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The Use of MySQL to Display Long Form Content in eReader Web Platform

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ABSTRACT A challenging aspect of database storage and retrieval is in long form content. The objective of this paper is to develop a web-based retail platform that hosts dynamic reading content and gives users the ability to view and track the content. The motivation for this project came from challenging our knowledge of database management systems, as well as front and back-end web development to extend our experience in industry. This project includes storing the long-form text of reading material, meta-data tags for each title, and strategies for pictures to be displayed within the pages. These tags will describe book content in order to recommend new choices to users based on their recent purchases and previous patterns of purchases. Our approach utilizes the MySQL database management system as well as JavaScript, HTML, CSS, and PHP to transmit, retrieve, and display information from the database.

INDEX TERMS eBook, eReader, Javascript, PHP, HTML, Meta-data, MySQL, Web-based eReader System, Retail System, Recommendation System

I. INTRODUCTION

E READERS have mostly overtaken conventional paper media and have grown in popularity in the fast-moving digital world (cite). These platforms have not only changed how we read literature but also provided us with an interactive and dynamic content experience. The first eReader appeared in the late 1990s, such as the Rocket eBook and Soft Book with simple reading devices. But the most famous eReader is the Amazon Kindle, released in 2007, marking a significant milestone in the history of eBook readers. These eBook readers can support various formats, including EPUB, PDF, etc. Our eReader Database Management System is a web-based platform designed to facilitate the storage, retrieval, and management of eBooks and related data. In addition, the eReader Recommendation system also involves the tracking of title meta-data to give recommendations based on readers' past purchasing patterns, helping readers discover new interesting titles.

There has been a lot of research on eReader Systems. Rosli [1] developed the eBook Recommender System which recommends Malay novels based on information such as the reader's age and gender. Their system website is based on the Waterfall model. The interface design is very simple, irrelevant functions are removed, and only simple language is used on the labels. However, their system cannot read books online and does not support audiobooks. Choi [2] introduced an interactive eReader that supports multimedia,

user interaction, and 3D model view. They used the HTML5 format with JavaScript and CSS. The authors adopted MVC architecture for this system to satisfy the requirements. However, the system still needs to solve the problems of reflow and content protection mechanisms. Mu [3] introduced an Android platform E-Reading System that supports local bookshelf, collection bookshelf, reading theme change, interface font increase and decrease, bookmark management, etc. They also adopted MVC architecture, using Java and SQLite lightweight databases to construct their EReader System.

The objective of this paper is to develop a web-based eBook reading content database platform that allows the user to keep track of the viewing content and the availability of it with a user login and a library personalized for each individual person. The project will count on tools like MySQL database management system to store the data, HTML to design the web interface, and PHP to retrieve data from the database efficiently. Our motivation for making this project lies in the interest of increasing our knowledge of database management systems and their relation with front-end and back-end web development. The project doesn't aim to store the full content of books, but several pages of each for proof of concept.

II. SYSTEM DESIGN

The purpose of this stage is to realize the overall requirements of the system and describe the functions of the main modules.

This includes the management of store assets, user purchases, and new recommendations. Figure 1 details the control flow between the web server that the client accesses and the database server that is used to query and return information. When the client connects to the local web server via a socket connection given by 'localhost', they are presented with a portal to log in. This is, by design, the only entry point to the system. For our purposes, we have already created several user accounts. The user's login credentials are then entered and submitted with PHP in a canned transaction to allow access to the rest of the website.

The 'home' page is then displayed, called My Library, which is the heart of the website. From here, the user can access and browse the Store, open and read their Purchases, view generated recommendations for new titles, and details about each title.

A. MY LIBRARY SYSTEM DESIGN

The library system involves facilitating a personalized book recommendations based on the users book purchases. The architecture is a web-based user interface with easy to access book content with the book covers. It allows to access the eReader and delete books when no longer wanted. It is connected to the database with the library table. The books are stored with a tuple primary key for userID and bookID. Each user has its own library and the books will affect the total count for each genre in its recommendations.

