

# Interactive Story Generation

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## 1. Problem Formulation

Storytelling [1] has been one of the most essential parts of human culture for many years. People tell stories to others to share their experiences, beliefs, and values via paintings, carvings, movies, podcasts, etc. Technological advancements and increased Artificial Intelligence have expanded our ability to tell stories. AI-based storytelling has become popular, but producing consistent, coherent, and engaging narratives takes a lot of work. This encompasses issues such as maintaining logical plot progression, developing well-rounded characters, and ensuring that the story's pacing remains appropriate. The AI may struggle with generating stories that flow naturally and captivate the audience, leading to disjointed or unsatisfying narrative experiences. Additionally, balancing creativity with coherence presents a complex problem, as the AI must innovate within established storytelling frameworks while still adhering to logical constraints.

This project aims to build a platform for interactive story generation by finetuning Large Language Models, such as GPT-2 models based on different themes. It also focuses on developing stories, ensuring consistency, coherency, and engaging narratives.

## 2. Motivation

With this project, we want to present the utility of Large Language Models for generating narratives. The idea behind this project is that engaging storytelling is fundamental to capturing and retaining users' attention, fostering immersion, and eliciting emotional responses. Without compelling narratives, users are less likely to interact with the AI generator, leading to

diminished satisfaction and decreased utility of the tool. Moreover, it is crucial to solve this issue since it is necessary to expand the potential of Generative AI in several fields, such as therapy, education, and entertainment. It also has the potential to increase the explainability of the AI models, especially Large Language Models, to help researchers enhance the AI models for various applications in future [2].

### **3. Literature Survey**

Several researchers have done various research work in AI-based story generation. Earlier works were based on logic, formal grammar and statistical machine-learning models. Nowadays, Deep Learning plays a crucial role in generating engaging narratives with high consistency and coherence. Fan et al. [3] have developed the dataset for story generation that is Writing Prompts, which has approximately 300K stores along with its prompts and trained fusion of Conv Seq2seq + self-attention-based model and achieved the perplexity of 36.08 and 36.56 on validation and testing set respectively and performed well on human evaluation test. Khan et al. [4] have developed a keyword-based story generation model by finetuning the GPT 2 model on the private dataset they created. They achieved the BLEU score of about 0.704, averaging over ten genres. Yao et al. [5] proposed a framework for generating the stories called Play-and-Write, which plans the storyline and generates the stories. It works in two static and dynamic schemas, which have performed better than the baselines in objective and subjective evaluation. Pradyumna et al. [6] used the Reward Shaping technique under Reinforcement Learning to generate stories. They trained the models on the CMU movies dataset and achieved lower perplexity values (7.61 and 5.73 for DRL Clustered and DRL Unrestricted with the goal ‘admire’) than the baseline model. They performed better in human evaluation. Ammanabrolu et al. [7] developed an ensemble-based framework for generating stories based on a combination of the Retrieve and Edit model, Sentence Templating, Monte-Carlo Beam Search and Finite State Constraint Search algorithms. They achieved the lowest perplexity and highest BLEU scores of 70.179 and 0.0481, respectively, compared to all four models applied individually. Kong et al. [8] developed the story generator model, which plans the stylised keywords and then generates the stories based on these keywords. This model achieved the LSC and SSC scores of 0.474 and 0.371 for emotion-driven style and 0.309 and 0.293, respectively, for event-driven style, higher than the baseline models. Mathews R.F. et al. [9] have developed the procedural story generation model using a handcrafted event network and a dynamic artificial social network created for each new story. SeokKyoo Kim et al. [10] have developed a story generation algorithm using a Constraint Narrative structure implemented in Storytelling Markup Language.

### **4. Novelty**

The novelty is introduced to the dataset. Unlike other story generation datasets, this dataset is collected from various websites, taking care of repeating the stories in the corpus and not including inappropriate stories as seen in other corpora.

## 5. Dataset

We have scrapped about 356 stories from websites like Medium, Reddit, Project Gutenberg, etc., based on six themes: adventure, horror, humour, mystery, romantic and sci-fi. However, the horror stories have been taken directly from the dataset used during baseline results. Some stories that exceed the word limit of 500 words are summarised using chat GPT 3.5. Based on the available computing resources, we worked with 100 adventure stories, 100 sci-fi stories and 100 horror stories. For each theme, nine stories are used for training, three for validation, and three for model testing. Figures 1, 2, and 3 show the maximum token length of the stories of each split per theme.

