Bilkent University

Department of Computer Engineering

Senior Design Project

Impartial - Group T2324

Analysis and Requirement Report

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1. Introduction

In a time where information surrounds us from various sources every day, there is a growing need for a platform that rises above biases and embraces an unbiased perspective. Introducing "Impartial News" – a project that goes beyond traditional news gathering. Impartial is developed not just to collect news from a variety of sources but to completely change the way we see and interact with information.

This dynamic website has the ability to smoothly transform articles from one viewpoint to another, removing the need for manual editorial editing of news articles to eliminate or manipulate bias. Whether an article starts from a left-leaning angle, Impartial can easily reframe it to match center or right perspectives. Beyond being just a sorting tool, Impartial aims to reshape the media landscape by promoting fairness, offering thorough information, and improving our understanding of global issues. Our goal is to bridge gaps in ideologies, encouraging a more detailed and informed public conversation that goes beyond usual limits.

2. Current System

Currently, no GenAI models are available specifically for neutralizing the political bias of news articles. A website named Allsides provides political bias classification for news articles, but they do not use any machine learning or artificial intelligence systems. The classifications are made by volunteer editors and community feedback.

Another existing system is a browser extension that seeks out identical news articles from various sources and assigns labels based on the political alignment of each news outlet. This extension, although helpful in identifying different perspectives on a given topic, relies solely on manual assessments by its users and lacks the sophisticated capabilities of machine learning or artificial intelligence. The classifications are subject to the interpretations of users and may not capture the nuanced and evolving nature of political bias in news reporting.

While these existing systems contribute valuable insights, they fall short in harnessing the power of technology to autonomously neutralize political bias within news articles. Recognizing this gap, "Impartial News" emerges as a project that leverages advanced GenAI

models to revolutionize the landscape of news consumption and provide a more dynamic and unbiased understanding of current events.

3. Proposed System

3.1 Overview

Our system fully automizes the previously described functions. We aim to classify the incoming news articles with the machine learning model we have trained instead of manual labor alternatives of other systems. After the output from our classification AI, our system will then neutralize the left or right political bias if detected. We aim to conduct this operation by training a GenAI model using a suitable large language model. By doing this we also eliminate manual labor required to rewrite the article free from any political bias.

3.2 Functional Requirements

- Users will be able to register/log in using their email and password.
- Users will be able to view news articles regardless of signing in.
- Users will be able to filter news articles based on their political alignment.
- Users will be able to save news articles.
- Users will be able to upvote/downvote the accuracy of classification of news articles.
- Admins will be able to add/edit/remove news manually.
- Admins will be able to perform a web scrape in case of breaking news in addition to the automated web scrapes performed hourly.
- The system will be able to scrape news from different sources.
- The system will be able to parse and categorize scraped news and save them to the database.
- The system will be able to generate a news article from a given news article that is written in other perspectives.

3.3 Nonfunctional Requirements

Usability

The app has a non-functional usability requirement because of the diverse and vast user base. The news is something that everybody on the planet sees, and if we want to succeed in this

area, the app should be user-friendly. It should have a trivial user interface and instinctive functionality.

Security

Since we will be getting requests from the users, we will be handling user data, and that is a big problem with security. We will design our app with the security constraints in mind and use the appropriate encryption and safety practices throughout our journey.

Performance

Since we will use machine learning, generative AI, microservices, and such, the new content should be processed with acceptable speed, like a minute at the top, and the generative part should be comparable to the other alternatives in the area. For example, if it is vastly slower than chatGPT's response time our application won't be preferred to better alternatives.

Supportability

We are building the app for the web because we want to support every device possible and get an extensive range of coverage across platforms, and to achieve that, we will optimize how our web app looks for every platform.

Scalability

Since all the consumers for news are a considerable number, our system should scale accordingly because of our revolutionary idea. We are expecting at least 10% of the Reuters users, and that number is in the order of millions. To accommodate that many users and handle their requests for the generative part, we need to write optimized and scalable code from the bottom up.

3.4 Pseudo Requirements

- GitHub will be used for version control and code repository
- Java Spring will be used for backend development
- Python, Pytorch and HuggingFace Transformers will be used for GenAI and Classifier model development
- Vue.js 3 will be used for frontend development
- WhatsApp, Discord and Google Meet will be used for meetings related to the project

- Google Docs will be used for report writing
- PostgreSQL will be used as a database
- AWS infrastructure will be used for hosting the project and creating development pipelines
- Google Collab and Jupyter Lab will be used for the testing and benchmarking of several different models

3.5 System Models

3.5.1 Scenarios

Scenario 1: Signup

Actors: Visitors

Entry Condition: Visitor enters the site and clicks on the signup button

Exit Condition: Visitor clicks on the "X" button

Flow of Events:

1. Visitor enters their mail
2. Visitor enters their password
3. Visitor clicks on the signup button
4. Visitor is navigated to home and logged in automatically

Scenario 2: Login

Actors: Customers, Admins

Entry Condition: Actors enter the site and click on the login button

Exit Condition: Actors click on the "X" button

Flow of Events:

1. Actors enter their mail
2. Actors enter their password
3. Actors click on the login button
4. Actors are navigated to home and logged in

Scenario 3: Logout

Actors: Customers, Admins

Entry Condition: Actors enter the site and click on the logout button

AND

being logged in

Exit Condition: Actors click on the "X" button

Flow of Events:

1. Actors click on the logout button
2. Actors are navigated to home and logged out

Scenario 4: Evaluate an article

Actors: Customers

Entry Condition: Actors click on the evaluation button for any article

AND

being logged in

Exit Condition: Actors click on the "X" button

Flow of Events:

1. Actors select an evaluation grade
2. Actors click submit

Scenario 5: Comment on an article

Actors: Customers

Entry Condition: Actors click on the comment button for any article

AND

being logged in

Exit Condition: Actors click on the "X" button

Flow of Events:

1. Actors enter a comment
2. Actors click submit

Scenario 6: Using the API for classification

Actors: Customers

Entry Condition: Actors click on the comment button for any article

AND

being a premium customer

Exit Condition:

Flow of Events:

1. Actors send their text

2. The backend sends the classification for that text

Scenario 7: Using the API for GenAI

Actors: Customers

Entry Condition: Actors send their text through the API

AND

being a premium customer

Exit Condition:

Flow of Events:

1. Actors send their text

2. Actors send what side of the spectrum they want the result in

3. The backend sends the generated text back

Scenario 8: View an article

Actors: Visitors, Customers

Entry Condition: Actors click on the article

Exit Condition: Actors click on the "Back" button

Flow of Events:

1. Actor clicks on the selected article

2. App navigates user to that articles page

Scenario 9: Change bias of an already existing article

Actors: Visitors, Customers

Entry Condition: Actor should be viewing an article

Exit Condition: Actors click on the "Back" button

Flow of Events:

1. Actor clicks on the bias that the article should be converted
2. App shows the converted article

Scenario 10: Change password

Actors: Customers, Admins

Entry Condition: Actors click on the change password button

Exit Condition: Actors click on the "X" button

Flow of Events:

1. Actor enters the new password
2. Actor clicks submit
3. Backend changes that password

Scenario 11: View profile

Actors: Customers

Entry Condition: Actors click on the profile

Exit Condition: Actors click on the "Back" button

Flow of Events:

1. App shows the profile

Scenario 12: Add article to the bookmarks

Actors: Customers

Entry Condition: Actors click on the article

Exit Condition: Actors click on the "Back" button

Flow of Events:

1. Actors clicks on the "Bookmark" button on the selected article
2. App saves that bookmark for that Actors

Scenario 13: View bookmarks

Actors: Customers

Entry Condition: Actors click on bookmarks

Exit Condition: Actors click on the "Back" button

Flow of Events:

1. App shows the bookmarks

Scenario 14: Delete user

Actors: Admin

Entry Condition: Actors click on users

Exit Condition: Actors click on the "Back" button

Flow of Events:

1. Actors select the user to be deleted
2. Actor clicks on the delete button
3. Backend deletes the user

Scenario 15: Buy premium membership

Actors: Customers

Entry Condition: Actors click on upgrade

Exit Condition: Actors click on the "Back" button

Flow of Events:

1. Actors enter the payment method
2. Actor clicks on the buy button
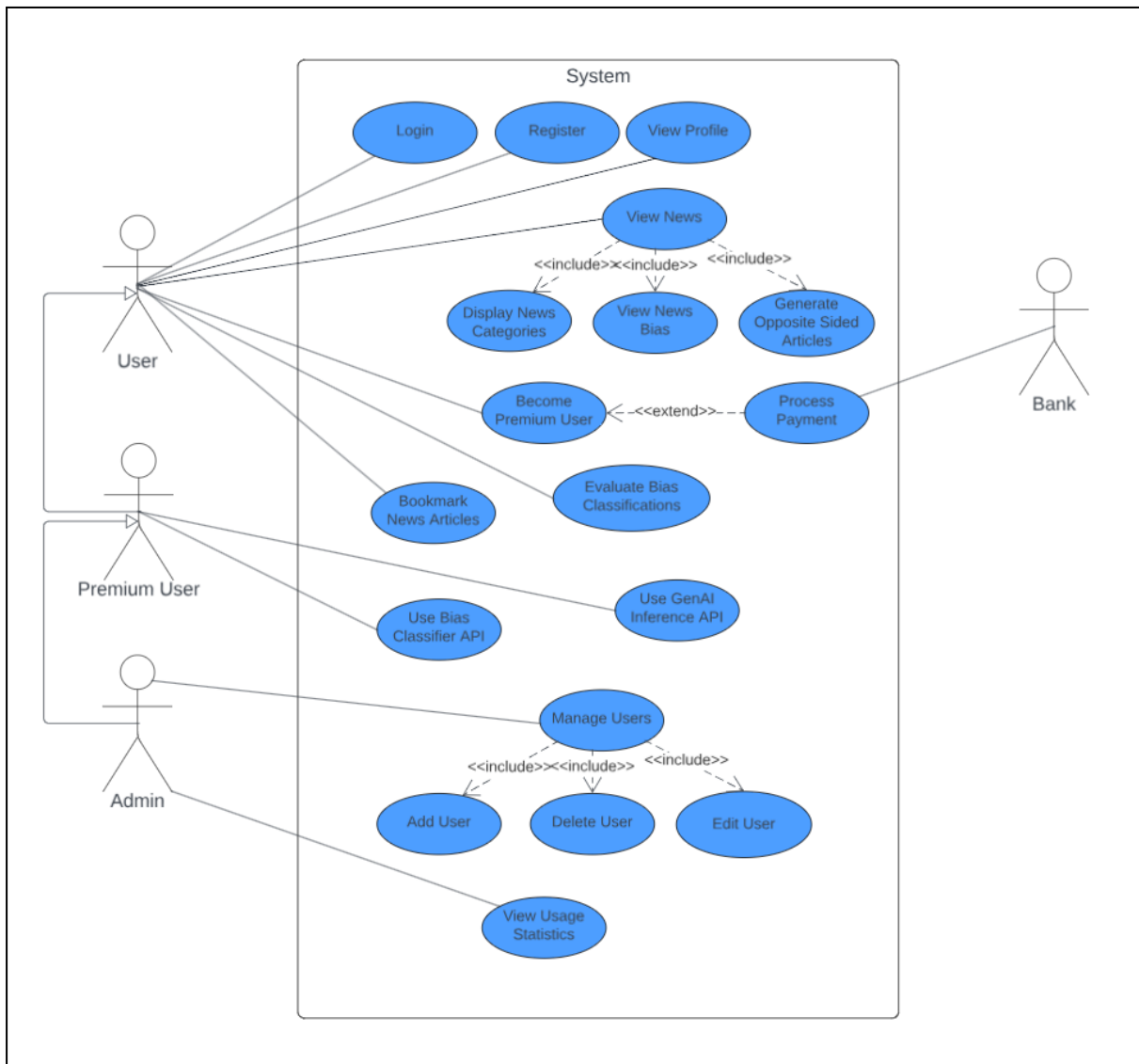3. Backend and Bank handles transaction

3.5.2 Use Case Model

Figure 3.5.2.1: Use Case Model for Impartial

The above diagram depicts the general view of Impartial. There are mainly 3 types of actors in the system. These are users, admins and premium users. The users can also be visitors, in this case they can only view the news articles. If the visitor registers and creates an account they can also bookmark articles and evaluate bias classification. If the registered user wants to become a premium user, they can do so by paying the premium user fee.

If the user is a premium user, they can use the bias classifier API as well as the generation API. They can use these APIs to classify news on Impartial or any news article they supply.

Same applies for the generation API. When the subscription period ends, the user has to pay a premium user fee again to benefit from these APIs.

Admins can control the system manually. They can manage users, news articles and view usage statistics.
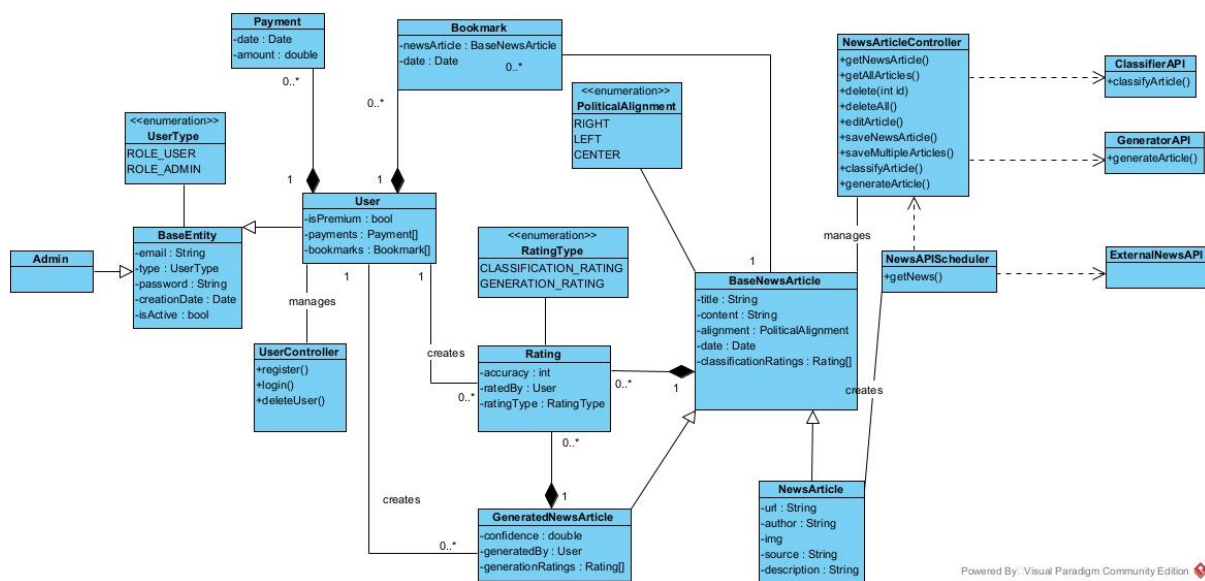
3.5.3 Object and Class Model

