

# Design of Library Collection Procurement System in Bali

I Putu Suhartika<sup>1</sup>, I Nengah Punia<sup>2</sup>, Ni Putu Premierita Haryanti<sup>3</sup>,  
& A. A. Putu Oka Sujana<sup>4</sup>

<sup>1,2,3,4</sup>Universitas Udayana, Indonesia

Correspondence email: [premierita@unud.ac.id](mailto:premierita@unud.ac.id)

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## ABSTRACT

The process of library collection development encompasses several crucial tasks, including identification, selection, acquisition, processing, and distribution of collections to the public. This study endeavors to develop a library collection procurement application focusing on two primary functionalities: selection and procurement. The system accommodates stakeholders, including publishers, librarian profiles, system masters, and other users, while adhering to specific user and system requirements. The design methodology employed in this study leverages the Unified Modeling Language (UML). The development process follows the waterfall method, encompassing stages such as requirements analysis, design, implementation, verification, and maintenance. The resulting application features an intuitive interface for collection procurement, incorporating essential components such as login mechanisms, a comprehensive book collection database, catalog data management, procurement selection tools, recommendation algorithms, catalog selection options, and access to selected catalog data. Employing the CodeIgniter (CI) framework, the system facilitates data filtration and selection processes based on publication year, price, and language criteria. Rigorous system testing, conducted through black box testing methods, confirms the functionality and reliability of the application. This research contributes to addressing the needs of libraries lacking robust collection procurement systems, offering a sophisticated solution to streamline and automate traditionally manual processes.

**Keywords:** Library collection procurement system; library collection development; library collection database

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## 1. INTRODUCTION

Academic libraries are integral to the learning process within academic institutions, serving as vital support systems. They are responsible for providing a diverse range of collections to meet the needs of students and lecturers across different fields of knowledge, thereby supporting the requirements of various university departments. These collections typically comprise a wide array of documents, such as books, pictures, inscriptions, archives,

and other materials essential for academic research and learning (Agusta, 2019). These collections may include both printed and digital resources that are expertly managed.

Academic libraries routinely procure new materials every year, engaging faculty members in selecting which book titles to add. This procurement is a key component of collection development activities aimed at providing library users with relevant and up-to-date resources. Collection development encompasses policy determination for selection, identification of user needs, document selection, resource sharing, and budgeting (Suryadi, 2022). User needs, collection development policies, selection, procurement, evaluation, weeding, and preservation are all areas of collection development (Agbanu et al., 2019). The collection development process can offer fulfillment and satisfaction to library users. The primary activities of collection development include the selection and procurement of library materials.

According to Johnson (2018), the selection library materials involves the filtering of collections that meet user needs. Collection selection focuses on who chooses the collections, how selection policies are established, what the criteria are, and alternative collection development selections. Procurement of library materials is a technical service activity in the library aimed at providing information needed by library users. Procurement of library materials is a series of policies for collection development and ultimately leads to the procurement of library materials (Murnahayati, 2018). It is the process of acquiring collections (Atef, 2020). The library materials procurement is carried out to match the library's collection and ensure it aligns with users' needs. This matching activity requires careful selection to ensure that the selected items meet the users' needs. Furthermore, using appropriate selection tools greatly assists librarians in finding collections that match users' needs. The most commonly used selection tools in libraries include printed publisher catalogs, book lists, book reviews in magazines and newspapers, CD-ROM databases, online addresses, book displays, and user suggestions through the library system (Ashilungu & Onyancha, 2024). The scope and relevance of subjects are the most preferred criteria as selection tools (Mondal & Maity, 2016).

The diverse range of library materials presents challenges for library managers to select suitable items and meet the users' needs. This requires a rigorous and systematic approach to collection selection. Manual selection often produces less accurate results. Consequently, libraries need to develop an integrated collection development system that works in conjunction with other library systems to optimize the implementation of library automation. Library automation involves using automatic and semi-automatic data processing machines to perform traditional library activities such as acquisition, cataloging, and circulation (Tripathi, 2023). The computer system transforms traditional library activities into computer automation (Yanni, 2016). This transformation is part of electronic or digital libraries. According to the IFLA manifesto, a digital library is an online digital collection created or gathered and managed according to internationally accepted collection development principles, accessible coherently and sustainably, with support services that enable users to access and utilize its resources (Anna, 2018). The transformation from traditional to digital libraries expanded library services and information delivery to library users (Eje & Dushu, 2018).