B. RECOMMENDATION SYSTEM DESIGN

The Recommendation system involves providing personalized book recommendations based on user behavior and preferences. Typically, books of the same genre are the focus of the recommendation system. Its architecture, web-based user interface, and basic recommendation process are all designed to provide relevant and useful books of a specific genre based on the user's interests [1]. The eReader system may learn about a user's preferences by establishing book type tags, which enables it to suggest books with tags that are comparable to the user's preferences. This database we made, called "genre_tags," has 12 different categories. For the purpose of retrieving book titles and other information using bookID, the recommendation system can reference other tables in the database, such as 'book info' and 'library'. The specific operation can be expressed as follows: when a user purchases a book and accesses their recommendations, the recommendation system will obtain the genres of this book and other user purchases in the "genre tags" table. The system will then query other book IDs in the same database that have similar genres to the book. The top three genres will be selected, and the matches will be displayed from most likely to purchase descending. The user can click a title to access the same detailed web page as from the store to purchase the title.

C. STORE SYSTEM DESIGN

The Store System is a critical component of the eReader application, facilitating the discovery of new books to the users and their respective purchases. It plays a key role to the overall user experience. When users access the store from "My Library," they will be directed to the "Store" section, where they can explore and purchase books from the main database which contains all the available titles in the application. From the store they will be able to choose the "Display List." This list of books will provide the main information about each book allowing users to find what they are looking for. After selecting a book they will be lead to a more detailed page "Single Detailed Section" where they will be able to explore more about their proffered titles before purchasing them. They also will be able to go back to the "Display List" in case they change their mind. When the user decides to purchase an eBook (because they will) the system will direct them to the "Purchase Processing" where their request will be managed. After successfully purchasing a book, the book will be added to their "Purchase List" where they will be able to read it.

D. BOOK DETAILS SYSTEM DESIGN

The Book Details System Design allows to learn more about some of the primary details about a specific book. It shows the summary of the book and lets the user to purchase it. A user's purchases are displayed as hyperlinked tiles that hold a picture of the book cover. The web server queries the database to check tuples in the Purchases table, which holds purchases for all users. If tuples are found for the logged in user by their numerical ID, then the tiles will be returned and displayed.

E. EREADER DESIGN

All tiles link to one web page that queries the database and returns content dynamically, versus the method of a series of static web pages. A division in the middle of the page holds each page of the book's content by querying the book ID and page number and reassigns current content. The database holds the pages as Hypertext Markup Language (HTML) strings in the MySQL TEXT format in order to preserve formatting and allow only one web page to be used for all requests from a user. The PHP query returns the pre-made HTML string, and the content is displayed within the division. There are controls below to turn pages forward and backward through the pages of each book. When a user exits this web page.

F. LOG OUT DESIGN

When the user wishes to end their session, they will press the 'Log Out' button in the top right of the navigation bar. This loads a PHP page that clears environment variables from the browsing session, and returns users to the log in page.