Figure 3.5.3.1: Object and Class Model for Impartial
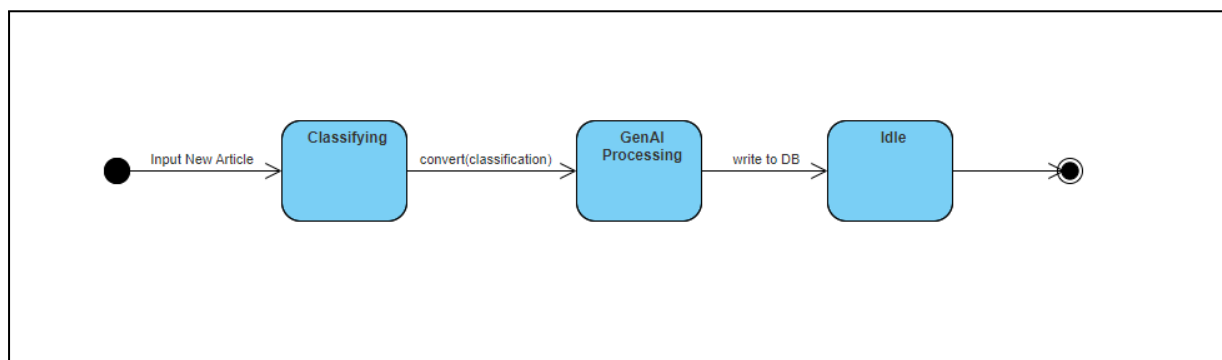
3.5.4 Dynamic Models

Figure 3.5.4.1: State Diagram for Classifying and Generating News Articles
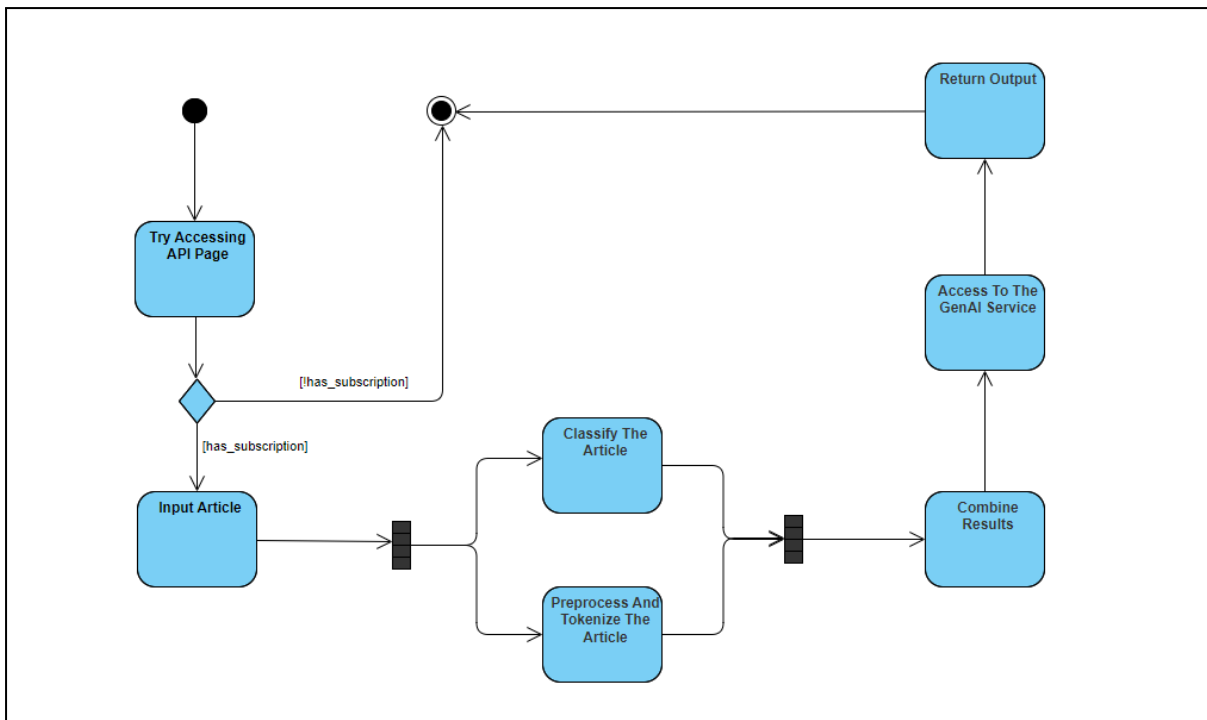
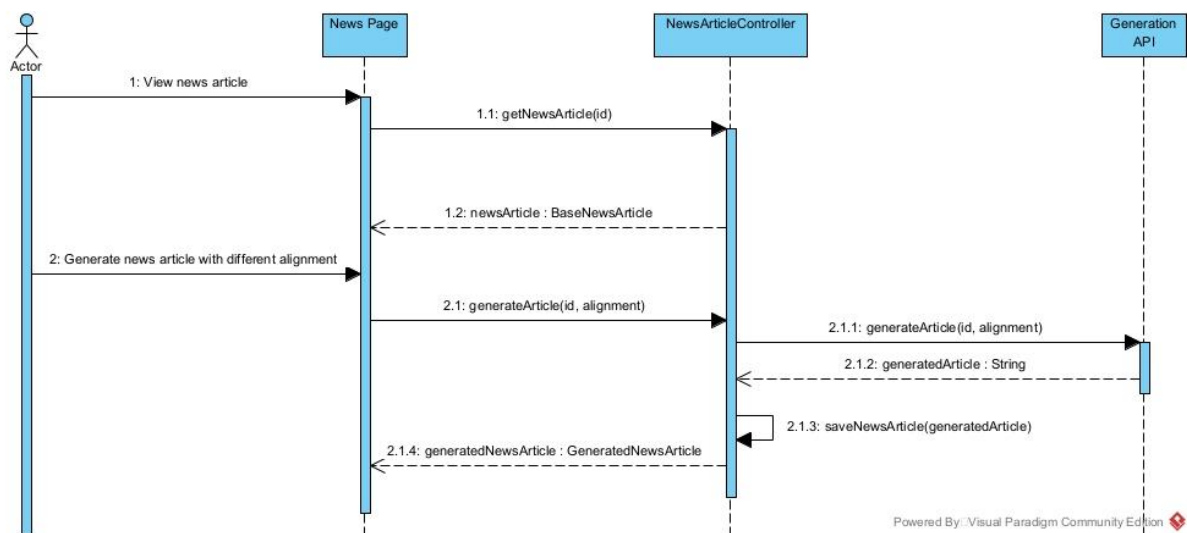Figure 3.5.4.2: Activity Diagram for Using Impartial APIs