Libraries must design and build a procurement system. This system is a specialized application designed to manage collection procurement activities, including an information system and a collection procurement database. It should align with the library management framework, encompassing planning, organizing, actuating, and monitoring (Pamungkas, 2018). Information flows within a system and is utilized to achieve objectives. Information is a crucial component that interacts with other elements within a system. A system comprises parts that interact in space and time, exchanging material, energy, or information in a measured manner (Sillitto et al., 2017). The definition emphasizes that a system consists of several interconnected elements or components. Therefore, "information" often accompanies the term "system," referring to a set of interrelated elements working together to achieve a goal. Ridwan (2021) defines a system as interconnected elements aimed at achieving a goal, while information is

data that undergoes processing to become more useful for its recipient. This data must be relevant, timely, efficient, and accurate (Filiari & McLeay, 2014). The term "information system," commonly used, refers to the interaction between people, algorithmic processes, data, and technology (Sudarmaji & Pranoto, 2020). Hence, an information system (IS) is a set of interconnected components designed to collect, manipulate, store, and disseminate information, providing feedback mechanisms to achieve objectives (Ghomari, 2022). Those components constitute resources that need to be fulfilled. They encompass technology (hardware, software, and data), communication networks, humans, and processes (Bourgeois et al., 2019). Meanwhile, Pham et al., (2021) state that the information system has six main components: hardware, software, network communication, data, people, and processes. All components play important roles in building an information system.

The term "design and development" is widely known in application systems for designing and creating application programs. Design and development involve translating the results of analysis into software packages and then creating or improving the system accordingly (Gunawan et al., 2021). The product of this research is an application system that provides automatic collection selection and procurement features.

Extensive research has been conducted on the design and development of library information systems. This includes the design and development of library and archive information systems (Saputro et al., 2022), the design and development of a web-based library system with a QR code (Hermanto, 2020), the design and development of a library information system using Java (Wijaya, 2019), and online library applications (Syukron, 2016). None of these previous researches offers a collection development features system. Therefore, this research stands out as it focuses specifically on designing and developing a library collection development system. The novelty of this research lies in its features, specifically tailored for library collection procurement.

This research aims to develop a library collection procurement application system to benefit Indonesian libraries that rely on manual activities and lack a dedicated procurement system. Implementing such a system is crucial for optimizing library processing and services, ultimately facilitating the acceleration of library digitalization in Indonesia.

## 2. METHODS

The methodology employed for data acquisition in this study encompassed interviews with library personnel concerning the procurement procedures for library collections in Bali. The interviewees comprised a procurement librarian from a university library, a regional library, a school library, a public library, and a special library. Furthermore, discussions were held with the directors or heads of these respective libraries. Additionally, data gathering encompassed the compilation of lists detailing the books slated for acquisition by the libraries.

This research adopts the Software Development Life Cycle (SDLC), which consists of several important stages in designing and building a system. SDLC is a structured framework involving sequential processes in system development. The Waterfall method, one of the commonly used SDLC models, is also utilized in the development of information systems or software in this study (Wahid, 2020), including the stages of requirement, design, implementation, verification, and maintenance. SDLC is a framework for planning, analyzing, designing, developing, testing, and implementing software (Hossain, 2023). All of these phases are directed towards one theme, which is quality assurance, in this case, providing software quality to the users (Lemke, 2018). The quality of a system or software is also influenced by other factors categorized into seven dimensions: system quality, service/support quality or vendor, system use, perceived usefulness, user characteristics, organizational structure, and management style (Kalankesh et al., 2020).