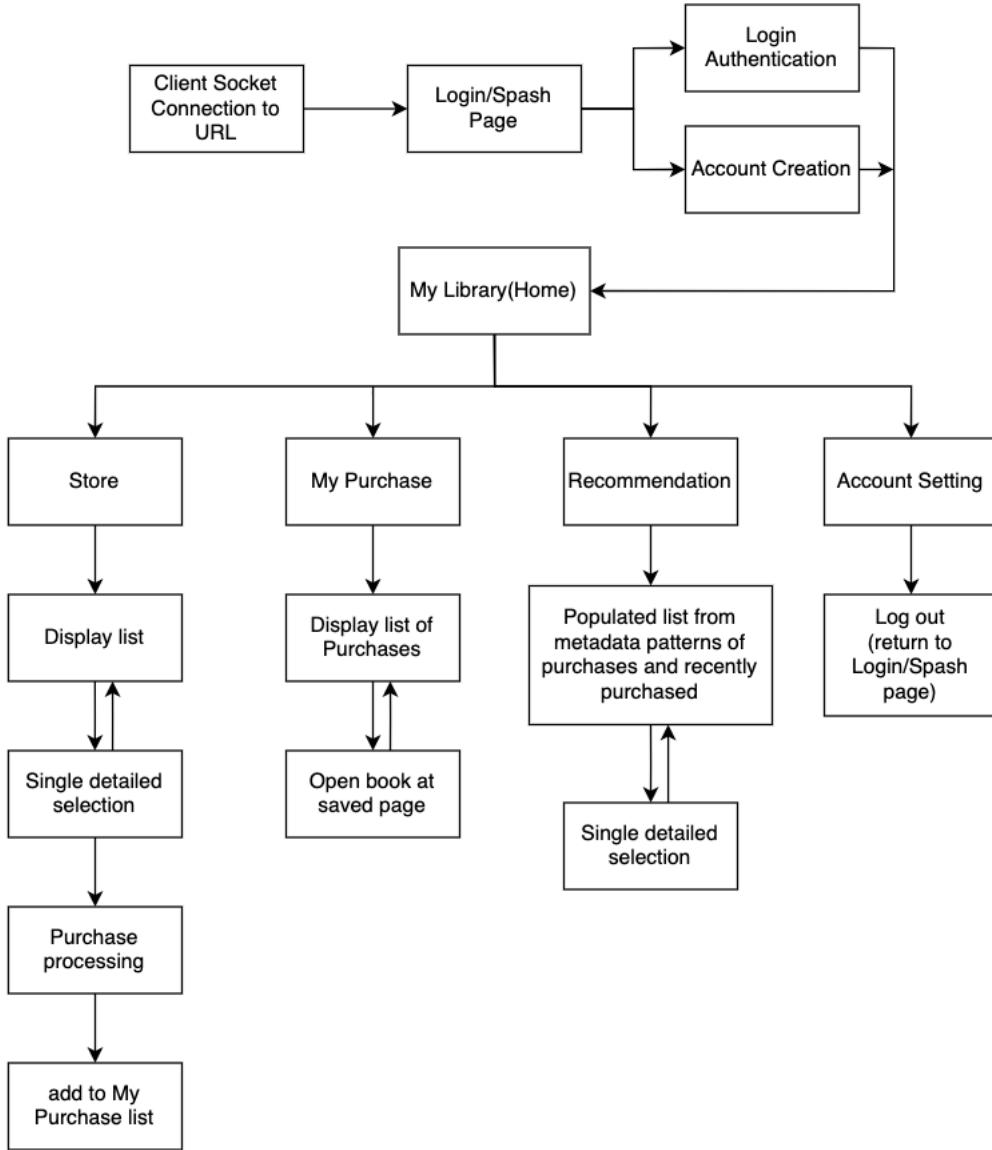


FIGURE 1. eReader web platform diagram.

III. ER DIAGRAM

In this section, we will discuss the ER diagram of this system. The ER diagram, also called an entity-relationship diagram, is essential for modeling the data stored in a database. It is the basic design for building a database. The ER diagram specifies what data we will store: entities and their attributes. They also show how entities relate to other entities. Figure 2 shows the ER diagram of the eReader Web platform [5].

In the context of this e-book reader network platform, key entities include "user," "ebooks," "library," "genre tags," and "author." These entities encapsulate essential components of the system, delineating users, the digital books available and their related metadata, and recommended books that are classified according to tags. Each entity is characterized by attributes that capture pertinent information. For instance,

the "user" entity includes attributes such as "user ID," "username," and "password." The "ebooks" entity includes attributes such as "book ID," "book cover," "title," "publish date," "ISBN," and "summary." The relationships between these entities are crucial in defining how data interacts within the system. For example, the "user" entity is related to the "library" entity, which indicates that the books purchased by the user will be stored in the library.

IV. METHODS

A. DEVELOPMENT ENVIRONMENT

In this project, the development was carried out using XAMPP (Cross-Platform, Apache, MySQL, PHP, and Perl). XAMPP provides a local server environment that includes Apache as the web server, MySQL as the database man-

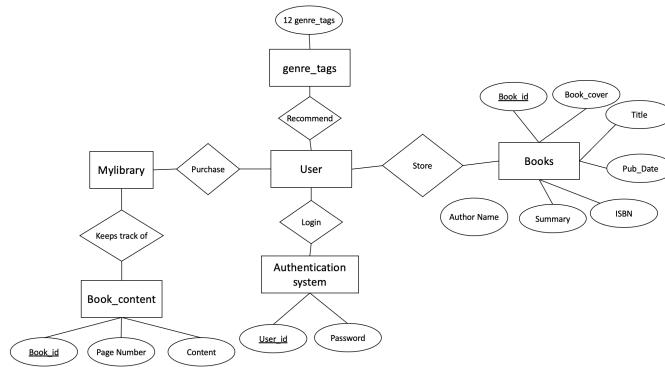


FIGURE 2. eReader web platform ER Diagram

agement system, and PHP as the scripting language. This environment allows for seamless development, testing, and deployment of PHP-based applications, making it well-suited for web development projects.

