g., for this prototype, **"libportal."** Then open the Drupal folder (after renaming libportal) and locate the **defult.**

setting.php file. You may rename it to **setting.php**. It is the index file that deals with the Drupal website. If you forgot to do so during the installation of the Drupal installer, it automatically runs the scripts, populates the database tables, and sets in the setting.php file.

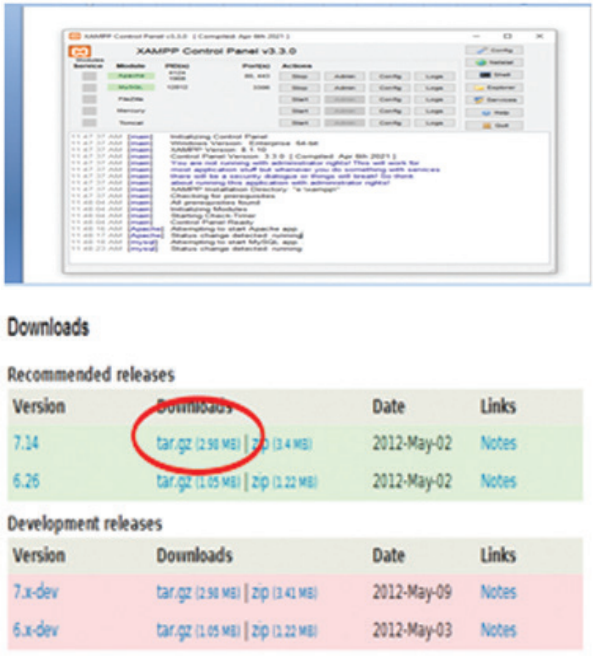

Figure 2: XAMPP Server Configuration & Drupal 7 or the latest version of Drupal download

Now, you may visit **http://localhost/phpmyadmin/** in the web browser and create an empty Mysql database for DRUPAL installation. Also, a user within the database can be made for Drupal while configuring the Drupal website. The defined MySql database can help store all the data on the DRUPAL website and control the whole website function.

After completing this step of creating a database and user account, we may run the Drupal Installer and start the installation process of the Drupal-based website via the web browser address field **http://localhost/libportal/**. Further, fill out the instructions and complete the installation and configuration process for the DRUPAL website. Finally, the newly installed Drupal homepage appears on your screen, as shown in Figure 3. During the configuration of your library website, it may be noted that

you must assign an administration user account, password, and email account to process all website work, such as assigning job roles, user management, site maintenance, backup, and other functions.

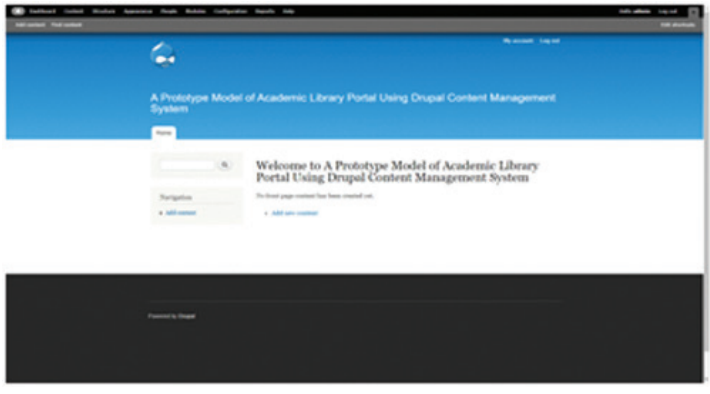

Figure 3: Prototype Academic library website primary homepage view

Customization of Drupal CMS library website

Once the installation of the Drupal-based library homepage has been completed, the next step is overall customization of the library website, which can be a range of operations to be completed before starting to create and manage the contents. Therefore, the next step is to customize the different sections of the library homepage, including layout design, menu, links, and content. To do this, log in to your library website and open the administration menu. You may find the toolbar at the top of the library homepage (header section), which contains links to each menu section. It can be viewed in two formats (administration as index and/or arranged by Task), as shown below in Figure 4.