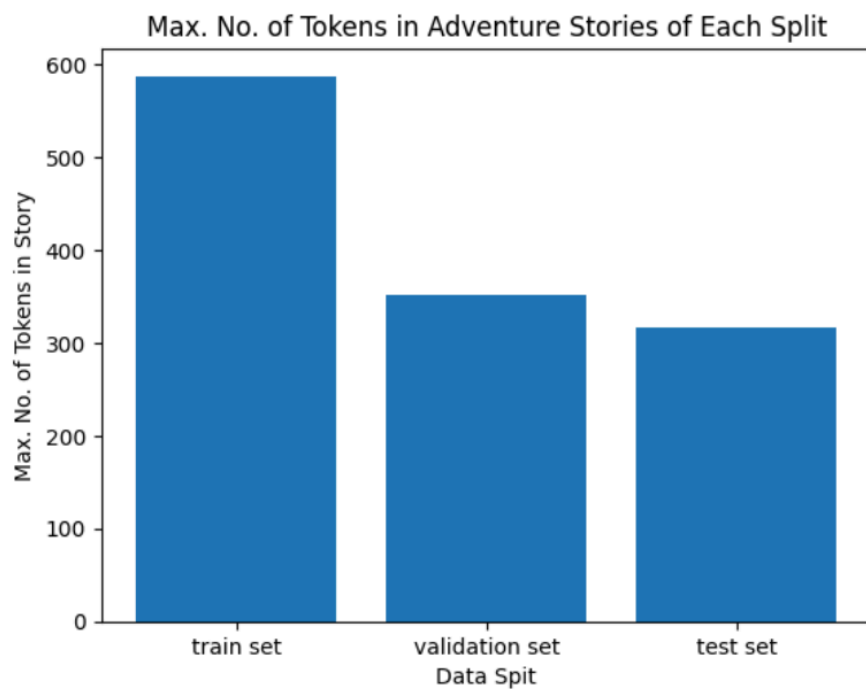


Figure 1: Maximum Number of Tokens of Adventure Stories of Each Split

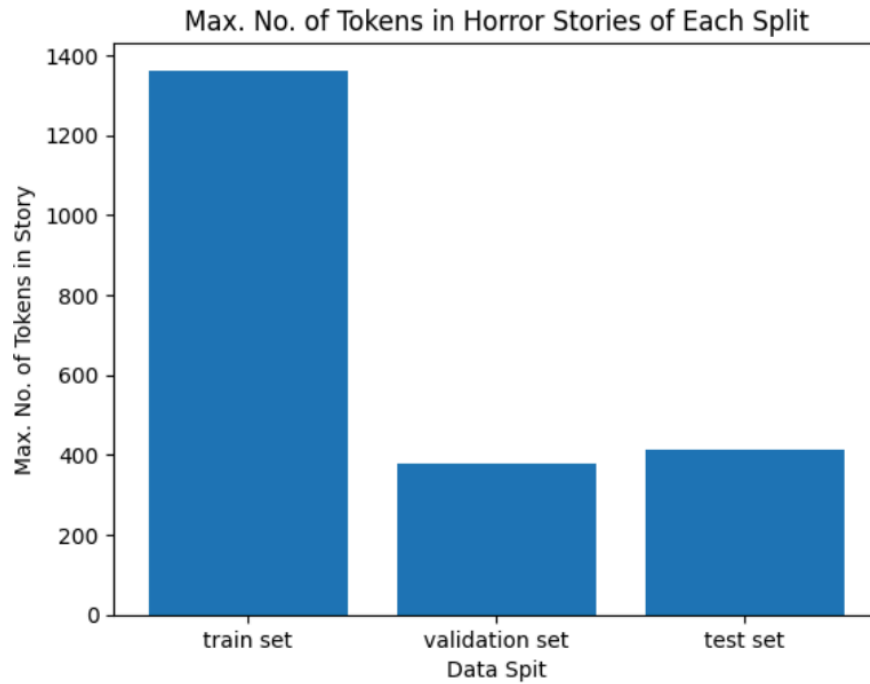


Figure 2: Maximum Number of Tokens of Horror Stories of Each Split

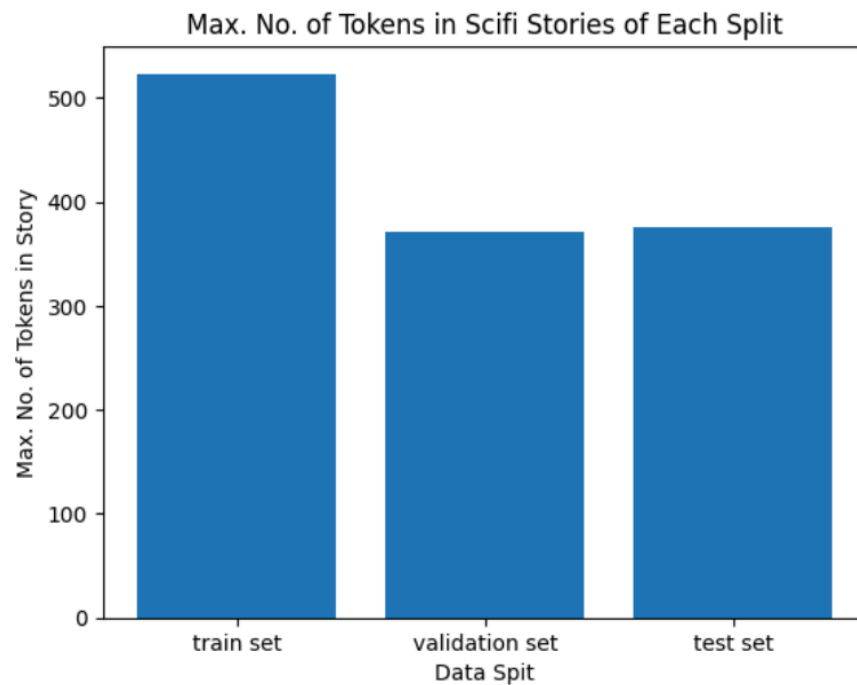


Figure 3: Maximum Number of Tokens of Scifi Stories of Each Split

In adventure stories, the maximum number of tokens in the training, validation, and test sets are 587, 352, and 317, respectively. In horror stories, the maximum number of tokens in the training,

validation, and test sets are 1362, 380, and 412, respectively. In adventure stories, the maximum number of tokens in the training, validation, and test sets are 523, 371, and 376, respectively.

## 6. Methodology

### 6.1 Data Pre-processing and Finetuning of Gemma2B Instruct Model

The following steps are followed for data pre-processing and fine-tuning of the Gemma2B Instruct model:

1. The prompts are created by taking the story's beginning, and each story and its corresponding prompt is saved in the .csv files, as shown in Figure 4.
2. Then, the prompts and the stories are combined in a conversational format, as suggested by [11].
3. The Gemma2B Instruct model is loaded from the hugging face library, and then it is quantised using LoRA and QLoRA so that it will not occupy too much space on the GPU, as suggested by [11].
4. Then, the model is finetuned for each theme to 4 epochs, with a learning rate of 0.0001 using a paged-adamw 8-bit optimiser, and the loss curves are plotted. Here, we have used 75 data samples for training, 10 for validation and 15 for testing.
5. The model is merged back to the original precision value for evaluation purposes, as suggested by [11].

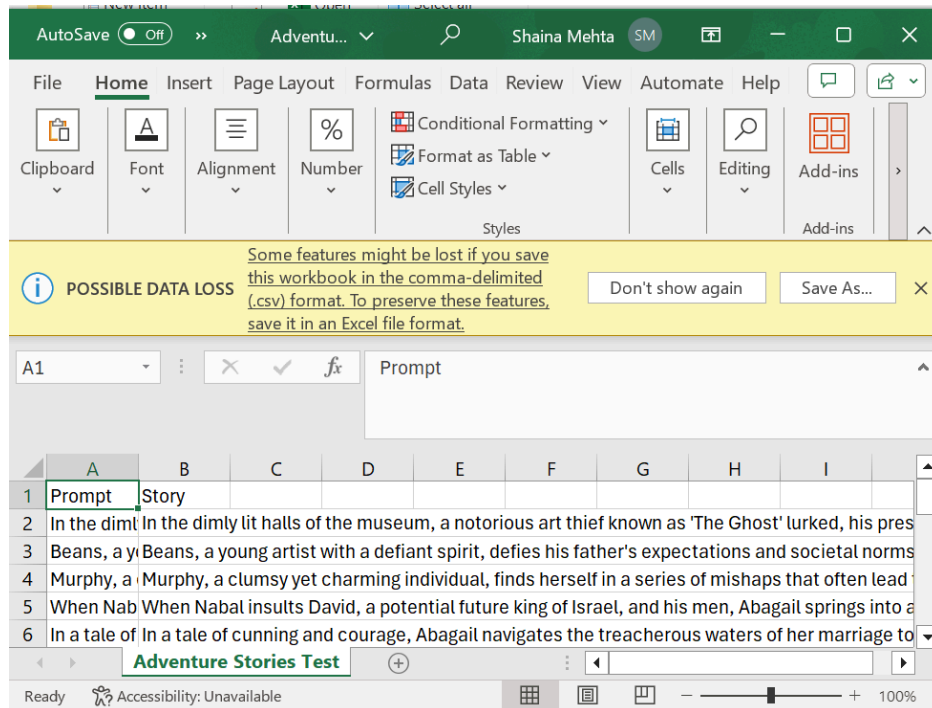


Figure 4: Sample Dataset for Finetuning Gemma2B Instruct Model



Mean Perplexity scores on the testing set of each theme trained on Gemma2B Instruct model and their description is given in the section 4.1 and 4.2.