B. HTML, CSS, JAVASCRIPT, AND PHP

After setting up the development environment, we employed a comprehensive stack of popular web technologies: including HTML for structuring content, CSS for styling and layout, Javascript for dynamic client-side interactions, and PHP for server-side scripting. We mainly used PHP to manage and process the backend operations of the eBook reader system to request and display content. JavaScript is employed to implement the functionality of reading books page by page as well as the capability to delete books within the system.

C. DATABASE DESIGN

The database used was written in MySQL. The name of the database is Leaflet. The database consists of five tables which are named **user_login**, **book_info**, **book_content**, **genre_tags**, and **library**. The table **user_login** consists of three members which hold the values of **user_id**, **username**, and **login_password** with **user_id** being the primary key. The table **book_info** consists of eight members which hold the values of **book_id**, **book_cover**, **title**, **author**, **pub_date**, **publisher**, **ISBN**, and **summary** with **book_id** being the primary key. The table **book_content** consists of three members which hold the values of **book_id**, **page_num**, and **content** with **book_id** and **page_num** being the primary keys, and **content** being a foreign key. The table **genre_tags** holds thirteen members which hold the values of **book_id**, **fiction**, **nonfiction**, **fantasy**, **action_adventure**, **mystery**, **thriller**, **self_help**, **graphic_novel**, **inspirational**, **romance**, **horror**, and **comedy** with **book_id** being the primary key and foreign keys. The table **library** consists of two members which hold the values of **user_id** and **book_id** with both **user_id** and **book_id** both being foreign keys.

D. DATA COLLECTION

We did not use a premade dataset for our project. Due to the nature of copyright, whole eBook content is usually privatized unless purchased, and is only held by large retail stores. In order for a real eBook platform to be legally operational, we would have to go into contract with book publishers. For our purposes of this project, we manually collected our detailed data for titles from online platforms such as Amazon, that lists the books for sale. We also manually collected the book covers from similar sources. For the book content, some of the titles had free online versions that we could pull sample content from for display and proof of concept. Some of these free versions had restrictions on copying the text, so we manually entered some of the content.

E. RECOMMENDATION SYSTEM ALGORITHM

Recommendation systems utilize relevant genre tags to generate book recommendations based on user preferences. First, a comprehensive dataset of books with relevant genre labels is collected and user purchase data are merged into the dataset. Second, each book in the dataset is assigned relevant genre labels. Third, understand user preferences and conduct a comprehensive ranking of all book tags based on the books that users prefer. Books that are closer to user preferences are ranked higher.

F. "LEAFLET" NAME

Our company name, Leaflet, means a few different things. First, a leaflet is something that you can read quickly and gain important information. Second, the 'leaf' represents being environmentally friendly and reducing paper used by using the eBook platform. Third, the 'let' is highlighted in the logo for psychological appeal - this platform allows you to do the things you want quickly and efficiently.

V. EXPERIMENT RESULTS

In this section, we will discuss the results generated by our system. These results will help us demonstrate that the proposed system can effectively and efficiently provide access to users. A multi-functional database is implemented in the system to store various types of tables and provide table editing, deletion, addition, and other functions. Figure 3-5 shows specific table records in the database, illustrating the variety of data stored and managed by the system.

Figures 6 to 11 illustrate the graphical interface of the eReader web platform. It provides basic pages on which users and administrators can access our system. Figure 6 shows the administrator login web page where the administrator can log in using the username and password. Figures 7 to 9 showcase the web pages for 'Home,' 'Store,' and 'Recommendation,' respectively. Figure 10 represents the 'Book Detail' web page, which users are directed to upon clicking on each book cover. Figure 11 represents the 'eReader' system which supports reading ebook page by page.