The system design adopted in this study employs the Unified Modeling Language (UML), a standardized language extensively employed in industry settings for delineating requirements, conducting analysis, designing, and illustrating architecture within object-oriented programming paradigms. The utilized UML encompasses various diagrams, including use case diagrams, entity-relationship diagrams, class diagrams, and flowcharts. A use case diagram serves as a visual representation introducing a system, wherein actors such as operators and users engage with the system. Meanwhile, a flowchart elucidates the system's operations sequentially, encompassing tasks such as book data management, user input of book data, and recommendation processes.

This research utilizes Entity-Relationship Diagrams (ERD), which depict the database structure containing relationships between objects or data in the database in the form of entities, attributes, and entity relationships. The library material procurement recommendation system is modeled with a class diagram constructed based on the use case diagram. The design of the class diagram is used to form the data storage structure that the system will use. Data Flow Diagrams (DFD) represent a graphical representation of a system. In this research, DFD consists of managing criteria, cataloging data, selecting books, and making library material recommendations.

The library material procurement system in this research is designed using the Microsoft Windows 10 Pro 64-bit operating system. The system is designed on a laptop with an Intel(R) Celeron N2830 processor, 4.00GB of RAM, and a storage capacity of 500 GB. The system is implemented using the CodeIgniter framework with web programming languages such as PHP (PHP Hypertext Preprocessor), JavaScript, AJAX, CSS (Cascading Style Sheet), HTML (Hyper Text Markup Language), and JQuery. The Database Management System (DBMS) used in this system is MySQL. The software used in the design and implementation of the system includes XAMPP control panel v3.2.2, Sublime Text Version 3.0, CodeIgniter 3, CorelDraw x6, ClickCharts Diagram Flowchart Software, and Google Chrome.

The system testing in this research employs Black Box Testing, a method based on logic that determines whether the inputs match the desired outputs according to user requirements. Black Box Testing ensures that each process functions as expected based on the desired needs (Wijaya & Astuti, 2021).

### 3. RESULTS AND DISCUSSION

#### Results

Implementing this database schema refers to the ERD (Entity Relationship Diagram) design, as seen in Figure 1.

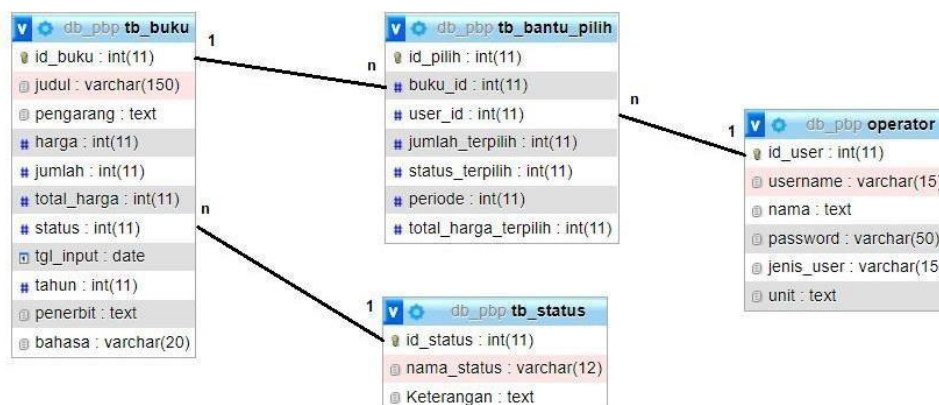
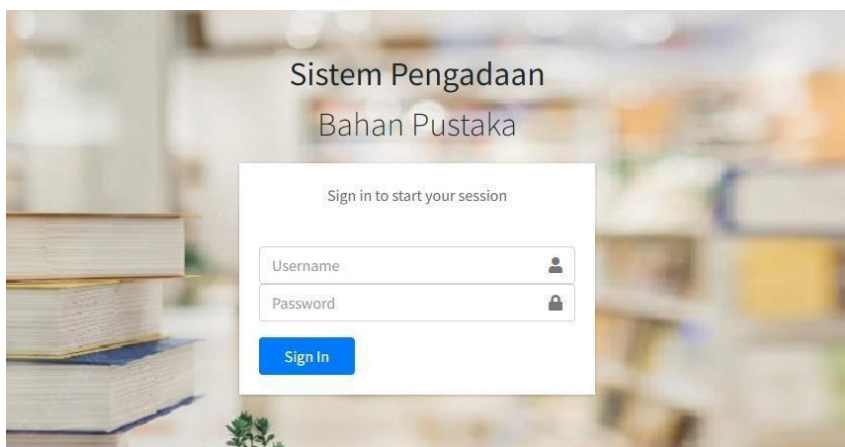