### 7.1 Gemma2B Instruct Model

Figures 6, 7, and 8 show the training and validation loss curves of the Gemma2B Instruct model trained on adventure, horror and sci-fi themes, respectively. From them, one can infer that the model is learning properly, but the learning process needs to be completed due to the lack of computation resources.

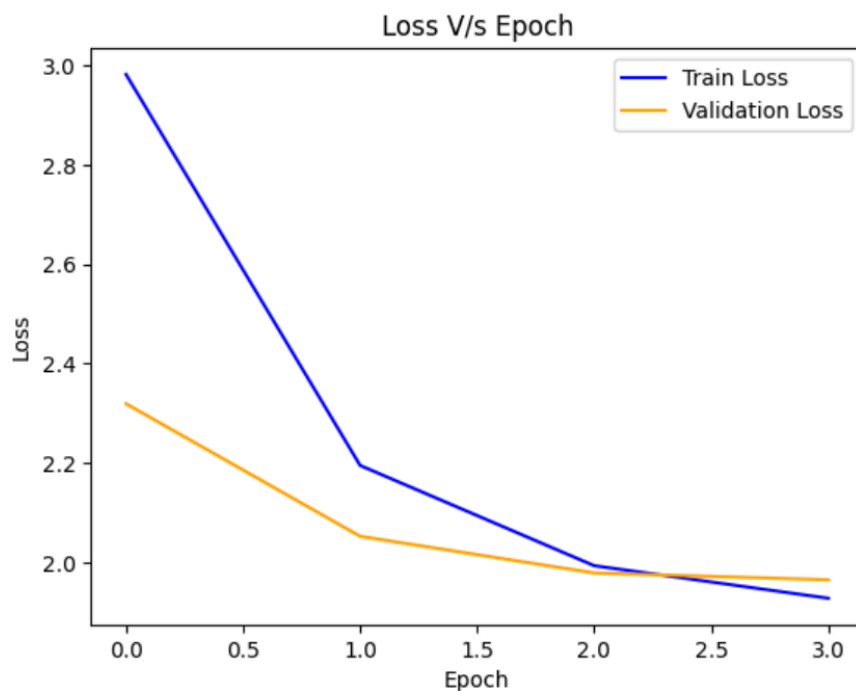


Figure 6: Training and Validation Loss Curve of Gemma2B Instruct Model trained on Adventure Stories

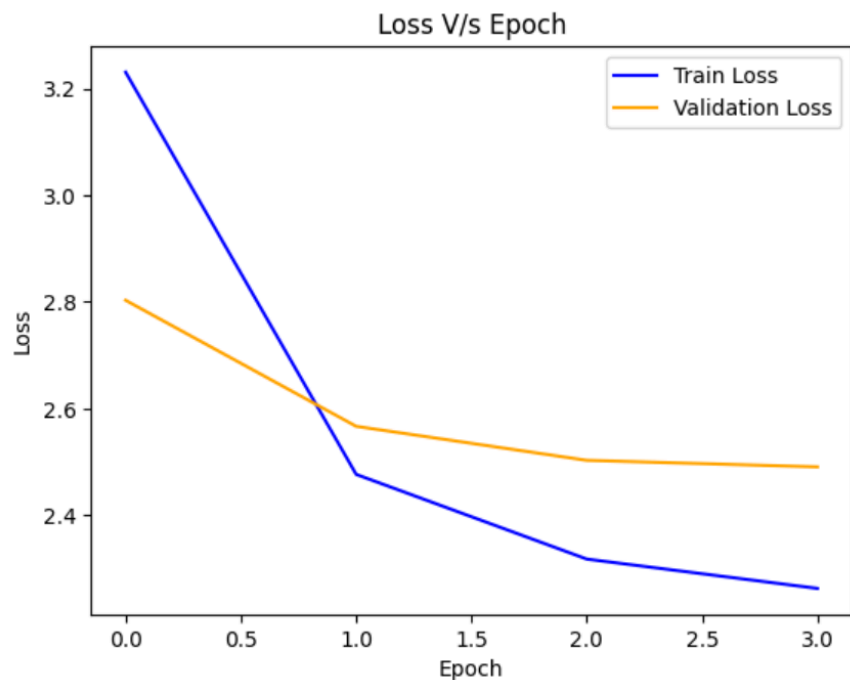


Figure 7: Training and Validation Loss Curve of Gemma2B Instruct Model trained on Horror Stories

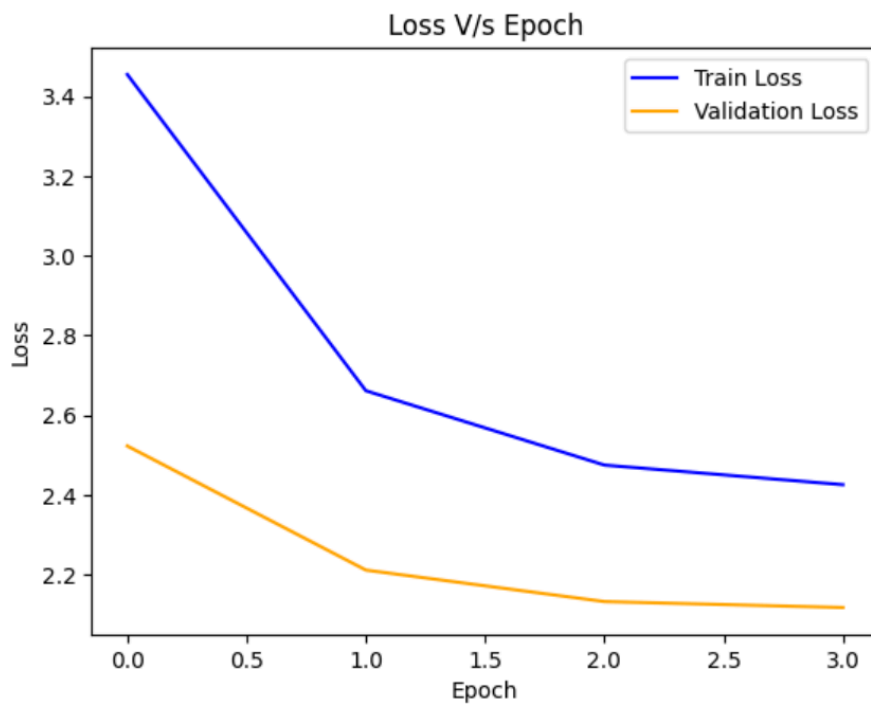


Figure 8: Training and Validation Loss Curve of Gemma2B Instruct Model trained on Sci-Fi Stories

Table 1 shows the BLEU and Mean Perplexity scores of the Gemma2B Instruct model trained separately on Adventure, Sci-Fi and Horror themes. From this, one can infer that horror story



generator model is far better than the adventure and sci-fi story generator models concerning the perplexity score, and the adventure story generator is far better than sci-fi and horror story generation models in terms of BLEU Score 2, 3 and 4. However, sci-fi story generator model is better than the horror and adventure story generator model in terms of BLEU Score 1 but all of the model performances are not upto the mark.