	book_id	title	author	pub_date	publisher	summary
1	1	Think and Grow Rich	Napoleon Hill	1937-01-10	The Raintree Society	This is a classic self-help book that has been called the "Bible of Self-Help."
2	2	Demon Slayer: Demon slayer	Stephen King	1988-01-05	Simon & Schuster	The 7 books have become
3	3	Harry Potter and the Prisoner of Azkaban	J.K. Rowling	1997-06-26	Scholastic Corporation	JK's Harry Potter series is one of the best-selling series in the world.
4	4	Gone Girl	Troy Patterson	2011-09-26	Grand Central Publishing	Washington, DC, has never seen anything like this.
5	5	Harry Potter and the Sorcerer's Stone	James Patterson	2001-09-01	Grand Central Publishing	It's a must-read for anyone who loves magic.
6	6	Denice Stover - Kryptos	Denice Stover	2000-01-01	Via Media, LLC	Thrills will set in the path of the reader.
7	7	The Shining	Stein, M.	1980-01-01	Random House	Horror fans will love it.
8	8	Harry Potter and the Chamber of Secrets	Stephen King	1999-01-01	Grand Central Publishing	It's a classic that everyone should read.
9	9	The Shining World	Barry Atkinson	2000-04-01	Pavilion Publishing	For those who want more go behind the scenes.
10	10	The Catcher in the Rye	Jerome David Salinger	2001-01-01	Little, Brown	Many hidden details with its descriptions.
11	11	The Wizard of Oz	E. Frazee Clark	1900-01-01	Chicago, New York, G.M. & Co.	A classic that every child should read.
12	12	Pride and Prejudice	Austen Jane	1813-01-01	London: George Allen	It's a classic that every reader should read.
13	13	The Shrike	Stephen King	1977-01-01	Doubleday	The tale of a troubled man.
14	14	The Shrike	Stephen King	1977-01-01	Doubleday	The tale of a troubled man.
15	15	The Shrike	Stephen King	1977-01-01	Doubleday	The tale of a troubled man.
16	16	The Shrike	Stephen King	1977-01-01	Doubleday	The tale of a troubled man.