Figure 1. The database scheme

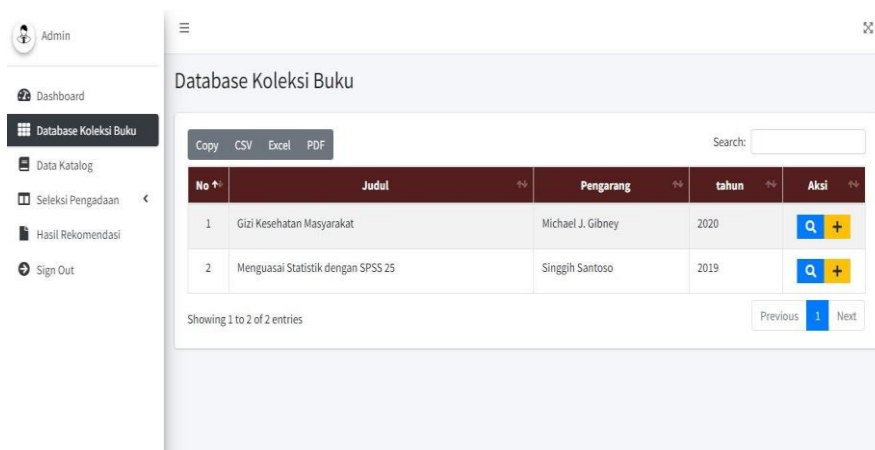
From the database schema, tables for Operator, Book, Helper Select, and Status were created. The interface of the library items procurement system in this research looks seems in Figure 2.



**Figure 2.** Login interface  
(Source: the author’s documentation)

The figure depicts the login interface of the web-based library material procurement system. Login is the initial view of the system that appears when the system is first opened via a web browser. Users are required to enter a username and password to access the system. If the username and password are incorrect, the system will display an error message.

The book collection database menu shows the library collections, seen in Figure 3.

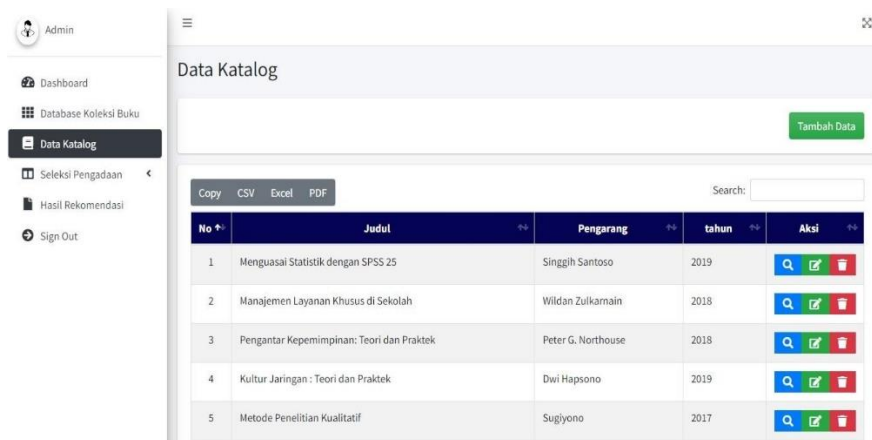


**Figure 3.** The book collection database interface  
(Source: author’s documentation)

The provided menu function to check whether the selected collection by the user is already available in the database. On this page, the operator will see the books that are already in the library. The operator can edit and delete books from the list of book collection databases. This menu needs to be provided since collection selection is also done through duplicates.