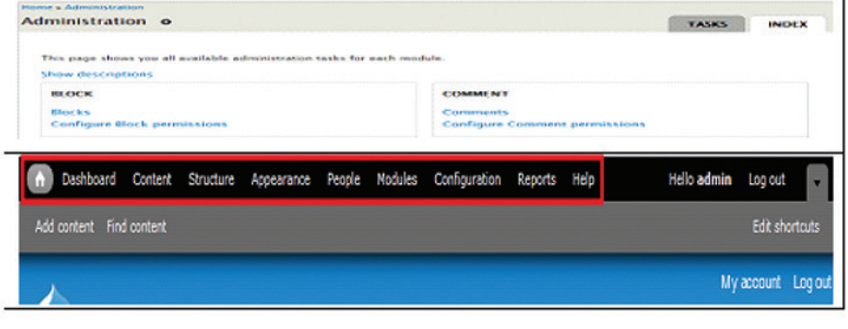

Figure 4: Administrative toolbars of Drupal website arranged by Index or Tasks

According to the tasks, the sections of customization can be made under the following heads they are namely:

a. Dashboard
b. Content
c. Structure
d. Appearance
d. People
f. Modules
g. Configuration
h. Report
i. Help

a) DASHBOARD: The dashboard specifies the different **regions/ areas/blocks** where you can place the items for your layout design, as depicted below in Figure 5. Different themes have different design layouts. Therefore, you must select the theme that best suits your library. These themes are available for free or on a payment basis.

Figure 5: Drupal Danland Theme Dashboad View

b) CONTENT: Drupal deals with all types of content like pages, stories, blogs, web forms, books, articles, etc. You can create a page by adding content to it. You may also make other content types like images, video, audio, etc. For example, if you want to ***create a content page – About Us*** following steps, you can follow as shown in Figure 6 below.

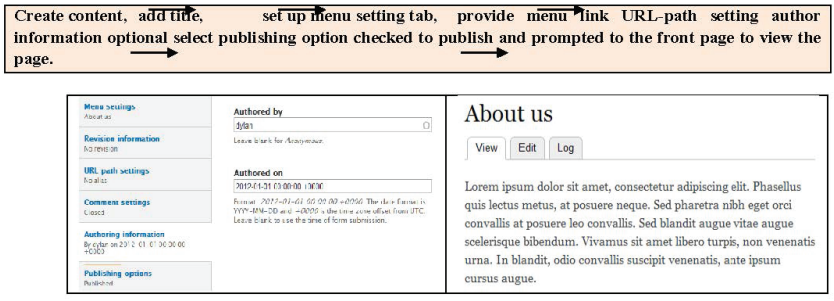

Figure 6: Content creations and publishing about us page

c) **STRUCTURE:** The structure menu primarily contains sub-menu items such as **blocks, content types, menus, and taxonomy**. It is noted that any other modules added later to your library site can also be viewed within the structure menu, such as the view module, features, and feed module.

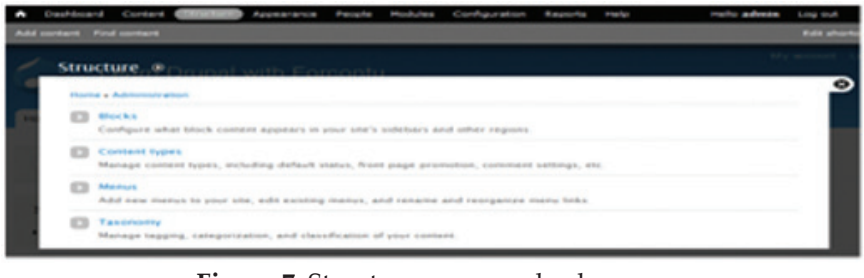

Figure 7: Structure menu and sub-menu

d) **APPEARANCE:** This menu deals with various Drupal website themes. You can change the **look and feel of the layout, sidebar, menu bar, header, footer, logo,** etc. within this theme setting. Therefore, choosing a suitable theme according to the requirements is essential for the Drupal-based library website.

