

# **BSc (Hons) Artificial Intelligence and Data Science**

**Module: CM2601 Object Oriented Development**

**Individual Coursework Report**

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## Introduction

Software development is a dynamic field that combines creativity, analytical thinking, and technical expertise. This assignment is designed to provide practical experience in tackling a real-world problem by translating a set of requirements into a functional software solution. It emphasizes the importance of understanding the problem domain and devising a solution that meets both user and system needs.

The assignment begins with an analysis of the problem statement, identifying the core functionalities and constraints. Using the principles of system design, we are required to create UML diagrams that provide a clear representation of the system's architecture. This step ensures a structured approach to software development and lays a foundation for efficient implementation. (Sommerville, 2015)

The implementation phase challenges us to transform our designs into a working application. This process involves selecting appropriate programming techniques, adhering to coding best practices, and ensuring that the final product is robust and user-friendly. By emphasizing both design and execution, the assignment mirrors the iterative processes followed in professional software engineering projects.

Overall, this assignment serves as a comprehensive exercise in problem-solving, design, and implementation. It prepares us to approach software development with confidence and equips them with valuable skills applicable in both academic and professional settings. (Fowler, 2003)

## Requirement Analysis

### Use Case Diagram

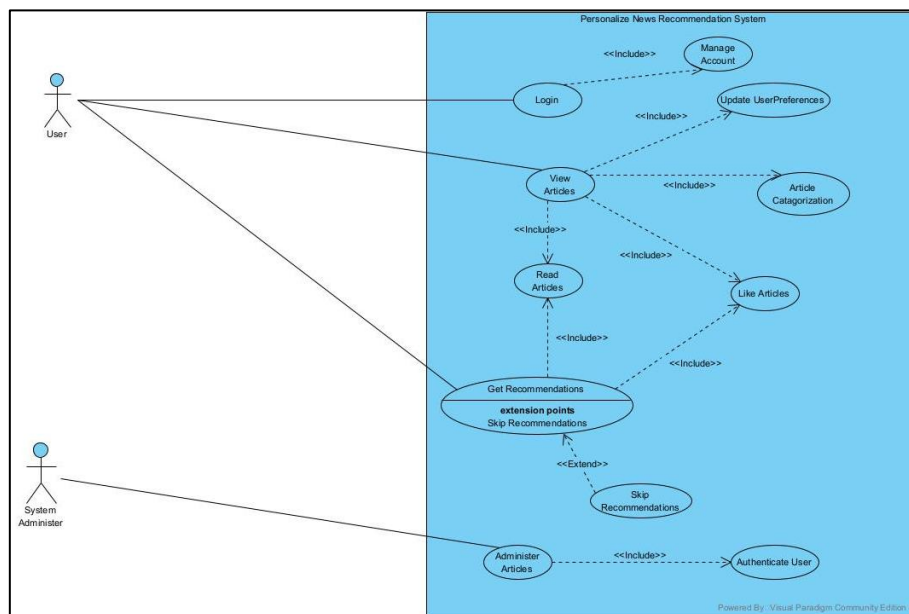


Figure 1: Use Case Diagram

## Use Case Description

### Use Case 1: Login

- Actor: User, System Administrator
- Description: Enables users and administrators to authenticate and access the system.
- Preconditions: The actor must have a registered account.
- Postconditions: The actor is logged into the system.
- Main Flow:
  - ❖ The actor enters their username and password.
  - ❖ The system validates the credentials.
  - ❖ If valid, access is granted.
- Alternative Flow:
  - ❖ If credentials are invalid, an error message is displayed, and the actor can retry.

(Boehm, 1988)

### Use Case 2: View Articles

- Actor: User
- Description: Users can browse categorized articles in the system.
- Preconditions: The user must be logged in.
- Postconditions: Articles are displayed based on the user's preferences or categories.
- Main Flow:
  - ❖ The user selects a category or a trending tab.
  - ❖ The system fetches and displays articles from the relevant sources.

### Use Case 3: Like Articles

- Actor: User
- Description: Users can rate articles based on their reading experience.
- Preconditions: The user must be logged in and have selected an article to read.
- Postconditions: The rating is recorded and stored in the system.
- Main Flow:
  - ❖ The user reads an article.
  - ❖ The user submits a like (e.g. there is a Like button to click).

(Unified Modeling Language (UML), n.d.)

### Use Case 4: Get Recommendations

- Actor: User
- Description: Users receive personalized article recommendations.
- Preconditions: The user must be logged in.
- Postconditions: Recommendations are displayed on the user's homepage or a separate tab.
- Main Flow:

- ❖ The user selects the "Recommendations" option.
- ❖ The system fetches recommendations based on the user's reading history and ratings.
- ❖ Articles are displayed for the user.

### **Use Case 5: Manage Profile**

- Actor: User
- Description: Users can update their personal information and preferences.
- Preconditions: The user must be logged in.
- Postconditions: The updated information is saved in the system.
- Main Flow:
  - ❖ The user accesses their profile page.
  - ❖ The user updates information such as name, password, or preferences.
  - ❖ The system saves the changes and confirms the update.