Theme	BLEU 1 Score	BLEU 2 Score	BLEU 3 Score	BLEU 4 Score	Mean Perplexity
Adventure	0.31716247139588094	0.17325961579064542	0.10919435932358887	0.08116519561927048	23.833895842234295
Horror	0.3097818019890159	0.15963983213519858	0.09817129544520443	0.07301270232036362	30.47944227854411
Scifi	0.3482644628099173	0.1871588158681989	0.12080611134435604	0.0924673182941002	38.437459055582686

Table 1: BLEU and Mean Perplexity Scores of Stories of Each Theme

On human evaluation, as shown in figures 9, 10 and 11, it has been observed that the generated stories could be more up to the mark; some of them are not aligned to the theme and some have repetition of words and phrases. However, the results are far better than those of the baseline.

## Human Evaluation

```
In [ ]: prompt = 'Generate an adventure story given the beginning of the story: ' + 'Jack, a young photojournalist, finds himself amidst the chaos of war in Vietnam, hanging out of a medevac with other weary soldiers and wounded patients, watching the relentless rain fall from the roof as the helicopters roar overhead, bringing in a medical evacuation. The helicopter lands with a bang, throwing the soldiers off balance while they scramble to their feet. Jack takes the lead on the first patient, a young boy, and guides them to a medical tent where they're treated for a bullet wound on his leg. Despite the chaos and uncertainty surrounding the situation, Jack remains calm and focused, giving instructions and navigating through the medical emergencies with assurance and competence. As they tend to the boy's wounds, Jack feels a sense of solace knowing they're doing their best to support and protect each other amidst the chaos and uncertainty surrounding the situation. Their efforts bring momentary relief, but the weight of the war remains a constant thought in the air, a constant reminder of the fragility of human life in the midst of such a tumultuous and brutal conflict. As the sun begins to peek through the clouds, Jack and his team prepare to return to their firebase and await further instructions. Despite the challenges, he takes a moment to reflect on the fragility of even the briefest escape from war, knowing that they might be leaving behind a burden they may never be able to overcome. Despite the challenges, Jack and his team prepare to return to their firebase and await further instructions. Despite the challenges, Jack takes a moment to reflect on the fragility of even the briefest escape from war, knowing that they might be leaving behind a burden they may never be able to overcome. As the helicopters disappear into the horizon, Jack and his team await further instructions from their superiors, their hearts filled with a mix of hope and uncertainty in the midst of the chaos and uncertainty surrounding the situation. While the intensity of the violence in Vietnam fades into a memory only time can bring back, the memories of Jack and his team serve as a reminder of the sacrifices they made and the power of unity in the face of adversity. As the sun sets on Vietnam, casting long shadows across the firebase, Jack and his team rest, knowing that they remain a beacon of humanity and determination in a world consumed by hatred and violence. The chaotic battlefields of Vietnam serve as a backdrop to the ordinary stories of the soldiers who fight and die in pursuit of a fleeting dream of peace and freedom. Jack and his team stand as a testament to the
```

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Figure 9: Adventure Story Generated by Gemma2B Instruct Model Finetuned on Adventure Stories

```
In [ ]: prompt = 'Generate a horror story given the beginning of the story: '+ 'Two farmhands shared a room. One slept at the back of the room. The other slept near the door. After a while, the one who slept at the back of the room jumped out of bed and ran to the door and pushed it open. He peered out and saw the farmer taking a trip down the room. Then, the two farmhands went to sleep again. The first farmer's son dreamed that his father jumped out of bed and ran to the door and pushed it open. The two farmhands, one who slept at the back of the room and one who slept near the door slept soundly. One man was about to sleep when the farmer's son woke up and went to the door to get something. The first farmhand awoke and went to the door to push it open. The farmer's son looked out the door and saw the first farmhand. Suddenly, the farmer's son broke the door down. The door swung open and shut. Then, the first farmhand rushed through the door, and the farmer's son went inside. Then, the farmer's son went to the back of the room, and the second farmhand followed. The two farmhands took advantage of the situation and ran away. After a while, the farmer who lived back by the house took action. He told the farmer to be careful, and then the farmer told the man to take a good look out the back door and to be alert of anything that moved in the room. The farmer went out the back door and watched 5 minutes. Then he turned to leave the farm. At that moment, the second farmer slept soundly near the door. The farmer didn't know about the two farmhand. The farmer walked through the room and went up to his son's room. When he got there, he saw the door to the back of the room open. The farmer looked out the door and saw two farmhands running back, but he didn't know if they were the same ones as the ones that had attacked the farm several years ago. "What have you done to him!" the farmer shouted. "You scoundrel!" "Do not speak to me," the young man said. "Do not be foolish! When you awake, get well! A man is dead!" When he had finished speaking, he put his weight on the body's chest, in his hands. The farmer
```

Figure 10: Horror Story Generated by Gemma2B Instruct Model Finetuned on Horror Stories

## Human Evaluation

```
In [ ]: prompt = 'Generate a science fiction story given the beginning of the story: '+ 'Miriam Westlake, a successful novelist battling writer's block and sobriety, faces a dilemma on her apartment door. She is considering whether to write an essay about 14th century Chinese poetry while using her other three hours for more creative and artistic endeavors. She eventually decides to write another story, which she later describes as "a more beautiful, heartfelt piece" and has to write the essay about 14th century Chinese poetry. Marin's decision is influenced by three factors: an essay about a 14th century Chinese poem has the potential to become an award-winning book that will launch Miriam Westlake into stardom and fame. Marin says that although he wants to get his work published, he really wants to write a story about the beauty and strength of the natural world. He says: "I always felt that there was no beauty in a man alone, but in a man's life, facing problems." Miriam Westlake can't help but be drawn to 14th century Chinese poetry, despite the fact that she is in her late 60s and facing writer's block. She says: "Poetry is the way to make the world a better place, and there is no topic beyond 14th century Chinese poetry that could not be treated with great art." Marin also considers the idea that writing about 14th century Chinese poetry could lead to a new breakthrough for him. Although he says that he doesn't know yet which path he should take, it is clear that he is thinking about taking one of the two choices in a matter of life or death. Marin is faced with a difficult decision that Miriam Westlake would know if she were facing this situation. Marin says that ultimately the choice between choosing the essay about the 14th century Chinese poem, or the essay about 14th century Chinese poetry, is an "old one." In the face of a crisis, she feels that only three choices will lead to happiness: writing, swimming, or playing the piano. She chooses to write. Awww Miriam Westlake is forced to face the fact that she has come to a similar choice in her life. On each one of her three choices, the question of happiness itself would have to choose one of the three options: writing, swimming, or the piano. Miriam Westlake ultimately comes to the conclusion that the choice is not between the two former options, but between herself and death.
```