FIGURE 3. eReader web platform Book information Table

	genre_id	name	book_id
1	1	romance	1
2	2	fantasy	1
3	3	action, adventure	1
4	4	mystery	1
5	5	thriller	1
6	6	self help	1
7	7	graphic novel	1
8	8	inspirational	1
9	9	romance	1
10	10	horror	1
11	11	comedy	1
12	12	romance	2
13	13	fantasy	2
14	14	action, adventure	2
15	15	mystery	2
16	16	thriller	2
17	17	self help	2
18	18	graphic novel	2
19	19	inspirational	2
20	20	romance	2
21	21	horror	2
22	22	comedy	2
23	23	romance	3
24	24	fantasy	3
25	25	action, adventure	3
26	26	mystery	3
27	27	thriller	3
28	28	self help	3
29	29	graphic novel	3
30	30	inspirational	3
31	31	romance	3
32	32	horror	3
33	33	comedy	3
34	34	romance	4
35	35	fantasy	4
36	36	action, adventure	4
37	37	mystery	4
38	38	thriller	4
39	39	self help	4
40	40	graphic novel	4
41	41	inspirational	4
42	42	romance	4
43	43	horror	4
44	44	comedy	4
45	45	romance	5
46	46	fantasy	5
47	47	action, adventure	5
48	48	mystery	5
49	49	thriller	5
50	50	self help	5
51	51	graphic novel	5
52	52	inspirational	5
53	53	romance	5
54	54	horror	5
55	55	comedy	5
56	56	romance	6
57	57	fantasy	6
58	58	action, adventure	6
59	59	mystery	6
60	60	thriller	6
61	61	self help	6
62	62	graphic novel	6
63	63	inspirational	6
64	64	romance	6
65	65	horror	6
66	66	comedy	6
67	67	romance	7
68	68	fantasy	7
69	69	action, adventure	7
70	70	mystery	7
71	71	thriller	7
72	72	self help	7
73	73	graphic novel	7
74	74	inspirational	7
75	75	romance	7
76	76	horror	7
77	77	comedy	7
78	78	romance	8
79	79	fantasy	8
80	80	action, adventure	8
81	81	mystery	8
82	82	thriller	8
83	83	self help	8
84	84	graphic novel	8
85	85	inspirational	8
86	86	romance	8
87	87	horror	8
88	88	comedy	8
89	89	romance	9
90	90	fantasy	9
91	91	action, adventure	9
92	92	mystery	9
93	93	thriller	9
94	94	self help	9
95	95	graphic novel	9
96	96	inspirational	9
97	97	romance	9
98	98	horror	9
99	99	comedy	9
100	100	romance	10
101	101	fantasy	10
102	102	action, adventure	10
103	103	mystery	10
104	104	thriller	10
105	105	self help	10
106	106	graphic novel	10
107	107	inspirational	10
108	108	romance	10
109	109	horror	10
110	110	comedy	10
111	111	romance	11
112	112	fantasy	11
113	113	action, adventure	11
114	114	mystery	11
115	115	thriller	11
116	116	self help	11
117	117	graphic novel	11
118	118	inspirational	11
119	119	romance	11
120	120	horror	11
121	121	comedy	11
122	122	romance	12
123	123	fantasy	12
124	124	action, adventure	12
125	125	mystery	12
126	126	thriller	12
127	127	self help	12
128	128	graphic novel	12
129	129	inspirational	12
130	130	romance	12
131	131	horror	12
132	132	comedy	12
133	133	romance	13
134	134	fantasy	13
135	135	action, adventure	13
136	136	mystery	13
137	137	thriller	13
138	138	self help	13
139	139	graphic novel	13
140	140	inspirational	13
141	141	romance	13
142	142	horror	13
143	143	comedy	13
144	144	romance	14
145	145	fantasy	14
146	146	action, adventure	14
147	147	mystery	14
148	148	thriller	14
149	149	self help	14
150	150	graphic novel	14
151	151	inspirational	14
152	152	romance	14
153	153	horror	14
154	154	comedy	14
155	155	romance	15
156	156	fantasy	15
157	157	action, adventure	15
158	158	mystery	15
159	159	thriller	15
160	160	self help	15
161	161	graphic novel	15
162	162	inspirational	15
163	163	romance	15
164	164	horror	15
165	165	comedy	15
166	166	romance	16
167	167	fantasy	16
168	168	action, adventure	16
169	169	mystery	16
170	170	thriller	16
171	171	self help	16
172	172	graphic novel	16
173	173	inspirational	16
174	174	romance	16
175	175	horror	16
176	176	comedy	16
177	177	romance	17
178	178	fantasy	17
179	179	action, adventure	17
180	180	mystery	17
181	181	thriller	17
182	182	self help	17
183	183	graphic novel	17
184	184	inspirational	17
185	185	romance	17
186	186	horror	17
187	187	comedy	17
188	188	romance	18
189	189	fantasy	18
190	190	action, adventure	18
191	191	mystery	18
192	192	thriller	18
193	193	self help	18
194	194	graphic novel	18
195	195	inspirational	18
196	196	romance	18
197	197	horror	18
198	198	comedy	18
199	199	romance	19
200	200	fantasy	19
201	201	action, adventure	19
202	202	mystery	19
203	203	thriller	19
204	204	self help	19
205	205	graphic novel	19
206	206	inspirational	19
207	207	romance	19
208	208	horror	19
209	209	comedy	19
210	210	romance	20
211	211	fantasy	20
212	212	action, adventure	20
213	213	mystery	20
214	214	thriller	20
215	215	self help	20
216	216	graphic novel	20
217	217	inspirational	20
218	218	romance	20
219	219	horror	20
220	220	comedy	20
221	221	romance	21
222	222	fantasy	21
223	223	action, adventure	21
224	224	mystery	21
225	225	thriller	21
226	226	self help	21
227	227	graphic novel	21
228	228	inspirational	21
229	229	romance	21
230	230	horror	21
231	231	comedy	21
232	232	romance	22
233	233	fantasy	22
234	234	action, adventure	22
235	235	mystery	22
236	236	thriller	22
237	237	self help	22
238	238	graphic novel	22
239	239	inspirational	22
240	240	romance	22
241	241	horror	22
242	242	comedy	22
243	243	romance	23
244	244	fantasy	23
245	245	action, adventure	23
246	246	mystery	23
247	247	thriller	23
248	248	self help	23
249	249	graphic novel	23
250	250	inspirational	23
251	251	romance	23
252	252	horror	23
253	253	comedy	23
254	254	romance	24
255	255	fantasy	24
256	256	action, adventure	24
257	257	mystery	24
258	258	thriller	24
259	259	self help	24
260	260	graphic novel	24
261	261	inspirational	24
262	262	romance	24
263	263	horror	24
264	264	comedy	24
265	265	romance	25
266	266	fantasy	25
267	267	action, adventure	25
268	268	mystery	25
269	269	thriller	25
270	270	self help	25
271	271	graphic novel	25
272	272	inspirational	25
273	273	romance	25
274	274	horror	25
275	275	comedy	25
276	276	romance	26
277	277	fantasy	26
278	278	action, adventure	26
279	279	mystery	26
280	280	thriller	26
281	281	self help	26
282	282	graphic novel	26
283	283	inspirational	26
284	284	romance	26
285	285	horror	26
286	286	comedy	26
287	287	romance	27
288	288	fantasy	27
289	289	action, adventure	27
290	290	mystery	27
291	291	thriller	27
292	292	self help	27
293	293	graphic novel	27
294	294	inspirational	27
295	295		