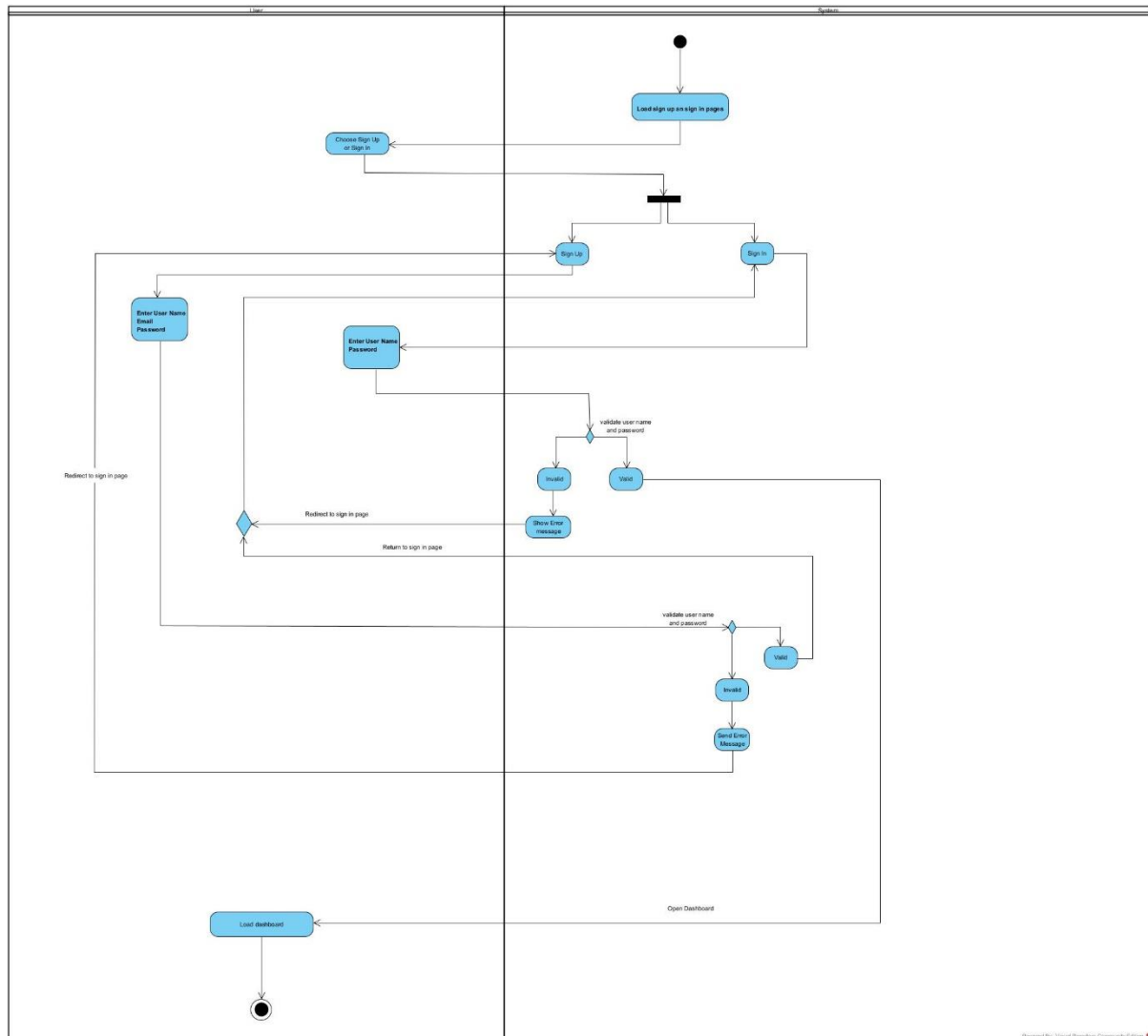
### **Use Case 6: Administer Articles**

- Actor: System Administrator
- Description: Allows administrators to manage articles and add new sources to the system.
- Preconditions: The administrator must be logged in.
- Postconditions: The new articles or sources are added to the system.
- Main Flow:
  - ❖ The administrator selects the "Administer Articles" option.
  - ❖ The administrator uploads articles or links to new sources.
  - ❖ The system validates and stores the new content.

(Introduction to the Unified Modeling Language (UML), n.d.)

# Activity Diagrams

## Login



## View Articles

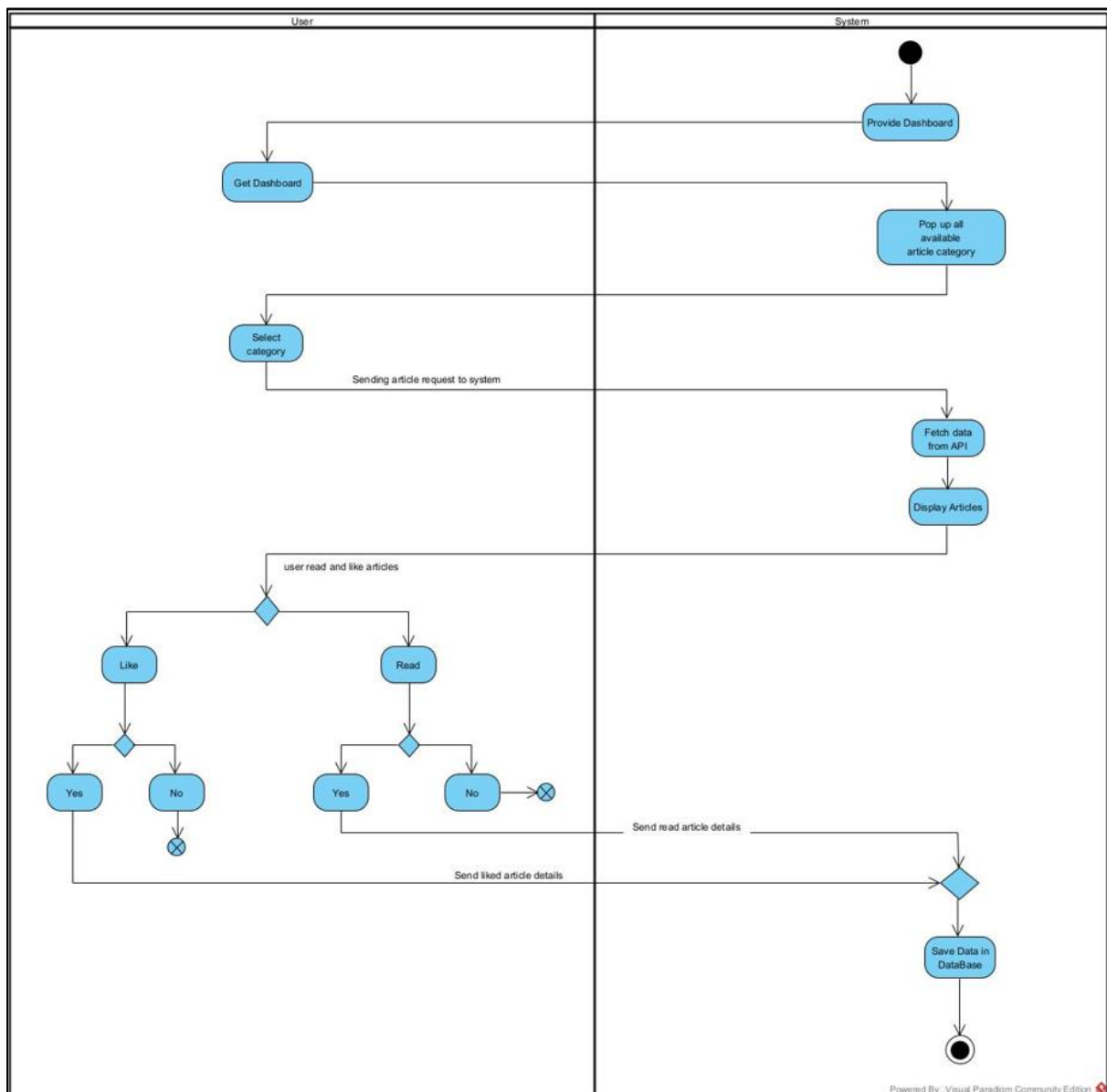


Figure 2: Article Activity Diagram

(Unified Modeling Language (UML) Specification, 2021)