Figure 11: Scifi Story Generated by Gemma2B Instruct Model Finetuned on Scifi Stories

## 7.2 GPT 3.5 Turbo Model

Figures 12, 13, 15, 16, 18, and 19 show the training and validation loss curves of the GPT 3.5 Turbo Model trained on adventure, sci-fi and horror themes, respectively. From these curves, one can infer that training loss and validation loss fluctuate. This means that the model is overfitting. Regarding human evaluation, the generated stories are better than the Gemma 2B Instruct model, but the narratives could be better.

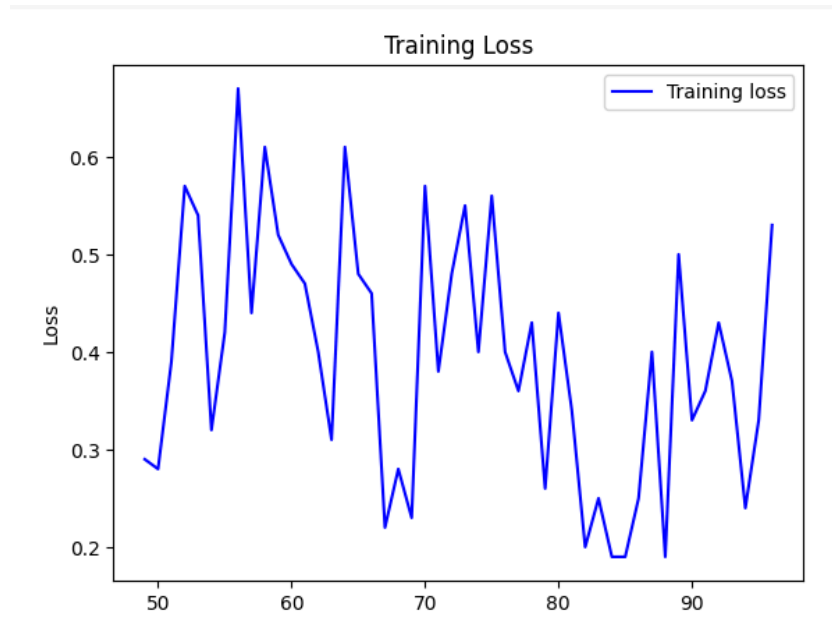


Figure 12: Training Loss of Adventure Stories using GPT 3.5 Turbo Model

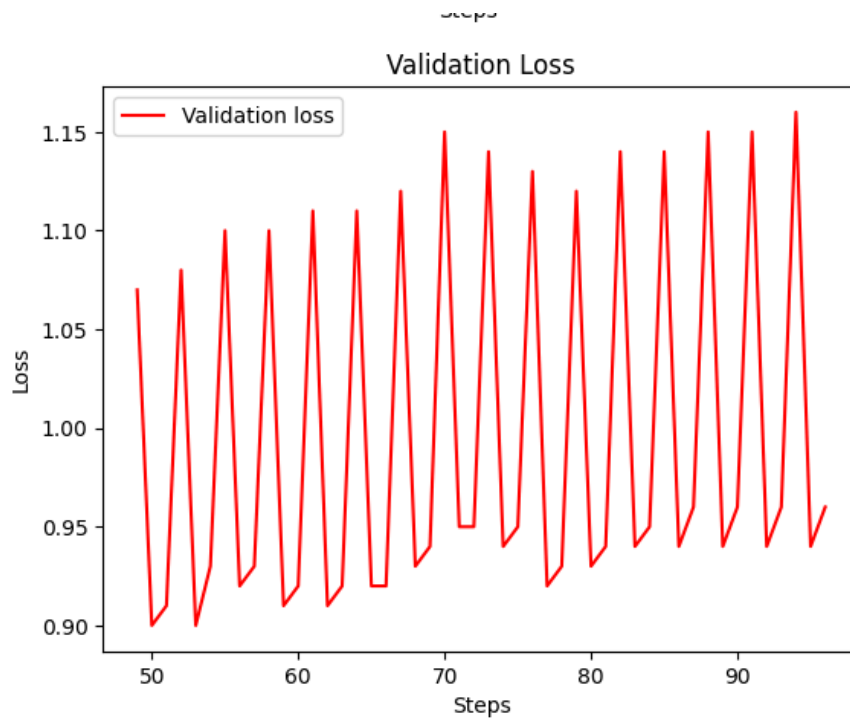


Figure 13: Validation Loss of Adventure Stories using GPT 3.5 Turbo Model

```
[ ]
test_messages = []
system_message = "You are a storyteller and you have to tell me an adventure story"
test_messages.append({"role": "system", "content": system_message})
user_message = "Generate the story titled \"Lost Kingdom Chronicles\""
test_messages.append({"role": "user", "content": user_message})

print(test_messages)

[{'role': 'system', 'content': 'You are a storyteller and you have to tell me an adventure story'}, {'role': 'user', 'content': 'Generate the story titled \"Lost Kingdom Chronicles\"'}]

response = openai.ChatCompletion.create(
    model=fine_tuned_model_id, messages=test_messages, temperature=0.7, max_tokens=500
)
print(response["choices"][0]["message"]["content"])

In the heart of the dense jungle, whispers of a long-forgotten kingdom beckoned to a daring explorer named Amelia. Armed w
```

In the heart of the dense jungle, whispers of a long-forgotten kingdom beckoned to a daring explorer named Amelia. Armed with a tattered map and boundless curiosity, she embarked on a quest to unravel the mysteries of the Lost Kingdom. The jungle's embrace was suffocating, its verdant canopy blocking out the sun and secrets alike. Guided by the faint markings on the map, Amelia hacked her way through the tangled undergrowth, each step fraught with the unknown. As days turned to weeks, she encountered ancient ruins shrouded in moss and guarded by nature's reclaiming grasp. Deciphering cryptic inscriptions, Amelia pieced together the history of a civilization lost to time. But the jungle jealously guarded its treasures, testing her resolve with treacherous swamps and elusive wildlife. Undeterred, Amelia pressed on, driven by the allure of discovery and the promise of untold riches. At the heart of the jungle, she stumbled upon the fabled ruins of the Lost Kingdom, its crumbling spires reaching for the sky like skeletal fingers. Within its walls, she found relics of a bygone era, their beauty a stark contrast to the decay that surrounded them. Yet, as she delved deeper into the ruins, Amelia uncovered a darker truth: a curse that had doomed the kingdom to oblivion. In a race against time, Amelia sought a way to lift the curse and bring light to the shadows that haunted the Lost Kingdom. With courage as her guide, she faced trials of wit and strength, confronting the echoes of the past with determination. And in the end, as the last vestiges of the curse were banished, the jungle seemed to exhale a sigh of relief, its secrets laid bare by Amelia's indomitable spirit.