Figure 3.5.4.3: Sequence Diagram for Viewing and Generating News Article

3.5.5 User Interface - Navigational Paths and Screen Mock-ups

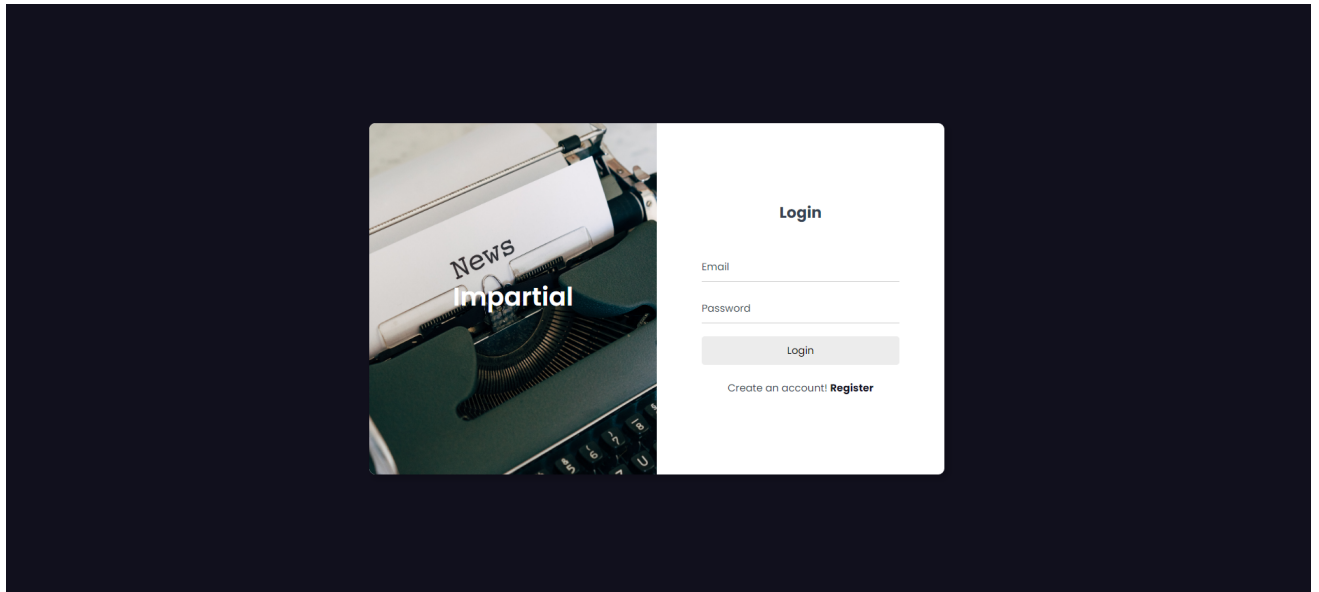The below images provide an overview of Impatial's user interface.
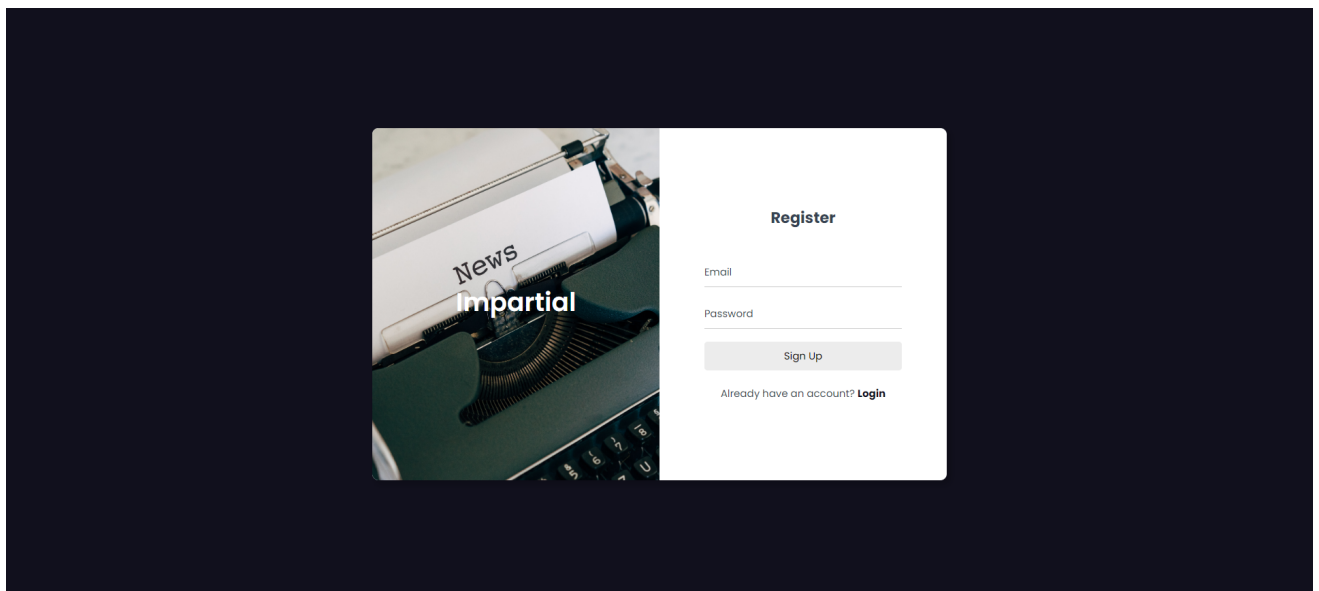