## Recommendation

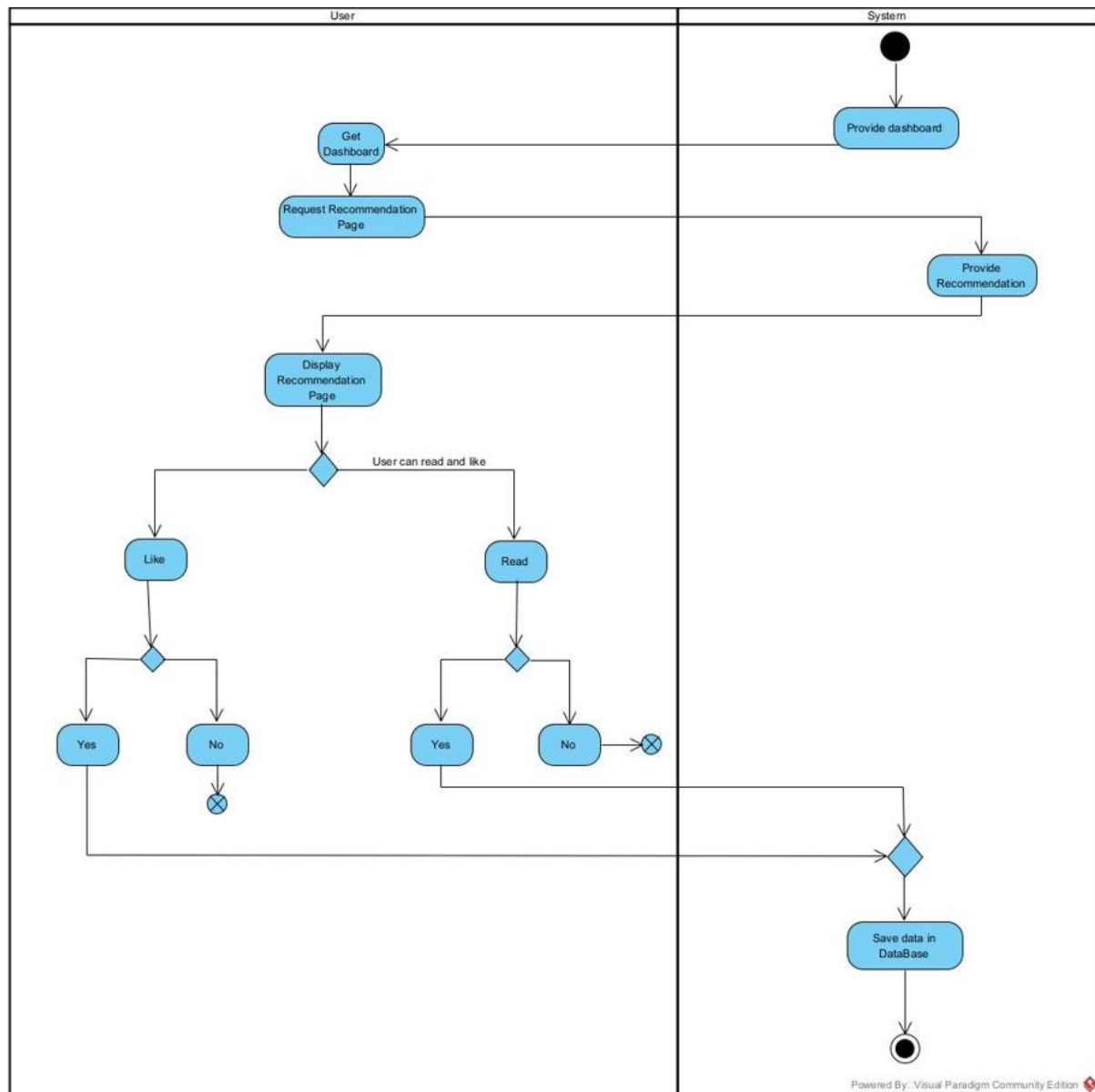


Figure 3: Recommendation Activity Diagram

## Class diagram

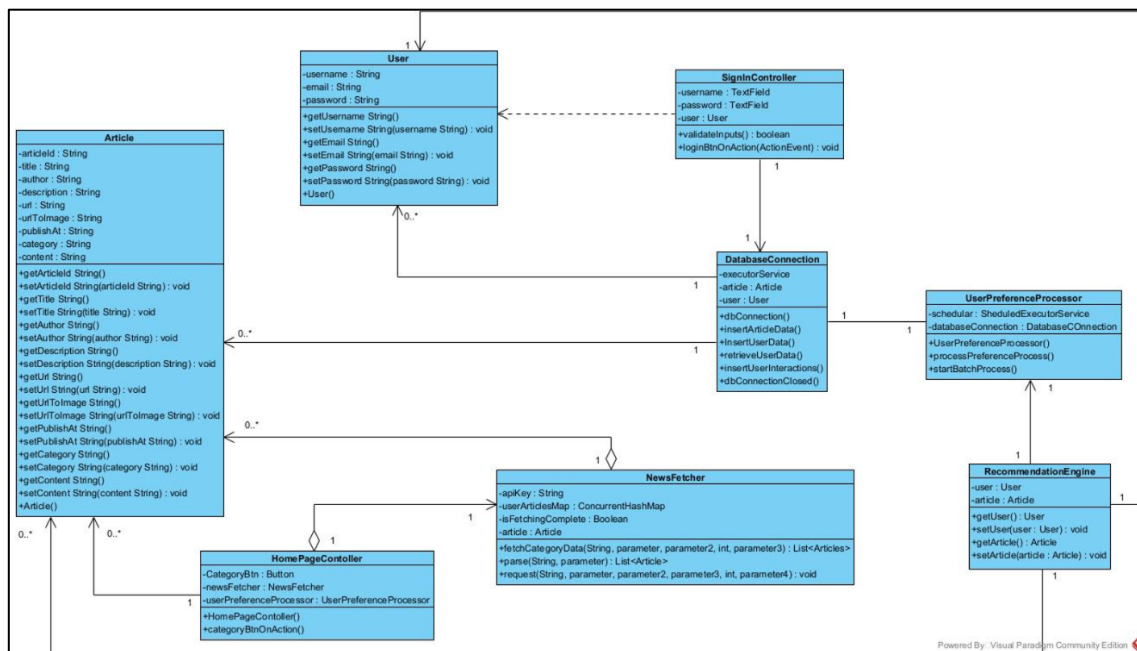


Figure 4: Single Class Diagram

## Sequence Diagrams

## Login

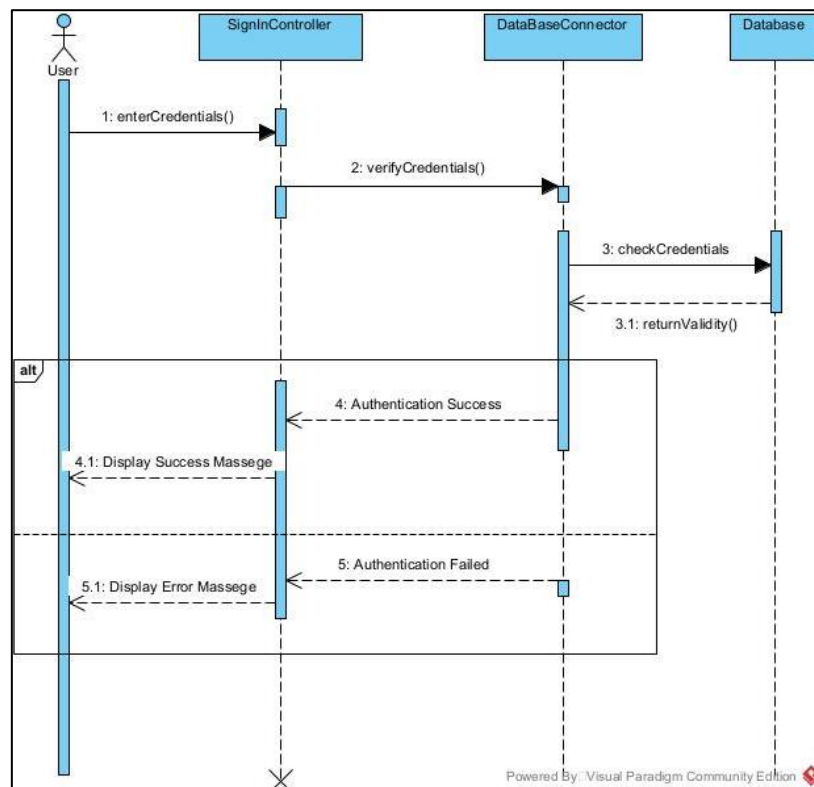


Figure 5: Login Sequence Diagram

## Article Read

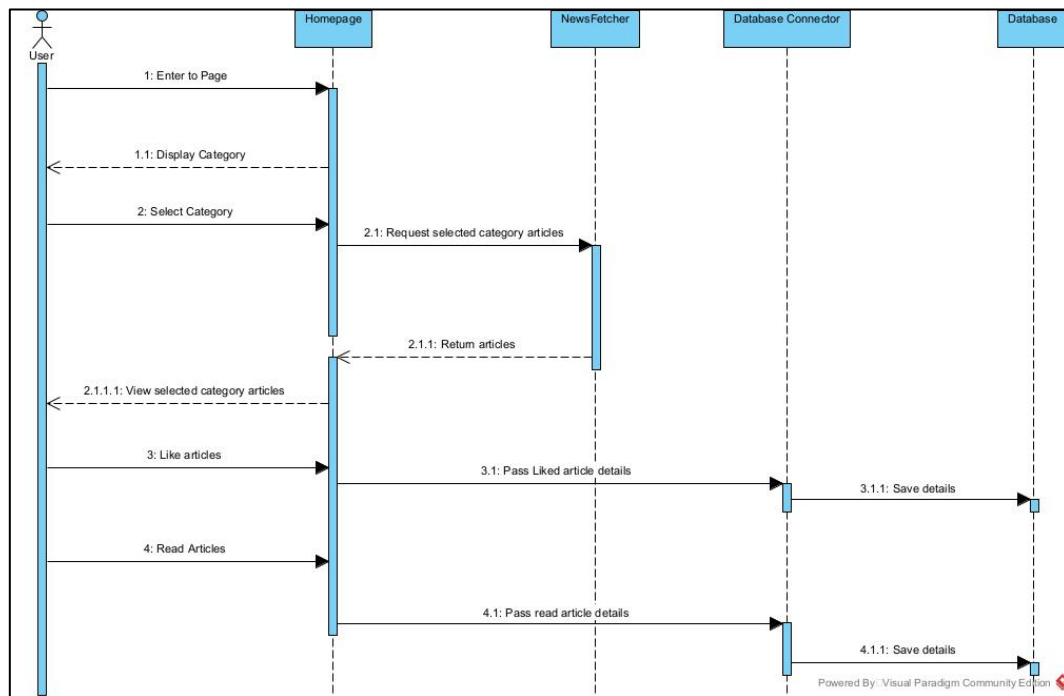


Figure 6: Article read Sequence Diagram

## Admin Login

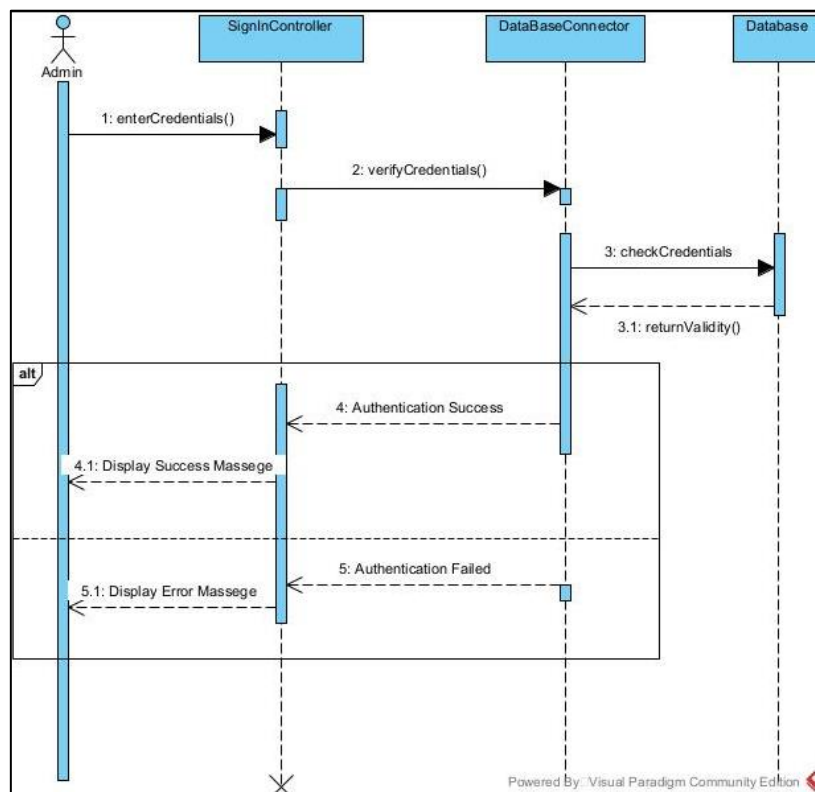


Figure 7: Admin Login Sequence Diagram

## User Signup

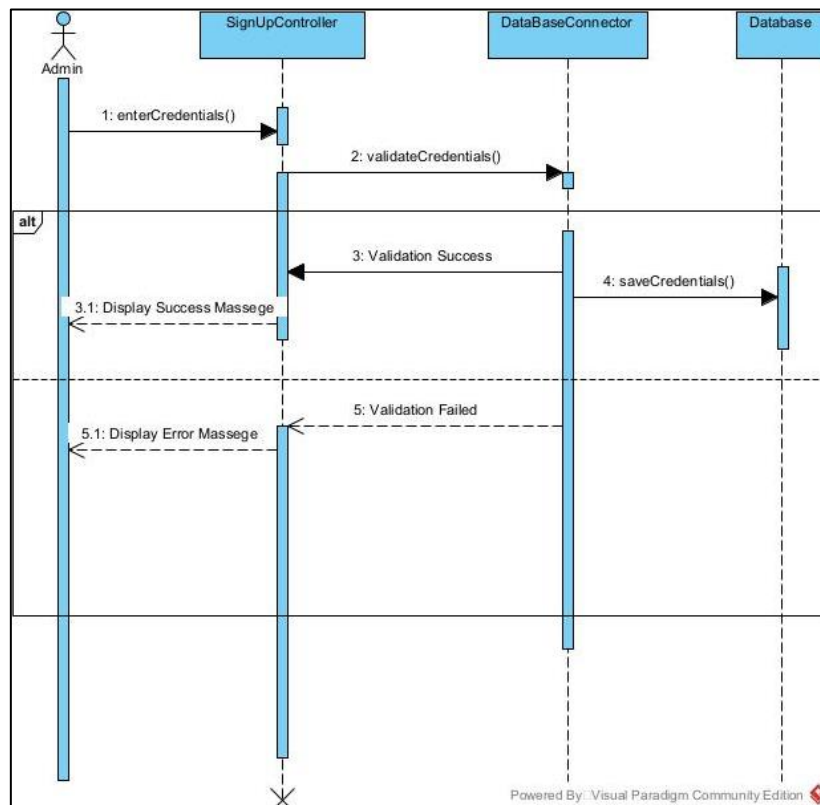


Figure 8: User Signup Sequence Diagram

## Recommendation

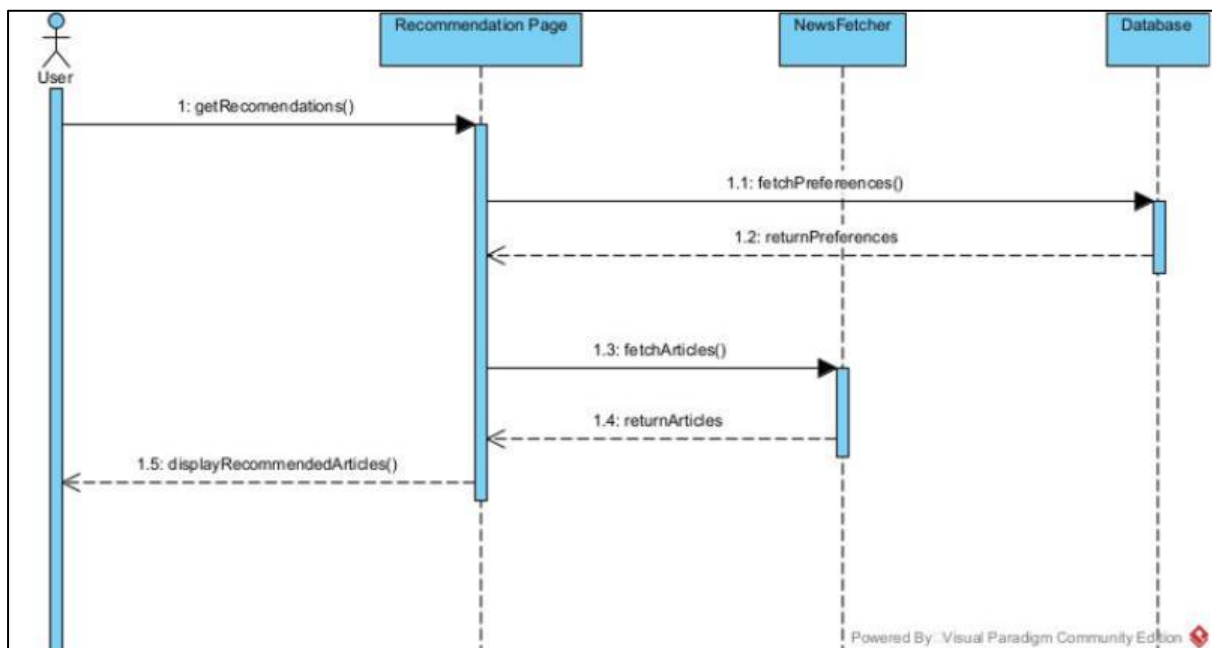


Figure 9: Recommendation Sequence Diagram

( Programming Tutorials and Resources, n.d.)

## Testing and evaluation

### Use Case 1: Login

- Test invalid credentials.
- Test valid credentials.
- Test account lockout after multiple failed attempts.

### Use Case 2: View Articles

- Validate articles display correctly.
- Ensure articles load according to user preferences.
- Check for performance when loading many articles.

### Use Case 3: Like Articles

- Verify the like button functions correctly.
- Ensure invalid inputs are handled.