The catalog data interface is a menu containing bibliographic data from the book list such as title, author, city of publication, year of publication, and price. This catalog data is used

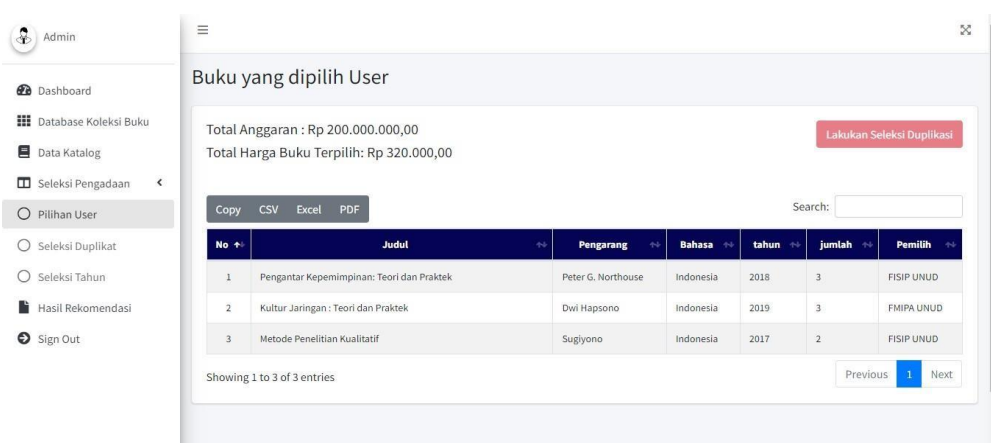
by users to select the books to be acquired. The list of books comes from several publishers and will be sorted according to the user's needs. The catalog data interface looks like the one shown in Figure 4.



**Figure 4.** Catalog data interface  
(Source: authors' documentation)

Figure 4 above depicts the Book Catalog Data interface in the web-based library material procurement system. On this page, the operator will see the books to be distributed to users as consideration for acquiring library materials. The operator can edit and delete books from the list of book catalog data.

The procurement selection interface is a menu used by the admin to select books chosen by users. This menu is crucial considering that in library collection development, there are two activities that need to be carried out by the library: selection and procurement. The selection activity is done by librarians and users, while the procurement activity is carried out by the procurement team appointed by the institution's leadership. The procurement selection interface looks like Figure 5 below.

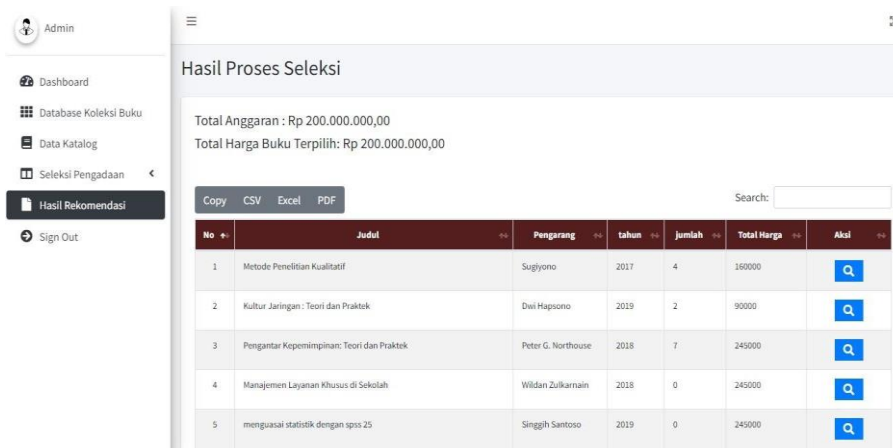


**Figure 5.** the interface of procurement selection  
(Source: author's documentation)

The image above depicts the selection process interface. The selection begins by sorting duplicate data. Next, the total book price will be calculated to determine if it exceeds the

budget. If the total price exceeds the budget, it will move to the next selection, which is the year selection. The selection process will be completed when the budget and the total book price are equal.