Figure 14: Adventure Stories Generated by GPT 3.5 Turbo Model



Figure 15: Training Loss of Science Friction Stories using GPT 3.5 Turbo Model

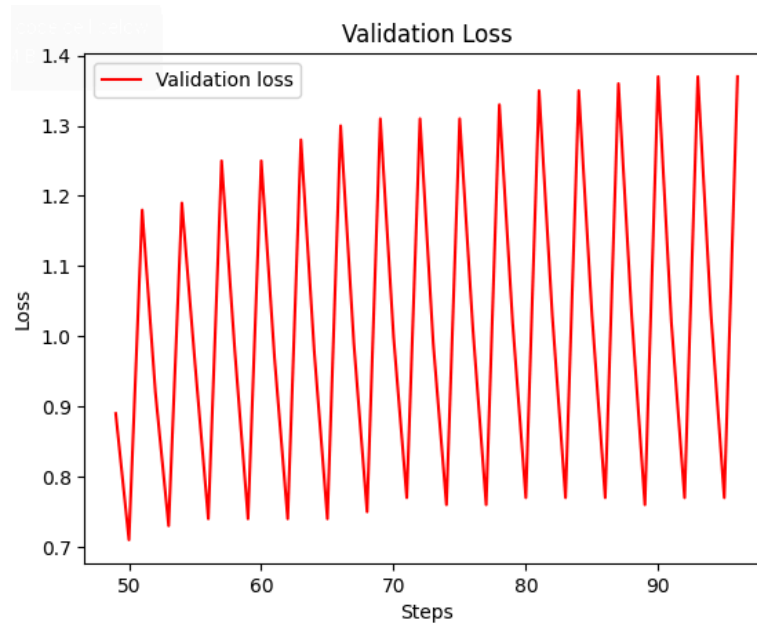


Figure 16: Validation Loss of Science Friction Stories using GPT 3.5 Turbo Model

```
[ ] test_messages = []
    system_message = "You are a storyteller and you have to tell me an adventure story"
    test_messages.append({"role": "system", "content": system_message})
    user_message = "Generate the story titled \"Echoes from the Quantum Frontier\""
    test_messages.append({"role": "user", "content": user_message})

    print(test_messages)

[{'role': 'system', 'content': 'You are a storyteller and you have to tell me an adventure story'}, {'role': 'user', 'content': 'Generate the story titled "Echoes from the Quantum Frontier"'}]

response = openai.ChatCompletion.create(
    model='gpt-3.5-turbo', messages=test_messages, temperature=0.7, max_tokens=500
)
print(response["choices"][0]["message"]["content"])
```

In a world where science and magic intertwined, a young physicist named Elara embarked on a daring quest to unravel the mysteries of the Quantum Frontier. Elara was a brilliant scientist who had always been fascinated by the unknown. She spent her days studying the intricacies of quantum mechanics, seeking to understand the fundamental laws of the universe. One fateful day, while conducting an experiment in her laboratory, Elara inadvertently opened a portal to the Quantum Frontier. When Elara regained her senses, she found herself in a strange and wondrous world unlike anything she had ever seen. The world was filled with floating islands, glowing crystals, and ancient ruins. As Elara journeyed deeper into the Quantum Frontier, she encountered beings of pure energy, sentient equations, and sentient

In a world where science and magic intertwined, a young physicist named Elara embarked on a daring quest to unravel the mysteries of the Quantum Frontier. The Quantum Frontier was a realm where reality was fluid, governed by the laws of quantum physics and inhabited by strange creatures and powerful forces. Elara was a brilliant scientist who had always been fascinated by the unknown. She spent her days studying the intricacies of the quantum realm, seeking to unlock its secrets and harness its power for the betterment of humanity. But her research had attracted the attention of dark forces who sought to control the Quantum Frontier for their own sinister purposes. One fateful day, while conducting an experiment in her laboratory, Elara inadvertently opened a portal to the Quantum Frontier. Before she could react, a powerful surge of energy swept her off her feet and pulled her into the swirling vortex of probability and uncertainty. When Elara regained her senses, she found herself in a strange and wondrous world unlike anything she had ever seen. The sky shimmered with iridescent colors, and the ground beneath her feet pulsed with energy. She knew she was no longer in her own reality, but in a realm where the laws of physics were but a suggestion. As Elara journeyed deeper into the Quantum Frontier, she encountered beings of pure energy, sentient equations, and sentient particles that danced and sang in harmony. She also faced terrifying challenges, from quantum storms that threatened to tear her apart to reality-warping phenomena that tested her sanity. But Elara pressed on, driven by her insatiable curiosity and her desire to understand the true nature of the universe. Along the way, she forged unlikely alliances with beings from different dimensions and learned to wield the power of quantum entanglement to bend reality to her will. As she delved deeper into the mysteries of the Quantum Frontier, Elara discovered a dark secret at its heart: a malevolent entity known as the Quantum Shadow, who sought to consume all reality and plunge the universe into chaos. With the help of her newfound allies, Elara embarked on a desperate quest to stop the Quantum Shadow and restore balance to the quantum realm. In a final showdown at the edge of existence, Elara faced the Quantum Shadow in a battle of wills and wits. Drawing upon all her knowledge and courage, she unleashed the full power of the quantum realm and banished the malevolent entity back into the depths of uncertainty.