- Confirm the user's like update the recommendation system.

### Use Case 4: Get Recommendations

- Validate the recommendations match user preferences and history.
- Test recommendations for a new user (cold start problem).
- Verify response time under high user load.

### Use Case 5: Manage Profile

- Test editing profile information.
- Verify password change functionality.
- Confirm error handling for invalid inputs.

## Evaluation Metrics

### 1. Functionality

- Percentage of test cases passed.
- Critical bug count.

### 2. Performance

- System response time under normal and peak loads.
- System uptime percentage.

### **3. User Satisfaction**

- Feedback collected during UAT.
- Average time taken to complete key actions (e.g., getting recommendations).

### **4. Scalability**

- The number of concurrent users supported without significant performance degradation.

(Community for Developers, n.d.)

## References

1. *Programming Tutorials and Resources*. (n.d.). Retrieved from W3Schools:  
<https://www.w3schools.com/>
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<https://stackoverflow.com/>
4. Fowler, M. (2003). *UML Distilled: A Brief Guide to the Standard Object Modeling Language (3rd ed.)*. Addison-Wesley.
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<https://www.ibm.com/topics/uml>
6. Sommerville, I. (2015). *Software Engineering (10th ed.)*. Pearson Education.
7. *Unified Modeling Language (UML)*. (n.d.). Retrieved from GeeksforGeeks:  
<https://www.geeksforgeeks.org/>
8. *Unified Modeling Language (UML) Specification*. (2021). Retrieved from Object Management Group (OMG): <https://www.omg.org/spec/UML/>

## Appendix

### Used Tool Details

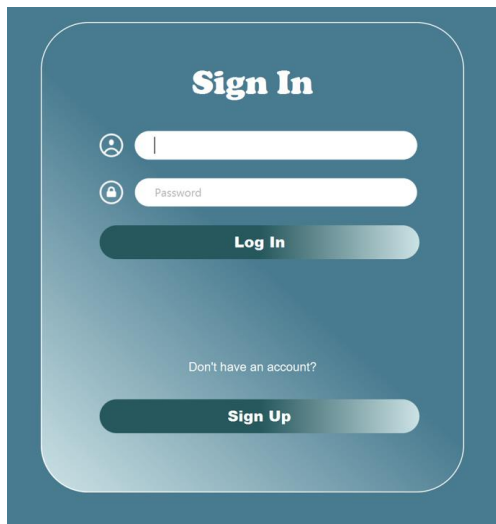
#### Java IDE

- ❖ Name - intellij IDEA
- ❖ Version - 2024.1.1

#### Database

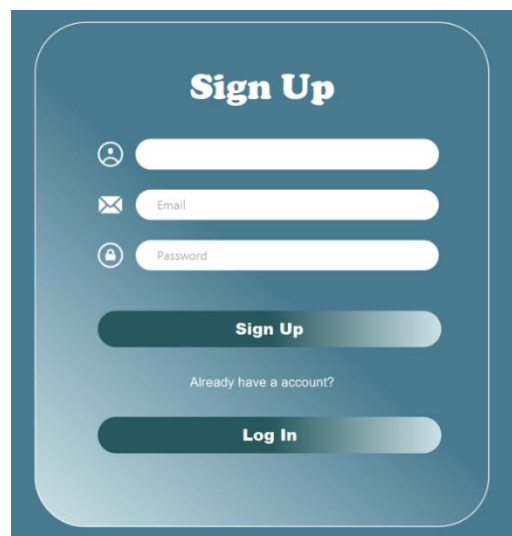
- ❖ Name – phpmyadmin
- ❖ Version – 5.2.1

### Application GUIs



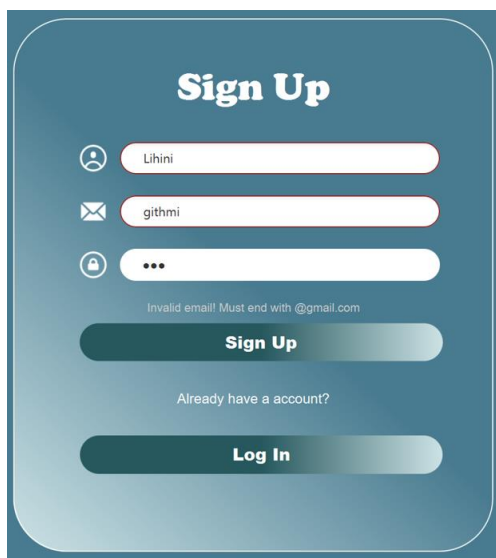
The Sign In GUI features a dark blue background with a light blue rounded rectangle containing the form. At the top, the text "Sign In" is displayed in white. Below it are two input fields: the first with a person icon and the second with a lock icon and the placeholder text "Password". A dark blue "Log In" button is positioned below the fields. At the bottom, the text "Don't have an account?" is followed by a dark blue "Sign Up" button.