Figure 8: Appearance Menu for Theme settings

e) PEOPLE: Apart from the admin user, you have provision for registering other users to assign roles and permissions in Drupal. So, multi-user applications can be applied to ensure the site's smooth operation.

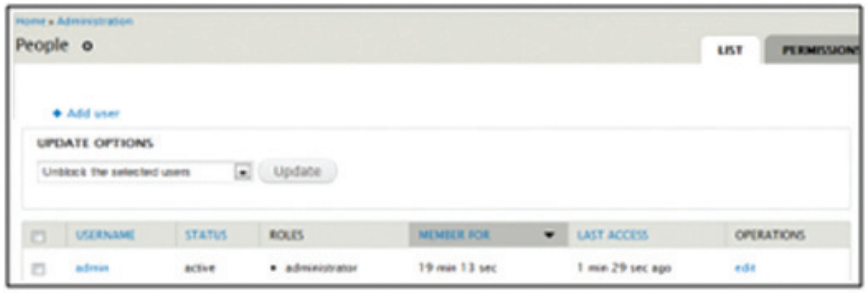

Figure 9: People's Roles and Permission

f) MODULES: In the modules menu, you can find all categories of modules, including core and contributed modules. With the help of modules, you can manage contents, configure, and assign roles and permissions that have been used for operations by enabling them.

Figure10: Modules menu

g) CONFIGURATION: Operations like system configuration and installation of third-party modules are essential areas of work for the site's configuration menu. It categorizes each section according to its working structure. As shown in the Figure below, you can manage all the configurations of the library site, including people, system, content, media, search, web services, and so on.

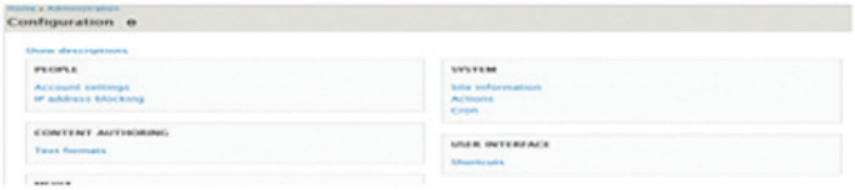

Figure 11: Configuration of the modules, system, people, and content

h) REPORT: You can access the status report of your library website through this menu. It also provides information about recent logs, errors, and available updates on your library website.

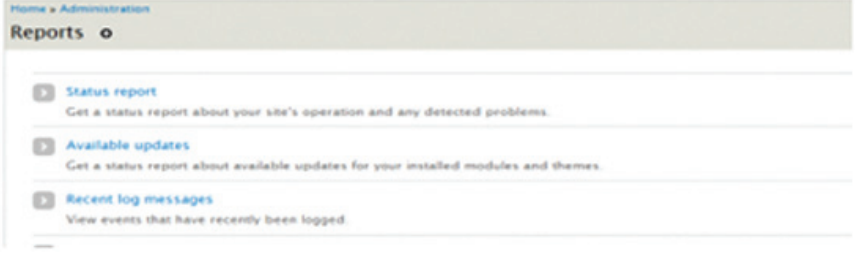

Figure12: Status report of the site

i) HELP: The help and advanced help menu offer a complete guide of information that the site builder can often use to learn more about the Drupal systems.

Before building the academic library website using Drupal CMS, library professionals must learn, identify, and acquire the basic knowledge of the above-discussed works operations and their roles in designing and managing library content.

