In [ ]:

```
NAME:HARINI KARTHIKA V
TASK NO:DS_task-4_prodigy
```

In [1]:

```
# This Python 3 environment comes with many helpful analytics libraries instal
# It is defined by the kaggle/python Docker image: https://github.com/kaggle/d
# For example, here's several helpful packages to load

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/" directory
# For example, running this (by clicking run or pressing Shift+Enter) will lis

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/) that ge
# You can also write temporary files to /kaggle/temp/, but they won't be saved
```

```
/kaggle/input/twitter-entity-sentiment-analysis/twitter_validation.csv
/kaggle/input/twitter-entity-sentiment-analysis/twitter_training.csv
```

Importing the packages and loading the datasets

In [2]:

```python
!pip install twython
!pip install nltk

import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from wordcloud import WordCloud
import re

import nltk
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize

from tqdm.notebook import tqdm

#1st approach
from nltk.sentiment import SentimentIntensityAnalyzer

#2nd Approach
from transformers import AutoTokenizer,AutoModelForSequenceClassification
from scipy.special import softmax
```

```
Collecting twython
  Downloading twython-3.9.1-py3-none-any.whl.metadata (20 kB)
Requirement already satisfied: requests>=2.1.0 in /opt/conda/lib/python3.10/s
ite-packages (from twython) (2.32.3)
Requirement already satisfied: requests-oauthlib>=0.4.0 in /opt/conda/lib/pyt
hon3.10/site-packages (from twython) (1.3.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /opt/conda/lib/pyt
hon3.10/site-packages (from requests>=2.1.0->twython) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/lib/python3.10/site
-packages (from requests>=2.1.0->twython) (3.6)
Requirement already satisfied: urllib3<3,>=1.21.1 in /opt/conda/lib/python3.1
0/site-packages (from requests>=2.1.0->twython) (1.26.18)
Requirement already satisfied: certifi>=2017.4.17 in /opt/conda/lib/python3.1
0/site-packages (from requests>=2.1.0->twython) (2024.2.2)
Requirement already satisfied: oauthlib>=3.0.0 in /opt/conda/lib/python3.10/s
ite-packages (from requests-oauthlib>=0.4.0->twython) (3.2.2)
Downloading twython-3.9.1-py3-none-any.whl (33 kB)
Installing collected packages: twython
Successfully installed twython-3.9.1
Requirement already satisfied: nltk in /opt/conda/lib/python3.10/site-package
s (3.2.4)
Requirement already satisfied: six in /opt/conda/lib/python3.10/site-packages
(from nltk) (1.16.0)
```

In [3]:

```
train_set = pd.read_csv("/kaggle/input/twitter-entity-sentiment-analysis/twitt
valid_set = pd.read_csv("/kaggle/input/twitter-entity-sentiment-analysis/twitt
df = pd.concat([train_set,valid_set])
df
```

Out[3]:

	TweetID	Entity	Sentiment	Content
0	2401	Borderlands	Positive	I am coming to the borders and I will kill you...
1	2401	Borderlands	Positive	im getting on borderlands and i will kill you ...
2	2401	Borderlands	Positive	im coming on borderlands and i will murder you...
3	2401	Borderlands	Positive	im getting on borderlands 2 and i will murder ...
4	2401	Borderlands	Positive	im getting into borderlands and i can murder y...
...	...	...	...	...
994	4891	GrandTheftAuto(GTA)	Irrelevant	⭐ Toronto is the arts and culture capital of ...
995	4359	CS-GO	Irrelevant	tHIS IS ACTUALLY A GOOD MOVE TOT BRING MORE VI...
996	2652	Borderlands	Positive	Today sucked so it’s time to drink wine n play...
997	8069	Microsoft	Positive	Bought a fraction of Microsoft today. Small wins.
998	6960	johnson&johnson	Neutral	Johnson & Johnson to stop selling talc baby po...