Figure 11: Sign in



The Sign Up GUI features a dark blue background with a light blue rounded rectangle containing the form. At the top, the text "Sign Up" is displayed in white. Below it are three input fields: the first with a person icon, the second with an envelope icon and the placeholder text "Email", and the third with a lock icon and the placeholder text "Password". A dark blue "Sign Up" button is positioned below the fields. At the bottom, the text "Already have an account?" is followed by a dark blue "Log In" button.

Figure 10: Sign up



The Sign Up GUI features a dark blue background with a light blue rounded rectangle containing the form. At the top, the text "Sign Up" is displayed in white. Below it are three input fields: the first with a person icon and the placeholder text "Lihini", the second with an envelope icon and the placeholder text "githmi", and the third with a lock icon and three dots. Below the email field, the text "Invalid email! Must end with @gmail.com" is displayed in red. A dark blue "Sign Up" button is positioned below the fields. At the bottom, the text "Already have an account?" is followed by a dark blue "Log In" button.

Figure 13: E-mail format Verification



The Sign Up GUI features a dark blue background with a light blue rounded rectangle containing the form. At the top, the text "Sign Up" is displayed in white. Below it are three input fields: the first with a person icon and the placeholder text "Lihini", the second with an envelope icon and the placeholder text "lihini@gmail.com", and the third with a lock icon and three dots. Below the password field, the text "Must be at least 8 characters. Must include an uppercase letter." is displayed in red. A dark blue "Sign Up" button is positioned below the fields. At the bottom, the text "Already have an account?" is followed by a dark blue "Log In" button.

Figure 12: Password format Verification





Figure 14: Sign in exist user verification

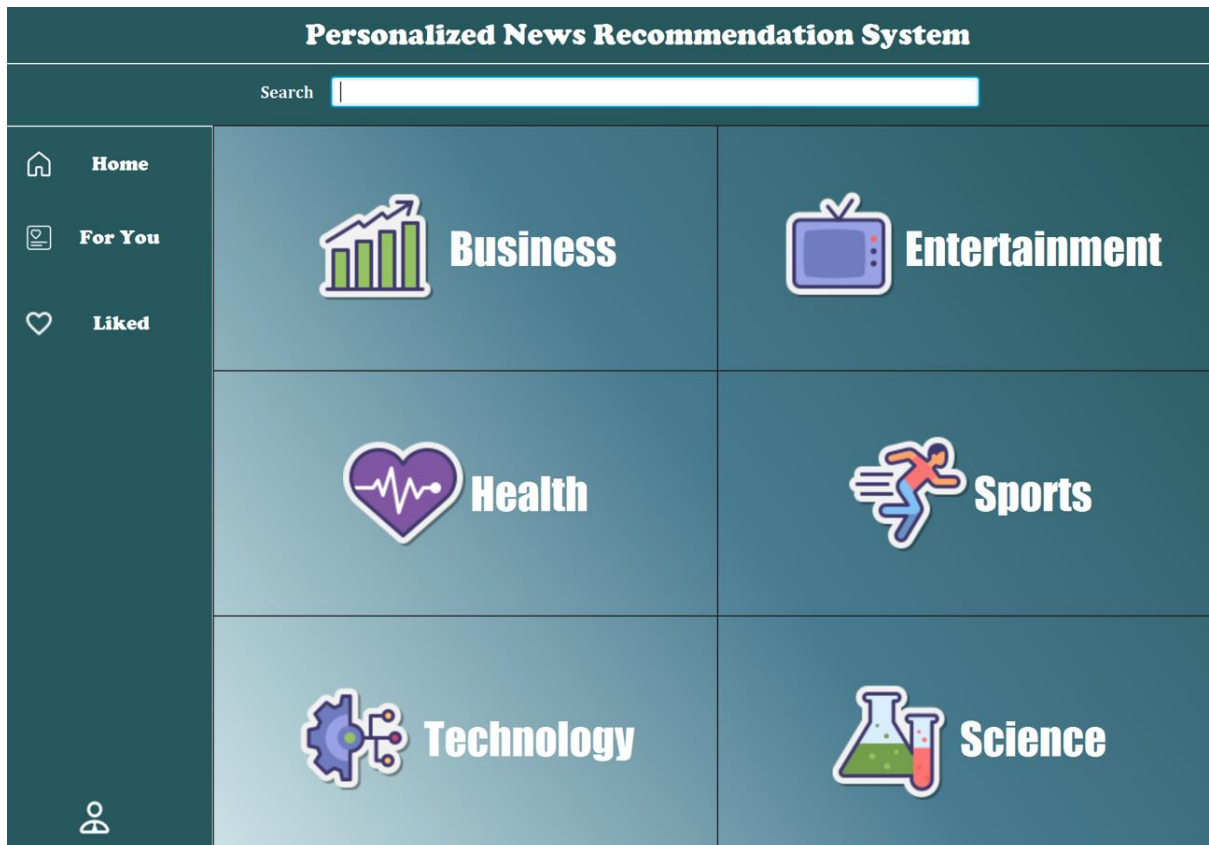


Figure 15: News Recommendation Engine in Home page


## Personalized News Recommendation System

Search

Home


For You

Liked




**JetBlue cuts more unprofitable routes, tweaks ...**

Leslie Josephs [Read more](#)




**Airbus to axe nearly 500 UK jobs to cut costs - ...**

Unknown [Read more](#)



**UnitedHealthcare CEO Brian Thompson shot dea...**

Page 1



**Intel Board Blasted For Handling Of CEO's Sudden...**

Figure 16: Categorized Articles view for one category


## Personalized News Recommendation System

Search

Home


For You

Liked




**Spiderweb protocluster is filled with baby ...**

Robert Lea [Read more](#)




**Archaeologists discover key tool that helped earl...**

Katie Hunt, CNN [Read more](#)



**James Webb Space Telescope discovers 4th ...**



**Mammoth Meat Powered Ice Age Humans, Stud...**

Page 1

Figure 17: For You Page (Recommendation Engine)