The last menu available in the system interface is the recommendation results menu. This menu contains a list of books that have been selected by the user and operator. This menu also shows the maximum budget allocation for book procurement, as seen in Figure 6 below.



**Figure 6.** The interface recommendation results (Source: author's documentation)

The image above shows the interface displaying the results of the book selection process chosen by the user in the web-based library material procurement system. On this page, the operator will see the books that have been selected. At this stage, the system flow has been completed, and the library operator can follow the recommendation results.

The system implementation uses the CodeIgniter (CI) framework, which has an MVC (Model View Controller) architecture. The MVC model helps structure the programming according to its tasks and makes learning the system easier. The first implementation involves data elimination and selection processes based on year, price, and language considerations. After the elimination process, the recommendation process is carried out, as shown in Table 1 below.

**Table 1.** The recommendation process code

Lines	Code fragment
1	public function proses_cek_dupliat(){
2	\$cek= \$this->M_buku->proses_cek_dupliat(); foreach (\$cek->result() as \$row){
3	\$this->db->where('buku_id', \$row->id_buku);
4	\$this->db->delete('tb_bantu_pilih');
5	}
6	\$this->M_buku->proses_hapus_dupliat();
7	\$this->M_buku->proses_update_status();
8	}
9	
10	public function hasil_rekomendasi(){
11	\$curr=\$this->M_buku->select_data_curr()->row();
12	\$data['anggaran']= \$this->rupiah(\$curr->anggaran);
13	\$cek= \$this->M_buku->all_total_harga_terpilih();
14	
15	\$total=0;
16	foreach (\$cek->result() as \$harga){
17	\$total+=\$harga->total_harga_terpilih;
18	}
19	\$curr=\$this->M_buku->select_data_curr()->row();
20	\$data['anggaran']= \$this->rupiah(\$curr->anggaran);
21	\$data['total_terpilih']= \$this->rupiah(\$total);
22	
23	\$data['buku']=\$this->M_buku->hasil_rekomendasi();
24	\$this->load->view('v_hasil_rekomendasi',\$data);
25	
26	}
28	

The code in Table 1 above is a snippet of the selection process. The first process is to check for duplicates in each book entered into the system or selected by the user. Then, the system automatically removes books with the same title. Next, the year selection process involves selecting the year according to the operator's input. After all processes are completed, the books that pass will be displayed as the result of the procurement recommendation.

The system testing uses black box testing. Black box testing will test the system's ability to perform the processes defined in the requirements analysis. The results of testing through Black Box Testing are shown in Table 2 below.

**Table 2.** The black box testing's result

Requirement Code	Users	Status
KF01	Operator dan User	Available
KF02	Operator	Available
KF03-A	Operator	Available
KF03-B	Operator	Available
KF03-C	Operator	Available
KF04	Operator	Available
KF05	Operator	Available
KF06-A	User	Available
KF06-B	User	Available
KF06-C	User	Available
KF07	Operator	Available



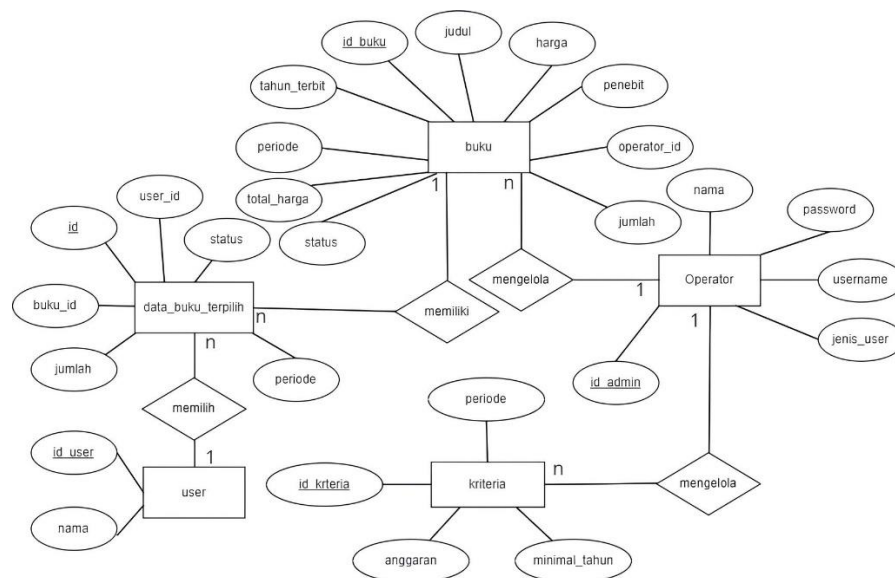
Table 2 above shows that the system testing using Black Box Testing demonstrates that all user (User and Operator) requirements are fulfilled. This indicates that the designed and developed library material procurement system can operate according to the system planning.