Figure 17: Science Friction Stories Generated by GPT 3.5 Turbo Model

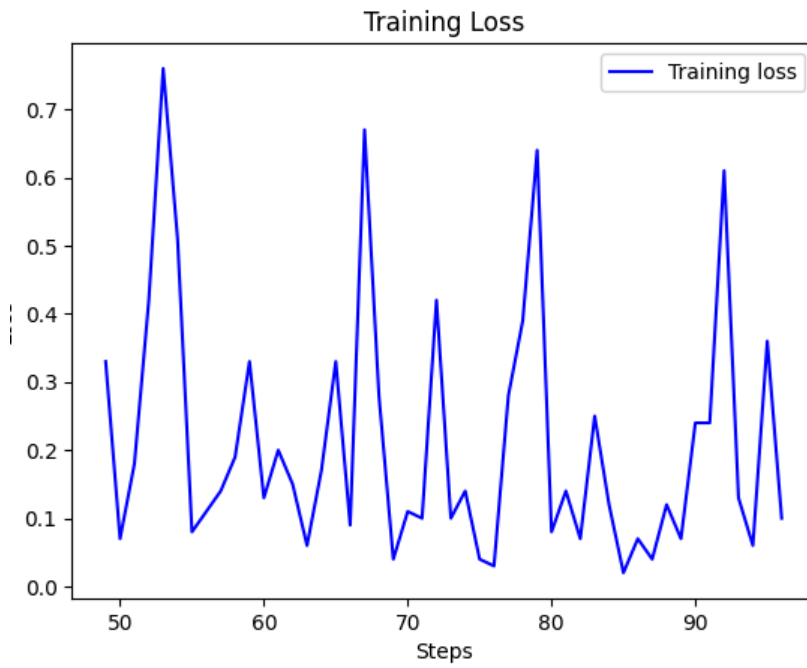


Figure 18: Horror Stories Generated by GPT 3.5 Turbo Model

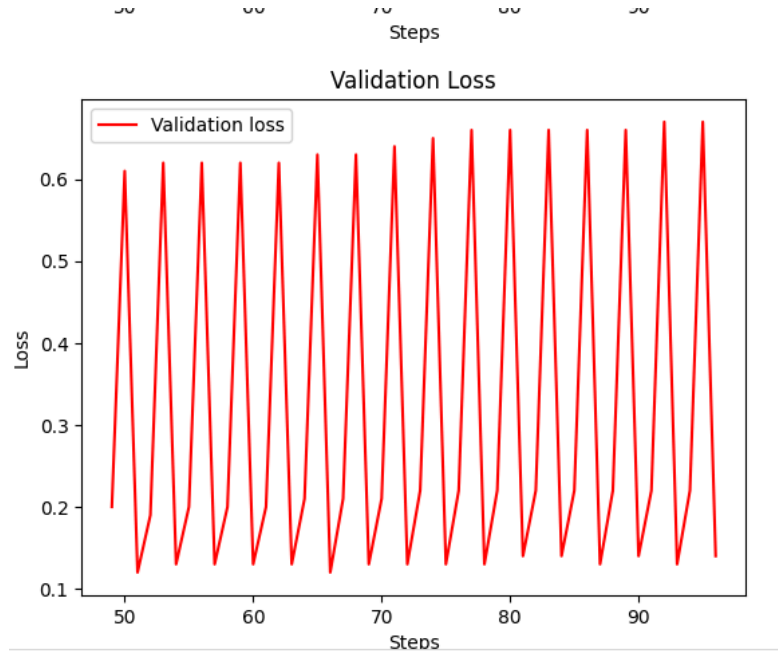


Figure 19: Validation Loss of Horror Stories using GPT 3.5 Turbo Model



```
[ ] test_messages = []
system_message = "You are a storyteller and you have to tell me an adventure story"
test_messages.append({"role": "system", "content": system_message})
user_message = "Generate the story titled \"The Haunted Mirror\""
test_messages.append({"role": "user", "content": user_message})

print(test_messages)

[{'role': 'system', 'content': 'You are a storyteller and you have to tell me an adventure story'}, {'role': 'user', 'content': 'Generate the story titled "The Haunted Mirror"'}]

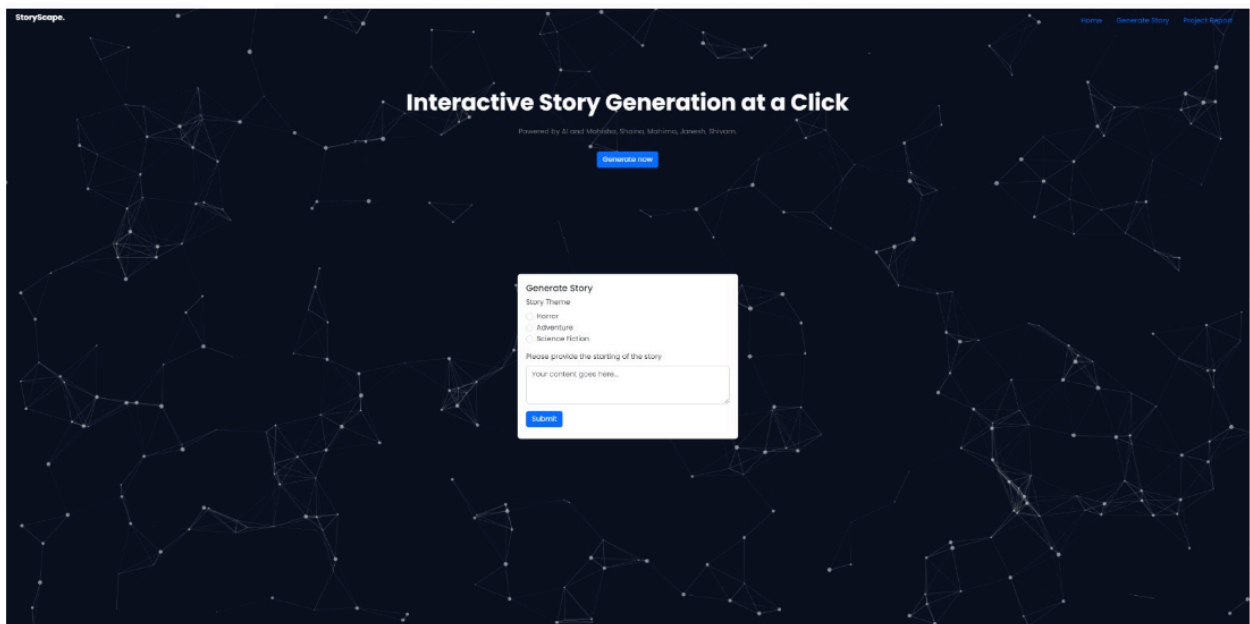
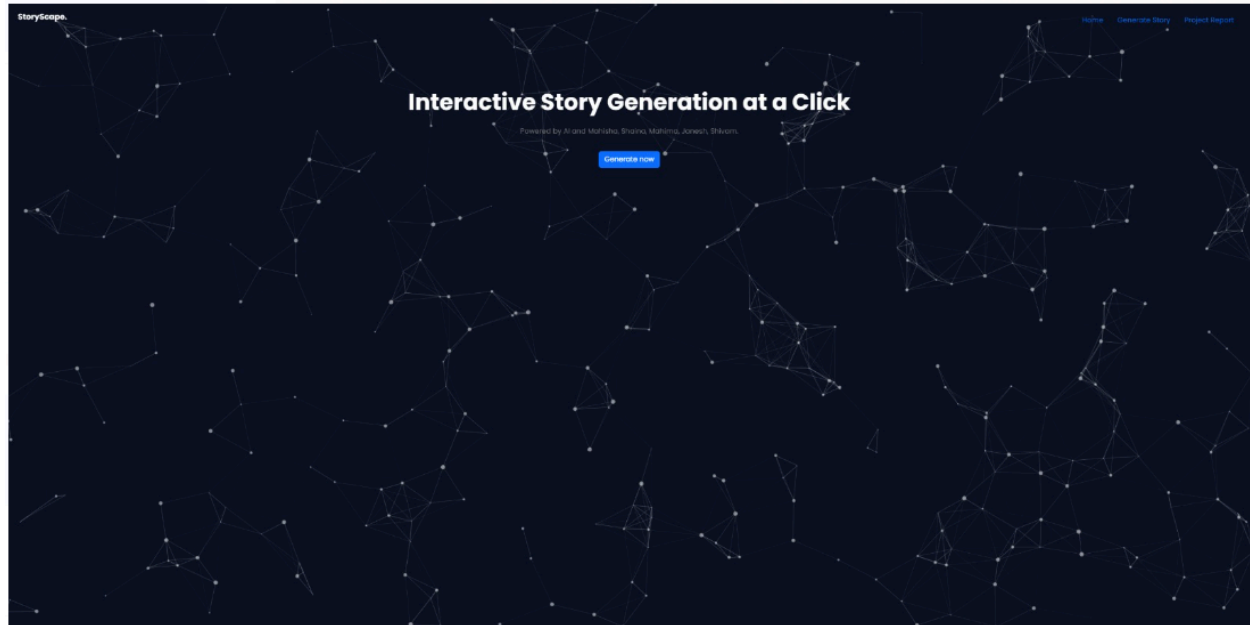
[ ] response = openai.ChatCompletion.create(
    model='gpt-3.5-turbo', messages=test_messages, temperature=0.7, max_tokens=500
)
print(response["choices"][0]["message"]["content"])
```