Proposed prototype academic library website model (Development and Design)

The following proposed prototype model of academic library websites is considered a guiding avenue for academic librarians and LIS professionals who plan to develop their library websites using the Drupal CMS application. With this guidance, one can create a CMS-based academic library website. As mentioned in Table 1, the following key features and functions are prime requirements for designing, developing, and managing the variety of works for the academic library website;

Prototype Model Academic Library website using Drupal

Content outline	**(Customization) -Details Description**	**Drupal Module used for design, development, and content management**
Homepage	Site logo, slogan, header, footer, integration of social tools icon, RSS feed, Main (primary) menu, sub-menu, search box, quick tabs, and panel view	The theme, block, modules, panel module, view modules, and content creations by adding page, article, news content
Primary Menu and Secondary menu pages	Library About Us, Facilities, Services, library Tour, Contact Us pages, etc,	Create the user menu and pages for all these items (add content and assign catalog information using content types)
Taxonomical View (keywords, phrase, vocabulary controls based search, and so on)	Categorized based search optimization facilities and discovery of content, content arrangement categorically, content management and delivery	View module and Taxonomy module
Event, Image Gallery, Audio/Video Library	Advanced visualizations of contents, layouts, and delivery of content	Media, Images, Video, YouTube, View module
Digital Library, ETD, Audio/Video Library	Table view with links to each section of the contents	View, Content-Type, Media, YouTube, Video, Images modules
LMS integration (library Automation)	OPAC search facilities for all documents	SOPAC, Biblio Module
Remote Access	Remotely access to library e-resources	Email server setup, EZproxy module
Web 2.0 tools (Blogs, Face book, RSS Feed)	Publishing of library information, integration of social media for marketing and promotion of the library	Social Tools module
Site Backup and Maintenance	For the safety of the library website, regular backup of the site is required.	Backup and Migrate Module

Table 1. Prototype model of academic library website/portal using Drupal tools and technique

LIS professionals can learn these tools and techniques and start making their library websites by using these modules, themes, APIs, and blocks of Drupal CMS. For the readers' guidance, a screenshot of the prototype model website homepage is placed below in Figure 13 after customization. While constructing this prototype academic library website, we followed the following essential considerations: site building, theme selections, menu building, and data content management using taxonomy tools, backup, and their considerable operation steps, as given below.

Figure 13: Prototype model of Academic Library website/portal using Drupal CMS

i) **Theme Selection:** Always choose a suitable theme according to the requirements of your library. You must always look at the stable version of the Theme module. You may also consider its features and functions; check whether it works with all browsers, is mobile-friendly, and accommodates customization or updates. For this prototype model, **"Danland Theme,"** is chosen which is simple, beautiful, mobile friendly, and accompanied by an image slideshow, drop-down menu, add panel, image, and other tools in effective ways.

ii) Workflow Layout for Content and Menu Building: After choosing the theme for your library website, the subsequent work is planning for the menu building; block setting, content creation, and other workflow processes. Therefore, it is essential to framing a flow chat of information sources and services your library wish to deliver to the user. As depicted in Table 2, the library should reflect its collection, resources, facilities, and services on the homepage and arrange for visual appeal so that the academic user can access the resources and services quickly.

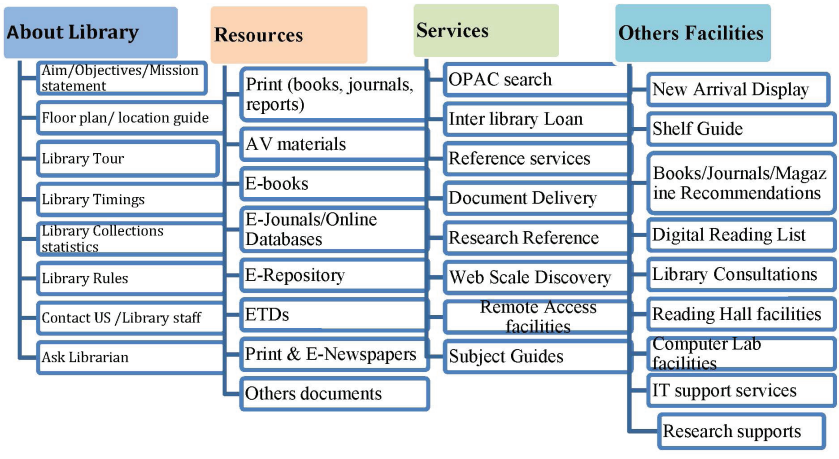

Table 2: Layout of library resources and services menu list design

For this, we have customized and created a user menu containing the sections mentioned above at the initial stage; a further menu can be made. Making such a user menu is very simple, using a GUI editor platform and drag and drop mechanism.