Figure 3.5.5.1: Login Page
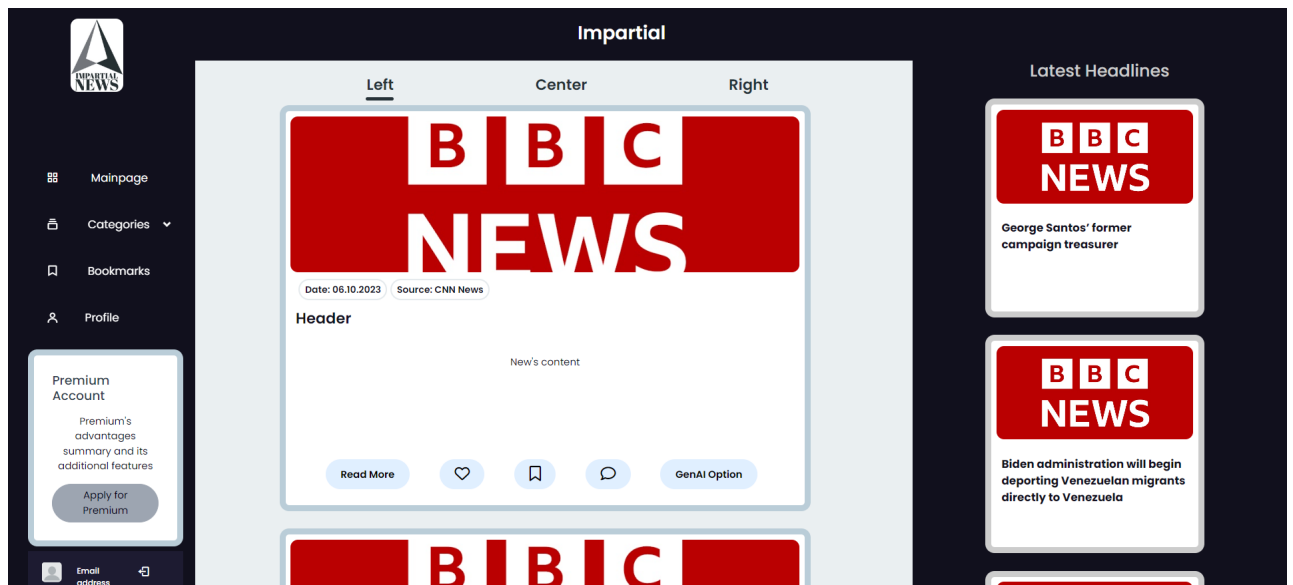

Figure 3.5.5.2: Register Page
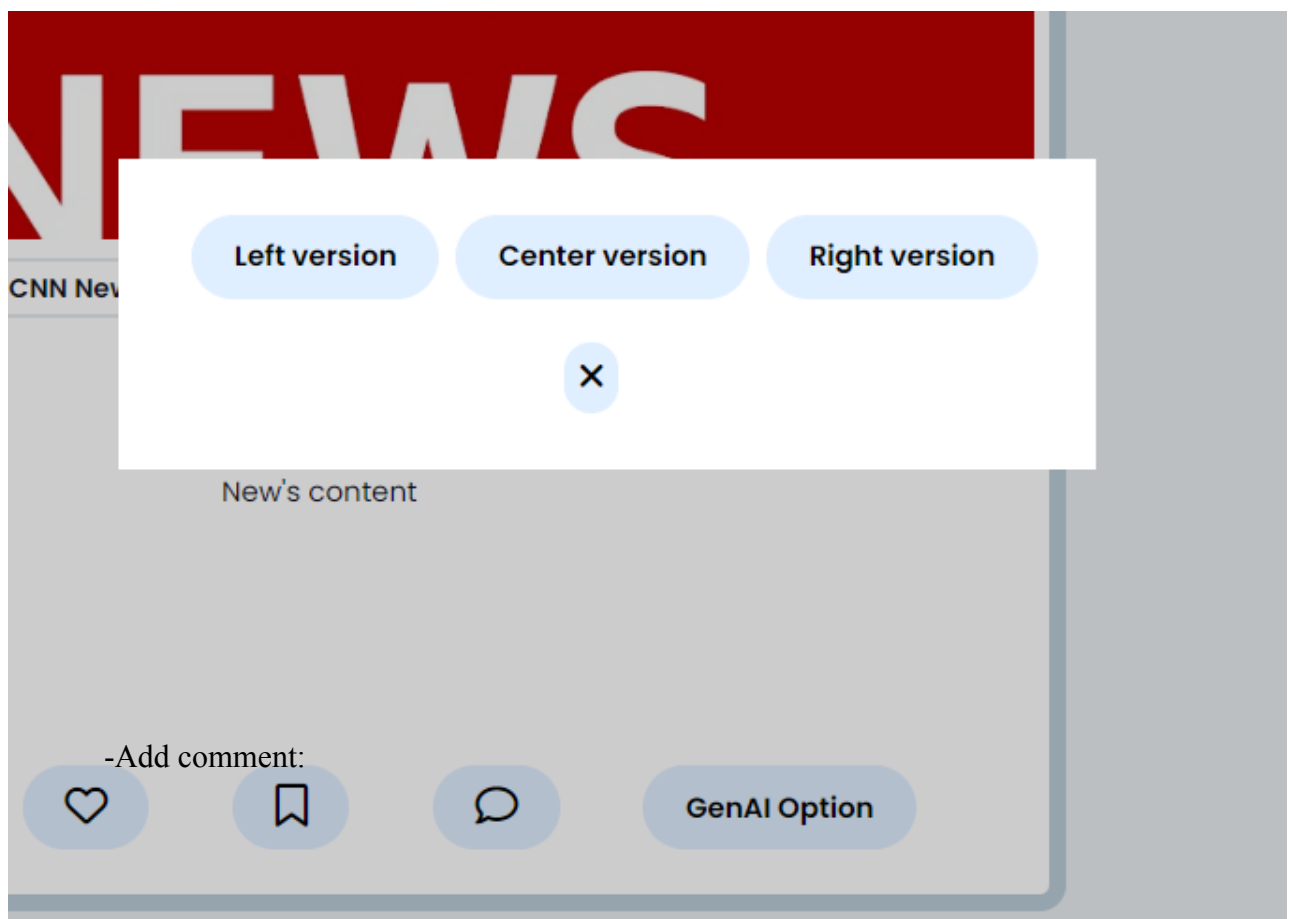
Figure 3.5.5.3: Main Page
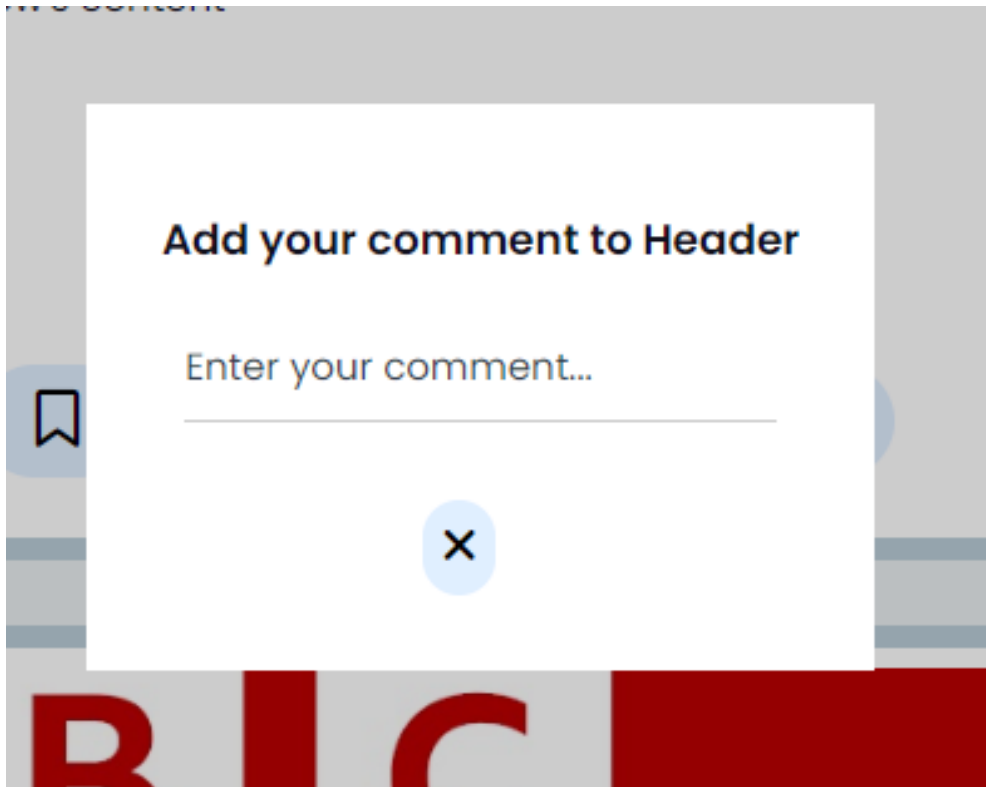