In a small village nestled deep within the misty forests, there stood an ancient mansion known as Blackwood Manor. The locals whispered stories of the mysterious disappearances that had plagued the manor for generations. One stormy night, a young explorer named Amelia dared to venture into the abandoned manor, drawn by the allure of the unknown. As she explored the dusty hallways and creaking staircases, she came across a room shrouded in darkness. In the corner of the room, covered in cobwebs, stood a large ornate mirror. Amelia felt a strange pull towards the mirror, as if it was calling out to her. As she approached, her reflection began to distort, twisting and contorting in unnatural ways. Suddenly, the mirror shattered into a thousand pieces, releasing a powerful burst of energy that enveloped Amelia in a blinding light. When the light faded, Amelia found herself in a parallel dimension, trapped within the mirror's twisted realm. The world around her was a distorted version of reality, filled with malevolent spirits and dark shadows. Desperate to escape, Amelia embarked on a treacherous journey through the mirror's haunted landscape, facing terrifying challenges and confronting her deepest fears. Along the way, she encountered a mysterious figure known as the Guardian, a spectral being who offered guidance and protection. Together, they braved the dangers of the mirror's realm, unraveling its dark secrets and confronting the malevolent force that held Amelia captive. As they neared the heart of the mirror's realm, Amelia discovered the source of the curse that plagued Blackwood Manor. A vengeful spirit, trapped within the mirror for centuries, sought to escape and unleash its wrath upon the world. With the help of the Guardian, Amelia confronted the spirit in a final showdown, using her courage and determination to banish the malevolent force back into the mirror once and for all. As the mirror shattered, Amelia was returned to the real world, her adventure coming to an end. From that day on, Blackwood Manor stood silent and still, the curse broken and the spirits at peace. Amelia emerged from her ordeal stronger and wiser, forever changed by her encounter with the haunted mirror. And though the manor remained abandoned, her story lived on as a cautionary tale of the dangers that lurked within the shadows.

Figure 20: Science Friction Stories Generated by GPT 3.5 Turbo Model

## 8. The Website

The website has been created using JavaScript on the front end and Python on the back end. The website is running on the Microsoft Azure Server. The website has the home page, the first page of the website, the report page, which has the project report, and the storyteller page, in which the user will give the story's beginning, select the story's theme and click on the submit button. The model will generate the story and return it to the front end.



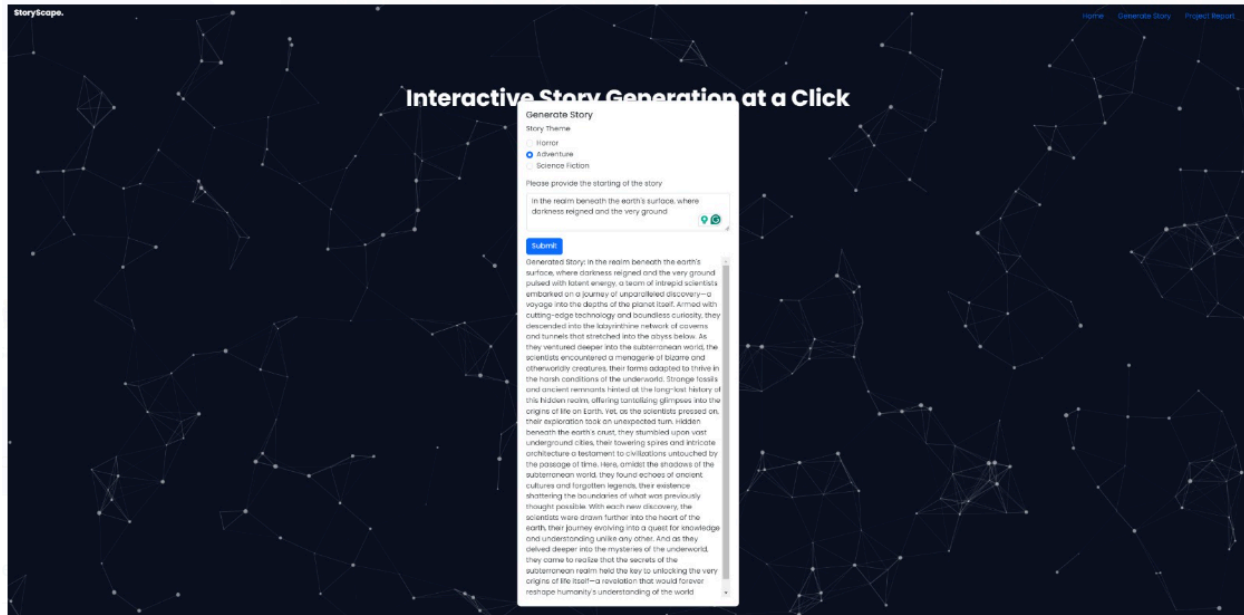


Figure 21: Screenshots of the Website of the Project

## 9. Conclusion and Future Work

We have fine-tuned the GPT-3.5 and Gemma2B Instruct models on stories based on three themes, and they are giving better performance than baseline results but could have done better. We planned to increase the dataset by taking the actual stories for many words, training the same models, and deploying them.

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