After menu building, the next step is to add content to each section, such as pages, articles, blogs, books, images, and videos. Drupal facilitated the inbuilt functions such as adding content, creating a menu in the structure section, and arrangement through drag and drop methods, and for delivery of presentation of data, you as an administrator follow the steps like filling and inputting the data within the inbuilt form generated by Drupal for each work. After completing the creation of data content, rightly you can publish it and opt for the front page view options so that it can be viewed on the homepage immediately.

iii) Data content management using Taxonomy and View Module

of Drupal: Further, to enhance data content management and different ways of presenting published content, Drupal provides tools like Taxonomy, which helps categorize the content. For example, search the thesis repository ETDs data by subject, title, author, supervisor, department, thesis number, etc. With the help of Drupal view modules, one can organize all the created content and view them in customized ways, like grid view, pager, table view, ascending or descending order, link to the complete text, and so on. It can offer various operations in the Drupal platform to accommodate any content types for their presentations. So, we often used this View and Taxonomy module to perform the content organization and management work, including preparing the E-database list, E-journals list, ETDs repository catalog, CD/DVD catalog, etc.

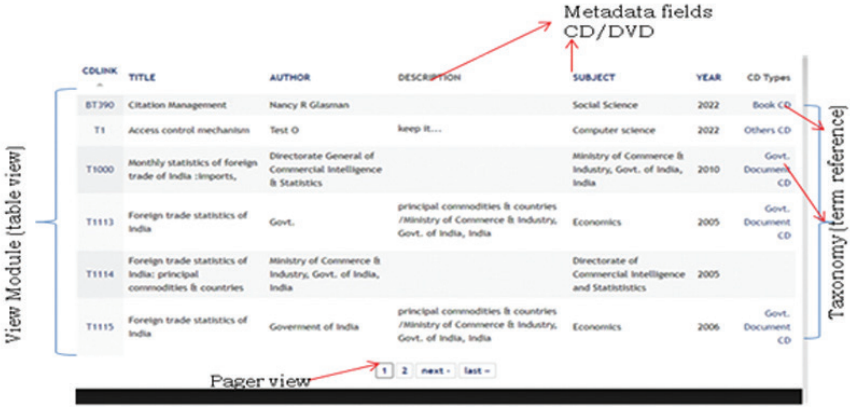

Figure14: Example of CD-list using view module and Taxonomy module of Drupal

iv) **Customize, extend, and accessibility with responsive design:** In this manner, one can design a lucid, simple, responsive, dynamic library website. One can use the features and functions of Drupal through learning and practice; it does not require any programming and scripting languages to learn, and you can do all the operations via a text editor (CKeditor, WYSIWYG). All the work can be performed through the GUI interface by logging into the Drupal site.

v) **Library management software system (LMS) integration:** Drupal can also facilitate the integration of LMS software features. You can enhance your library's visibility by integrating LMS into a Drupal-

based library website. Drupal can help discover library catalog information in more presentable ways. You can integrate the open-source software Koha through the Koha-Drupal Connector. Also, it has some independent Modules like OPAC, SOPAC, eXtensible, Biblio, etc., that can enhance the design, search, delivery, and access to the LMS contents and collections.

vi) **Site Backup and Maintenance:** A regular backup of the library website is vital for content safety and security. Drupal facilitates auto, manual, and schedule backup systems for the website. You can add the Drupal Backup and Migrate module for this work.

Conclusion

The study shows that the Drupal content management system has enormous potential for promoting library services via websites. It is known for its flexibility, security, and scalability. It is an ideal platform for a dynamic library website. It facilitates a seamless support system that saves many users time and engages them through collaborative features. Additionally, it plays a vital role in serving the diverse learning needs of end-user communities. Drupal enables library professionals to quickly manage and update their daily content management work on the website/portal. Embracing and learning such technologies proves a cost-effective solution for libraries and ensures their effectiveness and long-run visibility in this digital age.

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