Figure 3.5.5.4: Generative AI Option
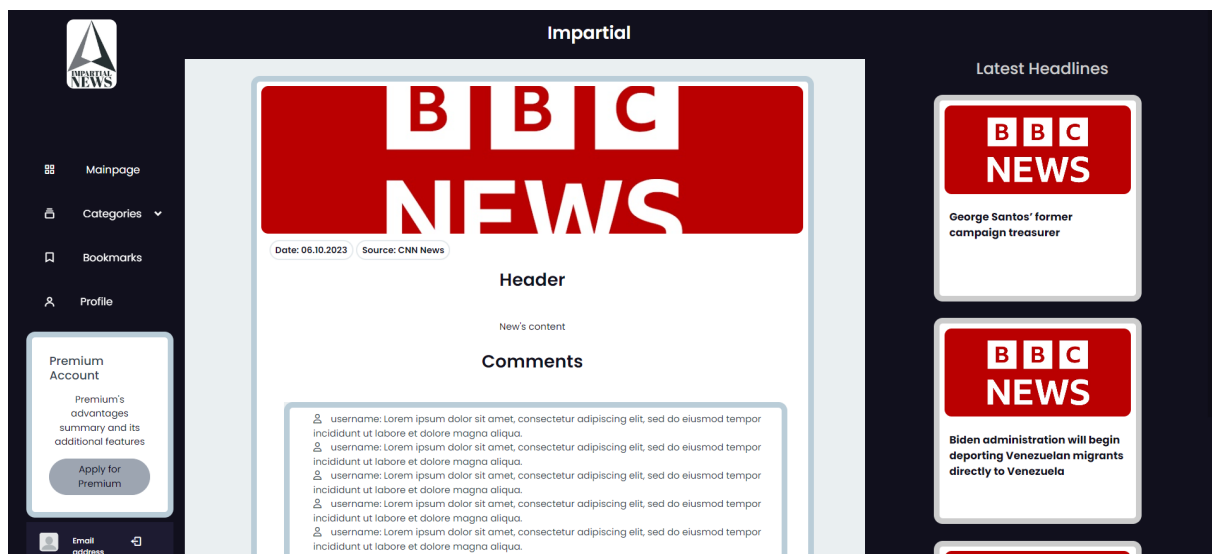
Figure 3.5.5.5: Comment Input

Figure 3.5.5.6: News Detail Page

Figure 3.5.5.7: Bookmarked News Articles of the User
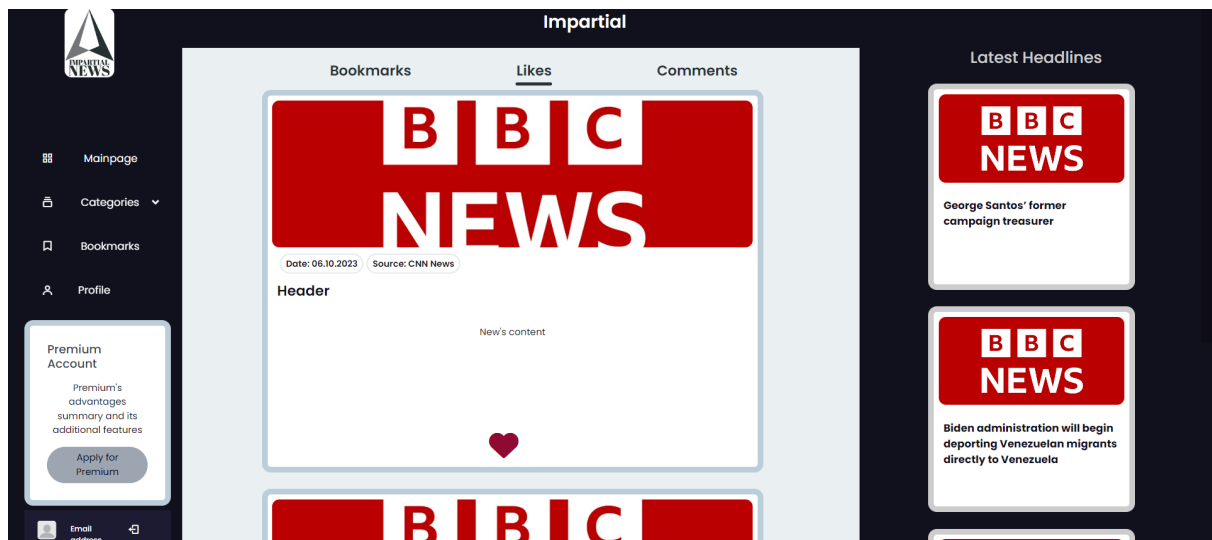
Figure 3.5.5.8: Liked News Articles of the User
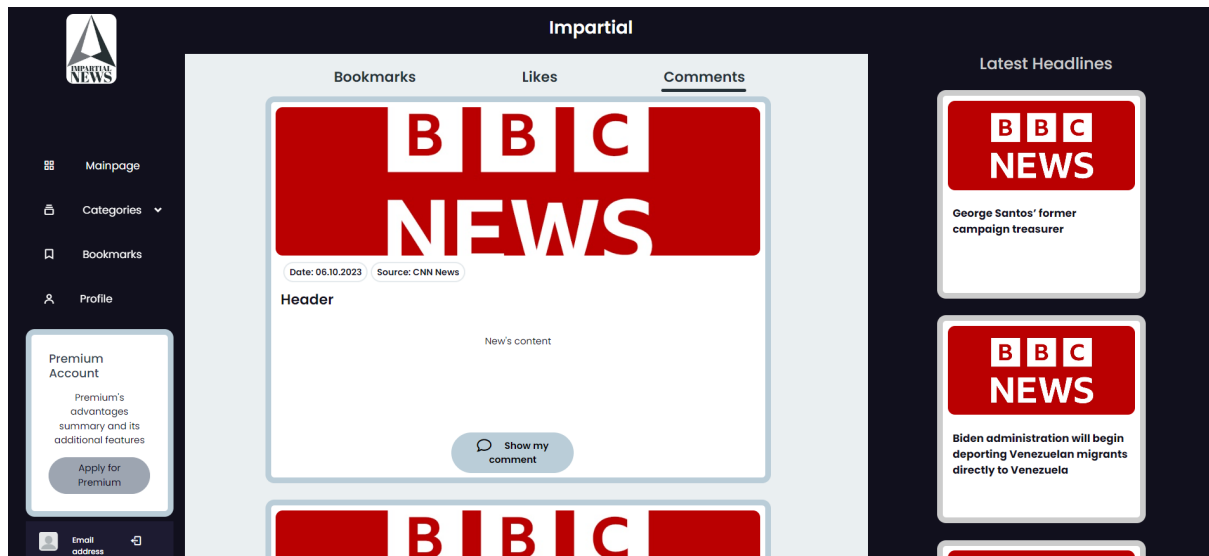
Figure 3.5.5.9: Commented Posts of the User