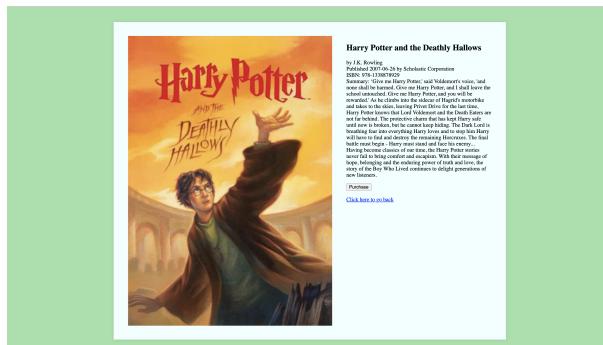


FIGURE 10. eReader web platform Book Details' Page

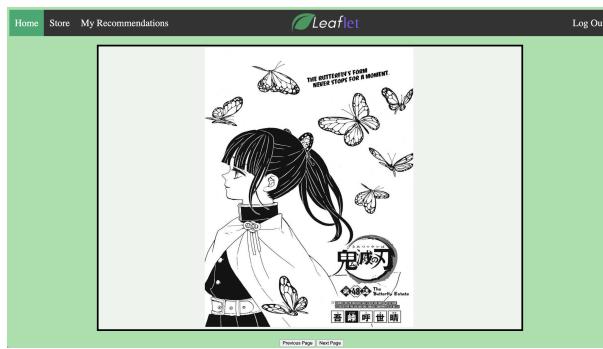


FIGURE 11. eReader web platform reading page

purchasing new books, updating user records, and facilitating seamless reading experiences.

In essence, the designed system underwent thorough testing, affirming its usability and reliability as an e-book purchasing and reading platform. The system performs seamlessly, meeting and even exceeding the initially outlined minimum expectations. It stands as a testament to the successful integration of technology into the domain of book consumption, offering users a robust and satisfactory platform for their e-book needs.

REFERENCES

- [1] Rosli, Nurameera Sofea, Wan Hussain Wan Ishak, and Fadhilah Mat Yamin. Web-Based Book Recommender System: Design and Implementation. International Journal of Synergy in Engineering and Technology 3, no. 2 (2022): 42-51.
- [2] Choi, Jongmyung, Youngho Lee, and Kiyoung Kim. Html5 based interactive e-book reader. International Journal of Software Engineering and Its Applications 8, no. 2 (2014): 67-74.
- [3] Z. Mu, Y. Peng and Y. Liu, E-reading system based on android. 2019 12th International Conference on Intelligent Computation Technology and Automation (ICICTA), Xiangtan, China, 2019, pp. 487-491, doi: 10.1109/ICICTA49267.2019.00110.
- [4] Araya, Tsega Weldu, and A. Mengsteab. Designing Web-based Library Management System. International Journal of Engineering Research & Technology 9, no. 10 (2020).
- [5] Vertabelo Team. Why Do You Need an ER Diagram? <https://vertabelo.com/blog/why-need-an-er-diagram/#:~:text=An%20entity%2Drelationship%20diagram%2C%20or,entities%20relate%20to%20other%20entities.>

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