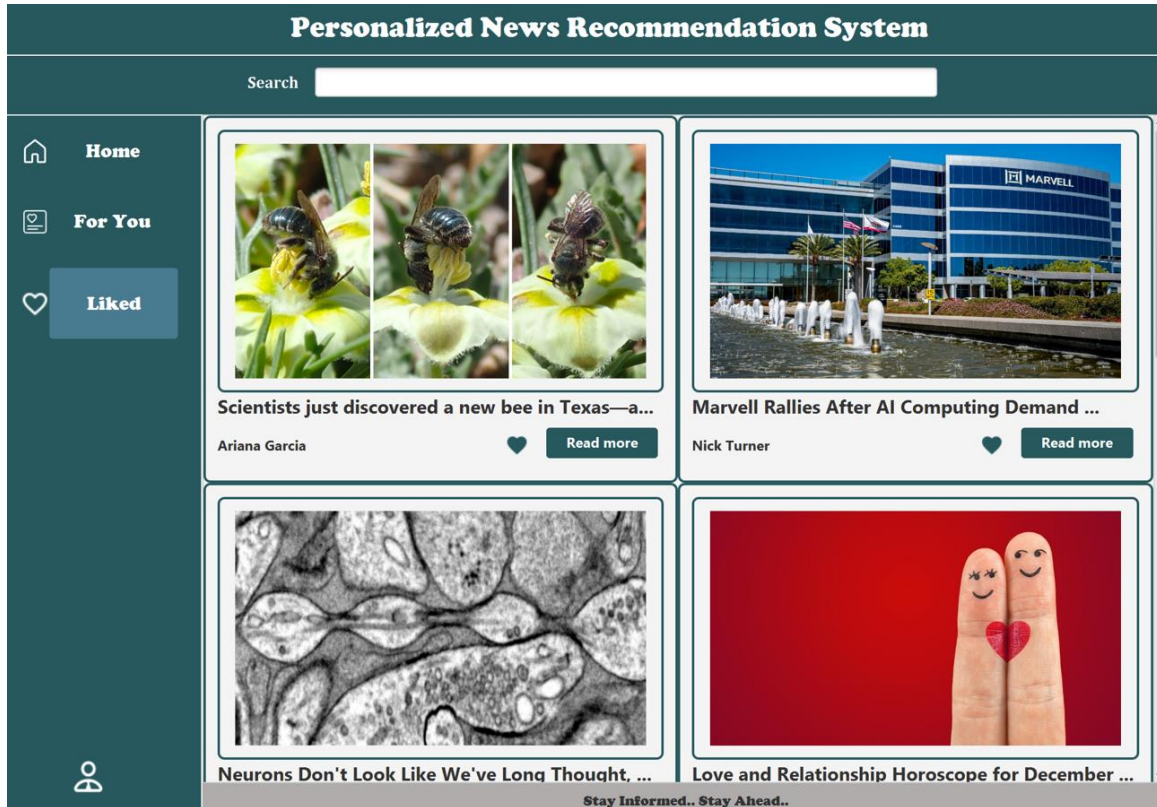


Figure 18: Liked Page

## Database Table Details

Table	Action	Rows	Type	Collation	Size	Overhead
<input type="checkbox"/> articles	Browse  Structure  Search  Insert  Empty  Drop	42	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> preferences	Browse  Structure  Search  Insert  Empty  Drop	9	InnoDB	utf8mb4_general_ci	32.0 KiB	-
<input type="checkbox"/> users	Browse  Structure  Search  Insert  Empty  Drop	6	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> user_interactions	Browse  Structure  Search  Insert  Empty  Drop	44	InnoDB	utf8mb4_general_ci	48.0 KiB	-
4 tables	Sum	101	InnoDB	utf8mb4_general_ci	176.0 KiB	0 B

Figure 19: All Table details

	article_id	title	author	url	category	published_at	image_url	description	content
		10c8a66	Playing Jared McCain in fourth quarter shouldn't b...	Paul Hudrick	sports	2024-12-04 04:26:50	https://cdn.vox-cdn.com/thumbor/7eTgrR55TBLBjGQ20P...	The Steelers blew a 19-point lead Tuesday as their o...	Nobody saw Jared McCain start to the season comin...
		12c34772	Goodreau honored by Flames. Blue Jackets with prog...	Unknown	sports	2024-12-04 05:54:49	https://media.d3nble.com/image/private/_ratio15...	Family of forward, who died along with brother, Ma...	Both teams lined up at their respective blue lines.
		1267644	S&P 500 futures are little changed after index pos...	Huiyong Kim	business	2024-12-04 00:33:09	https://image-cdnets.com/api/v1/image/10696937-17...	A state of labor market data is looming this week...	S&P 500 futures were higher Wednesday morning.
		1a0d279a	"Stay off my lawn": 1802, 2048, 320x video GPT's radi...	Unknown	sports	2024-12-04 05:36:00	https://a2-expressh.com/content/images/2024/12/07/...	Athletic director of Iowa State and OSU are in a	Athletic director at Iowa State said OSU's win is a...
		19d6d5dc	Spotify Wrapped 2024: Taylor Swift is Most-Stream...	Todd Spangler	entertainment	2024-12-04 13:00:00	https://variety.com/wp-content/uploads/2024/12/10/Ta...	Spotify Wrapped 2024 is out — and Taylor Swift is	The Spotify Wrapped 2024 year-end data file is out.
		2204937a	MLB Insider: Labels Red Sox 'Surprising Favor' to J...	Tim Crowley	sports	2024-12-04 04:31:56	https://www.espn.com/story/content/images/2024/12/04/...	The Athletics' Ken Rosenthal had quite the descrip...	Can the Red Sox get the deal done? The Boston Star.
		24303f6f	National signing day live: Comments, Rps, rumors ...	ESPN staff	sports	2024-12-04 16:15:00	https://a.espn.com/content/combiner/?img=5c2fphoto5c2f26...	We're tracking the latest news, rumors and class c...	College football's national signing day has kicked.
		274933ba	Waterborne Disease Outbreaks Associated with Splice...	CDC	health	2024-12-04 14:36:03	https://www.cdc.gov/newsroom/releases/2730c0a130d413...	This report characterizes waterborne disease outbr...	All Spanish Food-associated Outbreaks During 1997-2...
		3a8f4d8f	College Football Playoff Rankings reaction: SEC is...	https://www.cbssports.com/college-football/news/...	sports	2024-12-04 07:20:00	https://reporthub.dailymotion.com/2024/12/04/...	Step me if you've heard this one before: Alabama i...	The ACC branding issues struck again. And the SEC...
		475a470f	OPINION: Sabres suffer their worst home loss in 8...	Paul Hamilton	sports	2024-12-04 04:02:44	https://images.radio.com/raudio-media/Cal75813d5-5d...	This was not a game that is a "learning experience...	Buffalo, NY (WGR 550) On Tuesday night we witness...
		42a0e7b6	Lamine Yamal leads Barcelona's very important win...	GB Clark	sports	2024-12-04 01:00:00	https://file.vox-cdn.com/thumbor/Pf03Tep56kx4_wd0...	The teenager spoke out after victory at Mallorca	Barcelona wonderkid Lamine Yamal was happy to see...
		533719b3	African executives not to defend said face before...	Lucile Joseph	business	2024-12-04 00:00:00	https://image-cdnets.com/api/v1/image/106738015-1b...	Executives from American... United States, Frontier...	U.S. public occasions are not to defend that se...
		626b8d4e	Founder of failed crypto lending platform Celsius...	LARRY NEUMEISTER	business	2024-12-03 23:22:00	https://dms.apnews.com/dms/i/464a4b4b4b4b4b4b4b4b4b...	The founder and former CEO of the failed cryptos...	NEW YORK (AP) The founder and former CEO of the fa...
		63263601	Ex-Lily's Zapbound causes greater weight loss th...	Aurika Kim Constantino	science	2024-12-04 11:45:01	https://image-cdnets.com/api/v1/image/107433096-1f...	Zapbound's greater weight loss is a huge advantage	Ex-Lily on Wednesday said its obesity drug Zapbo...
		67163024	Live coverage: SpaceX to launch Falcon 9 rocket bo...	Unknown	science	2024-12-04 03:00:00	No image available	No description available	A SpaceX Falcon 9 rocket stands at Space Launch Co...
		68c10332	Neurons Don't Look Like We've Long Thought, Cente...	Carly Cavella	science	2024-12-04 06:29:04	https://www.sciencemag.com/newsroom-dont-look-lik...	The most complicated object in the known Universe	The most complicated object in the known Universe
		69d6626f	Coca-Cola just weakened its goal to reduce single...	Sarah Raza	business	2024-12-04 03:49:00	https://www.washingtonpost.com/wp-apps/images.php?r...	The company said it will shift its focus to plast...	Days after the U.N. global plastics treaty negotia...
		758a4a95	Love and Relationship Horoscope for December 4, 20...	Neeraj Chandra	entertainment	2024-12-04 00:30:19	https://www.hindustantimes.com/astrology/horoscope...	Daily Love Horoscope December 4, 2024: Today, the	Ades: Your laid-back disposition is today's winn...
		765d67b6	9 PM ET   E! News' Choice: Winning Cyber Monday Deal...	K. Thai Jensen	technology	2024-12-04 05:25:23	https://i.pinimg.com/imagery/v1/6a/43/09/6a4309966E...	Cyber Monday prices are still good as a handful o...	No content available.
		76757962	Why Za Darius Smith must take down his former team...	Brendan Kinney	sports	2024-12-04 12:30:00	https://cdn.vox-cdn.com/thumbor/k4fC0X0Q7T_JJ5uak...	Taking on the Green Bay Packers, Detroit Lions del...	The NFC North is easily the best division in the N...
		8773139b	Marie & Luigi Brotherhood developer wanted on 'idg...	Chris Scullion	technology	2024-12-04 14:41:30	https://www.videogameschronicle.com/news/marie-luigi...	"We'd unleashed Aquaria into the wild, only to go...	Aquaria, the studio behind Mario Bros: Luigi Bros.
		844d734	Bleeding eye disease caused by Marburg virus with...	TOI Lifestyle Desk	health	2024-12-04 03:26:00	https://static.toiimg.com/thumb/resize/119555355_aid...	The fast-spreading Marburg virus, also known as M...	No content available.
		88861433	Aging Is It a Disease, a Process, or Something El...	Neuroscience News	health	2024-12-03 22:47:37	https://www.neurosciencenews.com/2024/12/aging-a...	A survey of experts in aging research reveals sign...	Summary: A survey of experts in aging research rev...
		90427763	Last 2 defendants in Atlanta's Young Thug trial ar...	CHARLOTTE KRAMON	entertainment	2024-12-04 03:10:00	https://dms.apnews.com/dms/i/464a4b4b4b4b4b4b4b4b...	The long-running gang and racketeering trial in At...	ATLANTA (AP) The long-running gang and racketeer...
		96959b	Kim Zolciak claims Kory Bliemann drew her to the ...	Whitney Venguez	entertainment	2024-12-03 23:39:00	https://proton.com/wp-content/uploads/2024/...	The divorce drama continued	Kim Zolciak alleged her ex, Kory Bliemann, got phy...