4. Other Analysis Elements

4.1. Consideration of Various Factors in Engineering Design

One of the most critical constraints in the design of our project was the development of the GenAI model for bias manipulation/elimination. We used different platforms to test and develop our GenAI model as well as several different foundational models. The first one we experimented with was Bloom [1]. After we tried to fine-tune it using a database of articles with bias labels, we found out that the GPU RAM of the machine was not adequate. Below is the code and the corresponding error for the experiment.

```
trainer = transformers.Trainer(
    model=model,
    train_dataset=datadict,
    args=transformers.TrainingArguments(
        per_device_train_batch_size=4,
        gradient_accumulation_steps=4,
        warmup_steps=100,
        max_steps=100,
```

```
    learning_rate=1e-3,
    fp16=True,
    logging_steps=1,
    output_dir="outputs"
  ),
  data_collator=transformers.DataCollatorForLanguageModeling(tokenizer, mlm=False)
)
model.config.use_cache = False
trainer.train()
```

```
-----------------------------------------------------------------
OutOfMemoryError                         Traceback (most recent call last)
<ipython-input-11-b43a07fd98b5> in <cell line: 17>()
     15 )
     16 model.config.use_cache = False
---> 17 trainer.train()

                    ⇕ 18 frames
/usr/local/lib/python3.10/dist-packages/torch/nn/functional.py in cross_entropy(input, target, weight, size_average, ignore_index, reduce, reduction, label_smoothing)
   3051     if size_average is not None or reduce is not None:
   3052         reduction = _Reduction.legacy_get_string(size_average, reduce)
-> 3053     return torch._C._nn.cross_entropy_loss(input, target, weight, _Reduction.get_enum(reduction), ignore_index, label_smoothing)
   3054
   3055

OutOfMemoryError: CUDA out of memory. Tried to allocate 2.82 GiB. GPU 0 has a total capacity of 14.75 GiB of which 2.56 GiB is free. Process 3143 has 12.19 GiB memory in use. Of the
allocated memory 8.44 GiB is allocated by PyTorch, and 2.72 GiB is reserved by PyTorch but unallocated. If reserved but unallocated memory is large try setting max_split_size_mb to
avoid fragmentation.  See documentation for Memory Management and PYTORCH_CUDA_ALLOC_CONF
```

Figure 4.1.1: Error

As it can be seen here, a "CUDA out of memory" error is thrown. This was because the GPU RAM of the free Google Collab machine was not enough. This error persisted even after we decided to try the same experiment with the Google Collab Pro high-ram GPU machines.

We decided to use AWS SageMaker as another platform to develop our GenAI model, but the costs of using AWS machines is similar to Google Collab virtual machines. Currently, we asked for AWS credits from the AWS development support team and are waiting for their response. If we are granted credits from AWS, we can use SageMaker or AWS Bedrock as a GenAI developing platform.

Finding a good dataset for the classifier model and GenAI was also a problem. To eliminate this issue, we found several datasets. The first one provides various news articles from different news resources labeled with their bias. This dataset looks like below.

	title	main-entities	source	main-event	stance	paragraph
0	Donald Trump Signals He Has Investigators Look...	[Donald Trump, Barack Obama]	hpo	Trump holds birther meeting	center	WASHINGTON — Real estate tycoon Donald Trump s...
1	Donald Trump Signals He Has Investigators Look...	[Donald Trump, Barack Obama]	hpo	Trump holds birther meeting	center	Trump told NBC News in an interview that plans...
2	Donald Trump Signals He Has Investigators Look...	[Donald Trump, Barack Obama]	hpo	Trump holds birther meeting	center	A national NBC/WSJ poll released yesterday sho...
3	Donald Trump Signals He Has Investigators Look...	[Donald Trump, Barack Obama]	hpo	Trump holds birther meeting	center	NBC further notes, "Strikingly, Trump . . . fi...
4	Donald Trump Signals He Has Investigators Look...	[Donald Trump, Barack Obama]	hpo	Trump holds birther meeting	center	Trump said he didn't introduce the citizenship...
...	...	...	...	...	...	...
4898	GOP Senators Keep Pressure on Steele Over 'Ina...	[Michael Steele]	fox	Michael Steele Criticized for Afghanistan Comm...	conservative	The Arizona Republican said Steele needs to as...
4899	GOP Senators Keep Pressure on Steele Over 'Ina...	[Michael Steele]	fox	Michael Steele Criticized for Afghanistan Comm...	conservative	Trying to quell the furor, Steele issued a sta...
4900	GOP Senators Keep Pressure on Steele Over 'Ina...	[Michael Steele]	fox	Michael Steele Criticized for Afghanistan Comm...	conservative	He sent an e-mail to RNC members saying he hop...
4901	GOP Senators Keep Pressure on Steele Over 'Ina...	[Michael Steele]	fox	Michael Steele Criticized for Afghanistan Comm...	conservative	That didn't seem to quiet the controversy in t...
4902	GOP Senators Keep Pressure on Steele Over 'Ina...	[Michael Steele]	fox	Michael Steele Criticized for Afghanistan Comm...	conservative	"I think it would be better if he went," he said.

Figure 4.1.2: Dataset Example

This was a viable dataset for the GenAI model, but performed poorly when we trained it on the classifier model. So we had to find a different dataset. Another dataset we explored was the one given below, which presented articles along with their metadata.

	topic	source	bias	url	title	date	authors	content	content_original	source_url	bias_text
0	immigration	New York Times - News	0	https://www.nytimes.com/2019/08/17/us/politics...	How Stephen Miller Seized the Moment to Battle...	2019-08-17	Jason Deparle	Still , Mr. Miller has left a big mark , in wa...	Still, Mr. Miller has left a big mark, in ways...	www.nytimes.com	left
1	justice_department	New York Times - News	0	http://www.nytimes.com/2013/08/12/us/justice-d...	Justice Dept. Seeks to Curtail Stiff Drug Sent...	2013-08-12	Charlie Savage	For example , in the case of a defendant accus...	For example, in the case of a defendant accuse...	www.nytimes.com	left
2	education	Politico	0	http://www.politico.com/story/2013/08/educatio...	Advanced Placement classes failing students	2013-08-21	Stephanie Simon	Enrollment in AP classes has soared in recent ...	Enrollment in AP classes has soared in recent ...	www.politico.com	left
3	politics	Townhall	2	https://townhall.com/tipsheet/cortneyobrien/20...	NYT: At This Rate, It Will Take 11 Years to Ge...	2017-07-19	"Cortney OBrien", Matt Vespa, Leah Barkoukis, ...	Dozens of President Trump 's nominees are wait...	Dozens of President Trump's nominees are waiti...	www.townhall.com	right

Figure 4.1.3: Dataset Example

Below are other constraints given as a list.