**Discussion**

The Library Collection Development System (SPKP) in this research can connect users with library materials since the system provides pre-selected and pre-chosen results. This system can match needs with documents precisely. Therefore, the Library Collection Development System can serve as a means of interaction between people and technology to achieve a goal. This system can assist librarians in bridging the gap between users and the library and can serve their clients using state-of-the-art technology. The interaction process brings people together with the information provided by the system.

The design of the Library Collection Development System has been successful, as its design aligns well with the waterfall method and Unified Modeling Language (UML) model. The features available in this system meet the needs of the library, considering that the system uses the Software Development Life Cycle (SDLC), a software development method related to a structured framework containing sequential processes where information systems are developed.

The implementation of the Library Collection Development System consists of database implementation and interface. The implementation of the database schema refers to the design of the Entity Relationship Diagram (ERD). The ERD design looks like Figure 7 below.



**Figure 7.** The entity relationship diagram for the library material procurement system

From the designed ERD, are 4 entities involved, including book, criteria, operator, user, and selected\_book\_data. The relationships that occur among the above entities are as follows:

1. Relation 1: N between the operator entity and the book entity, where 1 operator can manage many books.
2. Relation 1: N between the book entity and the selected\_book\_data entity, where 1 book can have many selected\_book\_data.
3. Relation 1: N between the user entity and the selected\_book\_data entity, where 1 user can have many selected\_book\_data.

4. Relation 1: N between the operator entity and the criteria entity, where 1 operator can create many criteria.

The interface implementation is done to ensure that the software system and its results meet the needs of both users and the system itself. The interfaces provided in this Library Collection Procurement System consist of the Login form, Book Collection Database, Book Catalog Display, Procurement Selection, Recommendation Results, User Catalog, and Procurement Results. Overall, the system interface functions well, where all interfaces can be effectively utilized by system users, including users, operators, and administrators.

Users logging in as administrators are granted access rights to all available menus in the system. The menus provided for administrators include the dashboard, book collection database, catalog data, procurement selection, and recommendation results. Meanwhile, menus provided for users include book selection, selected books, and procurement results. With their respective access rights, system users are expected to use the system according to their roles, ensuring data security within the system.

The Book Collection Database menu in this study is used by administrators or operators to view the collection owned by the library. Operators can edit and delete books listed in the book collection database. This menu is necessary given that collection selection is also done through duplication.

The results of designing the Library Collection Development System have been tested using black box testing, which tests the system's functionality. The test results indicate that the system's functionality has performed well. This demonstrates that the system functions, such as data structure, interface, and other functions, are correct.

#### 4. CONCLUSION

The design of the library collection development system in this study has operated optimally according to its plan. The system has been tested with library users in Bali, who found it usable in their respective libraries. Until now, no information system specifically designed for collection procurement has been implemented in libraries in Bali. However, the system does not yet provide a central catalog (shared catalog) that offers a list of selected books for all types of libraries. Instead, it only provides a catalog menu for each library, meaning that the types of books needed in regional or public libraries may not necessarily be available in university libraries. Therefore, this system is suitable for use in each type of library. The Library Collection Development System can be further developed by adding several features that can be used to benefit various library users, addressing the system's current limitations in the future.

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