Figure 20: Article Table



←T→		user_id	username	email	password	created_at
<input type="checkbox"/>	Edit  Copy  Delete	1	gimu	githmirajapakshe2020@gmail.com	123	2024-12-03 23:32:58
<input type="checkbox"/>	Edit  Copy  Delete	2	chamo	chamodirajapakshe@gmail.com	1234	2024-12-04 07:49:46
<input type="checkbox"/>	Edit  Copy  Delete	4	dinesh	dinesh@gmail.com	Dinesh@123	2024-12-04 08:41:49
<input type="checkbox"/>	Edit  Copy  Delete	8	dammi	dammi@gmail.com	Dammi@123	2024-12-04 09:27:22
<input type="checkbox"/>	Edit  Copy  Delete	9	fara	farhaan@gmail.com	Fara@123	2024-12-04 09:44:28
<input type="checkbox"/>	Edit  Copy  Delete	10	vinu	vinu@gmail.com	Vinu@123	2024-12-05 21:54:20

Figure 21: User Table

←T→		interaction_id	user_id	article_id	interaction_type	timestamp
<input type="checkbox"/>	Edit  Copy  Delete	1	1	904277b3	read	2024-12-05 11:35:04
<input type="checkbox"/>	Edit  Copy  Delete	3	1	d73339a3	read	2024-12-05 11:48:51
<input type="checkbox"/>	Edit  Copy  Delete	6	1	88f61e33	read	2024-12-05 12:37:15
<input type="checkbox"/>	Edit  Copy  Delete	8	1	f080b94a	read	2024-12-05 12:42:00
<input type="checkbox"/>	Edit  Copy  Delete	10	1	dcb54612	read	2024-12-05 12:47:52
<input type="checkbox"/>	Edit  Copy  Delete	11	1	43ac0b9a	read	2024-12-05 12:51:08
<input type="checkbox"/>	Edit  Copy  Delete	13	1	75e50e1b	read	2024-12-05 12:56:13
<input type="checkbox"/>	Edit  Copy  Delete	16	1	bf589d8b	read	2024-12-05 13:00:10
<input type="checkbox"/>	Edit  Copy  Delete	19	1	ed6236e4	read	2024-12-05 13:06:07
<input type="checkbox"/>	Edit  Copy  Delete	21	1	67163f24	read	2024-12-05 13:06:21
<input type="checkbox"/>	Edit  Copy  Delete	23	1	b784d46f	liked	2024-12-05 13:06:35
<input type="checkbox"/>	Edit  Copy  Delete	26	1	e90d1bac	liked	2024-12-05 15:31:59
<input type="checkbox"/>	Edit  Copy  Delete	30	1	1eadc2ba	read	2024-12-05 15:43:33
<input type="checkbox"/>	Edit  Copy  Delete	31	1	dd254388	read	2024-12-05 15:47:49
<input type="checkbox"/>	Edit  Copy  Delete	32	1	68c10312	read	2024-12-05 15:59:49
<input type="checkbox"/>	Edit  Copy  Delete	34	1	68c10312	liked	2024-12-05 16:02:39
<input type="checkbox"/>	Edit  Copy  Delete	36	1	75844e50	read	2024-12-05 16:18:50
<input type="checkbox"/>	Edit  Copy  Delete	38	1	75844e50	liked	2024-12-05 16:19:21
<input type="checkbox"/>	Edit  Copy  Delete	39	1	9fbf9fb	read	2024-12-05 16:19:26
<input type="checkbox"/>	Edit  Copy  Delete	41	1	b784d46f	read	2024-12-05 17:45:20
<input type="checkbox"/>	Edit  Copy  Delete	42	2	63628dd1	read	2024-12-05 19:59:42
<input type="checkbox"/>	Edit  Copy  Delete	43	2	63628dd1	liked	2024-12-05 19:59:48
<input type="checkbox"/>	Edit  Copy  Delete	44	2	12c34772	liked	2024-12-05 20:00:25
<input type="checkbox"/>	Edit  Copy  Delete	45	2	10cfba86	liked	2024-12-05 20:00:33
<input type="checkbox"/>	Edit  Copy  Delete	46	2	415a701f	read	2024-12-05 20:00:40

Figure 22: User preference Table




























<div> <div>←T→</div> <div>▼</div> </div>				preference_id	user_id	category	score
<input type="checkbox"/>	 Edit	 Copy	 Delete	14	1	sports	20
<input type="checkbox"/>	 Edit	 Copy	 Delete	15	1	business	40
<input type="checkbox"/>	 Edit	 Copy	 Delete	16	1	entertainment	30
<input type="checkbox"/>	 Edit	 Copy	 Delete	17	1	science	50
<input type="checkbox"/>	 Edit	 Copy	 Delete	18	1	health	35
<input type="checkbox"/>	 Edit	 Copy	 Delete	19	1	technology	10
<input type="checkbox"/>	 Edit	 Copy	 Delete	32	10	business	15
<input type="checkbox"/>	 Edit	 Copy	 Delete	34	10	sports	35
<input type="checkbox"/>	 Edit	 Copy	 Delete	35	10	entertainment	15

Figure 23: User Interaction Table