Implementation Constraints

- Github and Jira will be used to control the development process of our application.
- Vue.js will be used for the frontend development.
- Java and Spring framework will be used for the backend development.
- Pytorch and Huggingface transformers frameworks will be used to develop the AI models.

- FastAPI and Python will be used to deploy the AI models.
- PostgreSQL will be the database system.
- The backend will be deployed to AWS.
- Our machine learning models will be trained in the cloud using Google Collab.
- NewsAPI will be used to acquire new news articles.

Economic Constraints

- Backend deployment will be free using AWS EC2 free tier.
- Depending on our performance requirements, we might upgrade our Google Collab to a paid plan.
- All frameworks and libraries used in this project are free.
- NewsAPI is free in the development stage.

Ethical Constraints

- Any user data collected will be necessary and relevant to our system.
- The collected data will not be shared with 3rd parties without the users' explicit permission.

Sustainability Constraints

- The application and AI models will be maintained periodically.
- Any discovered bugs will be fixed in a week.

Language Constraints

- The language of the website will be English. More languages may be added in the future.

4.2 Risks and Alternatives

Risk explaination	Probability of happening	Effect on Project	Alternative
Getting bad results with a LLM model	High	Complete catastrophic failure	Using a different model
Not having a good classification model	Low	Useless info for the GenAI model and misinforming the public	Adding new parameter for the ML model

Table 4.2.1: Risks and Alternatives
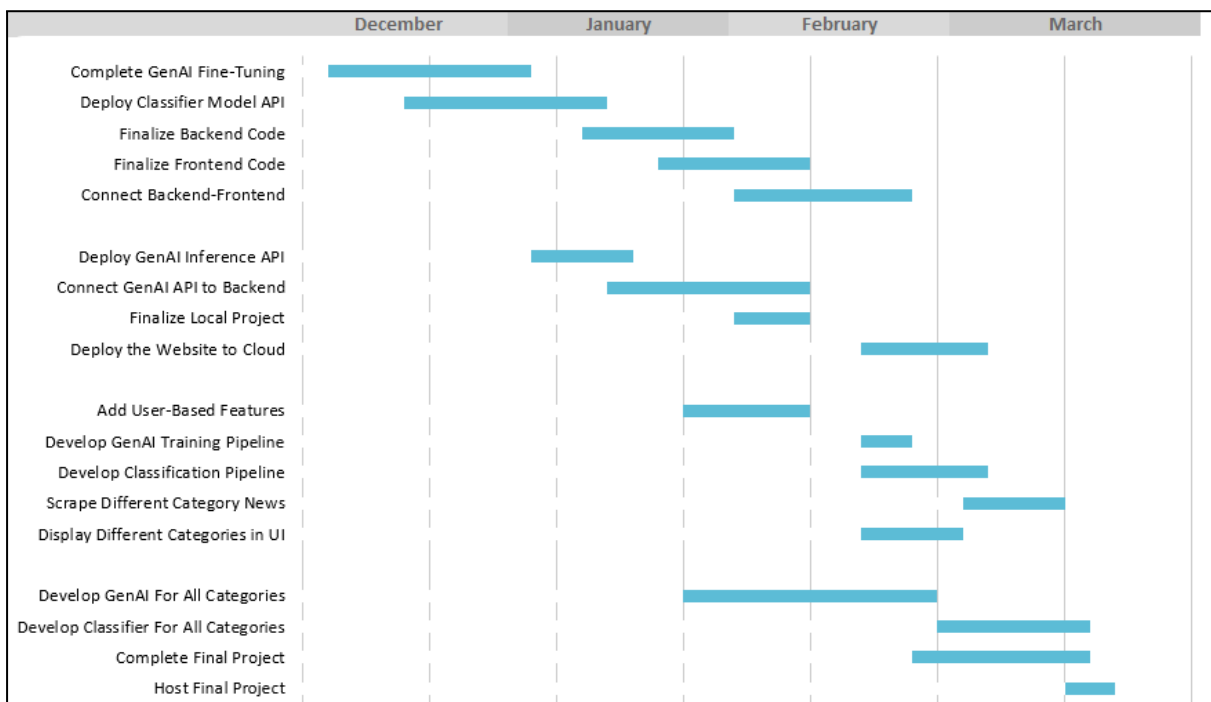
4.3 Project Plan

Figure 4.3.1: Project Plan Diagram

4.4 Ensuring Proper Teamwork

To ensure proper teamwork we devised a task distribution system. In this system, we divide our work on a weekly basis. We assess the current needs of our project and assign the parts according to our needs and match the unique skills of our teammates with tasks strategically. With this system we ensure that the work is distributed equally and according to

the strengths of each member. While creating reports and documentations for our project we divide the work equally among ourselves. In the other technical tasks, each member selects the tasks that fit their technical skills and the needs of our project. Tasks like research are also divided equally among all teammates. To keep track of the tasks and stay organized we use Jira.

4.5 Ethics and Professional Responsibilities

In accordance with data safety and security considerations, as well as compliance with the KVKK and GDPR, we want to emphasize that we refrain from processing any user data beyond the essential requirements. Specifically, we only retain the necessary information for our core functions, which includes usernames, emails, hashed passwords, and user activity data such as likes, comments, and bookmarks. Our commitment is to safeguard user privacy by avoiding the collection of unnecessary personal information.

4.6 Planning for New Knowledge and Learning Strategies

In order to execute the project to its fullest potential, we endeavored to comprehend the concept of GenAI. In pursuit of this understanding, we engaged with various models such as Bloom LLama2, ChatGPT, GPT-2, BERT, ALBERT, ROBERTA, and others. Additionally, we explored the prospect of constructing a transformer from the ground up, studying relevant tutorials. However, we determined that this undertaking necessitated extensive data and computational resources, prompting us to abandon the idea. Presently, our approach involves leveraging SageMaker and Bedrock for our GenAI objectives. We are actively engaged in continuous learning, acquiring new insights on a daily basis through tutorials and research paper reviews.

5. Glossary

AI: Artificial Intelligence

GenAI: Generative AI

KVKK: Kişisel Verileri Koruma Kurumu

GDPR: General Data Protection Regulation

LLM: Large Language Model

6. References

[1] B. Workshop et al., "Bloom: A 176B-parameter open-access multilingual language model," arXiv.org, https://arxiv.org/abs/2211.05100 (accessed Nov. 23, 2023).