75680 rows × 4 columns

In [4]:

```
df.isnull().sum()
```

Out[4]:

```
TweetID        0
Entity         0
Sentiment      0
Content      686
dtype: int64
```

In [5]:

```
df.dropna(inplace=True)
df.isnull().sum()
```

Out[5]:

```
TweetID      0
Entity       0
Sentiment    0
Content      0
dtype: int64
```

In [6]:

```
df.duplicated().sum()
```

Out[6]:

```
2856
```

In [7]:

```
df.drop_duplicates(inplace=True)
df.duplicated().sum()
```

Out[7]:

```
0
```

In [8]:
```
df
```

Out[8]:

	TweetID	Entity	Sentiment	Content
0	2401	Borderlands	Positive	I am coming to the borders and I will kill you...
1	2401	Borderlands	Positive	im getting on borderlands and i will kill you ...
2	2401	Borderlands	Positive	im coming on borderlands and i will murder you...
3	2401	Borderlands	Positive	im getting on borderlands 2 and i will murder ...
4	2401	Borderlands	Positive	im getting into borderlands and i can murder y...
...	...	...	...	...
987	7516	LeagueOfLegends	Neutral	♥ Suikoden 2\n 1️⃣ Alex Kidd in Miracle World\...
988	5708	HomeDepot	Positive	Thank you to Matching funds Home Depot RW paym...
990	2165	CallOfDuty	Neutral	Late night stream with the boys! Come watch so...
994	4891	GrandTheftAuto(GTA)	Irrelevant	⭐ Toronto is the arts and culture capital of ...
995	4359	CS-GO	Irrelevant	tHIS IS ACTUALLY A GOOD MOVE TOT BRING MORE VI...

72138 rows × 4 columns

In [9]:
```
df.describe()
```

Out[9]:

	TweetID
count	72138.000000
mean	6435.525521
std	3743.594729
min	1.000000
25%	3195.000000
50%	6432.000000
75%	9607.000000
max	13200.000000

In [10]:
```
df.describe(include = 'object')
```

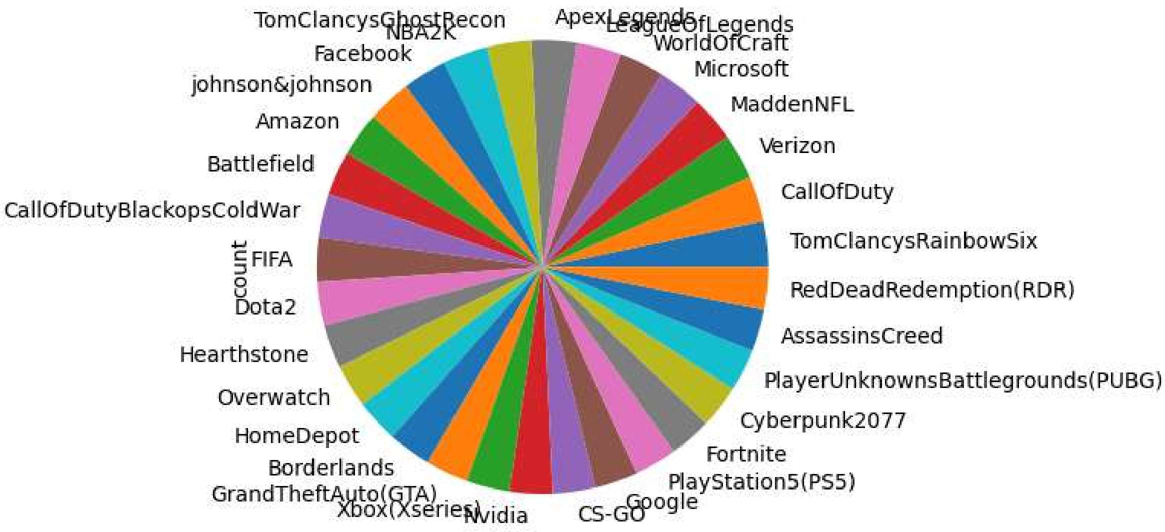
Out[10]:

	Entity	Sentiment	Content
count	72138	72138	72138
unique	32	4	69973
top	TomClancysRainbowSix	Negative	At the same time, despite the fact that there ...
freq	2349	21790	172

Data Visualization

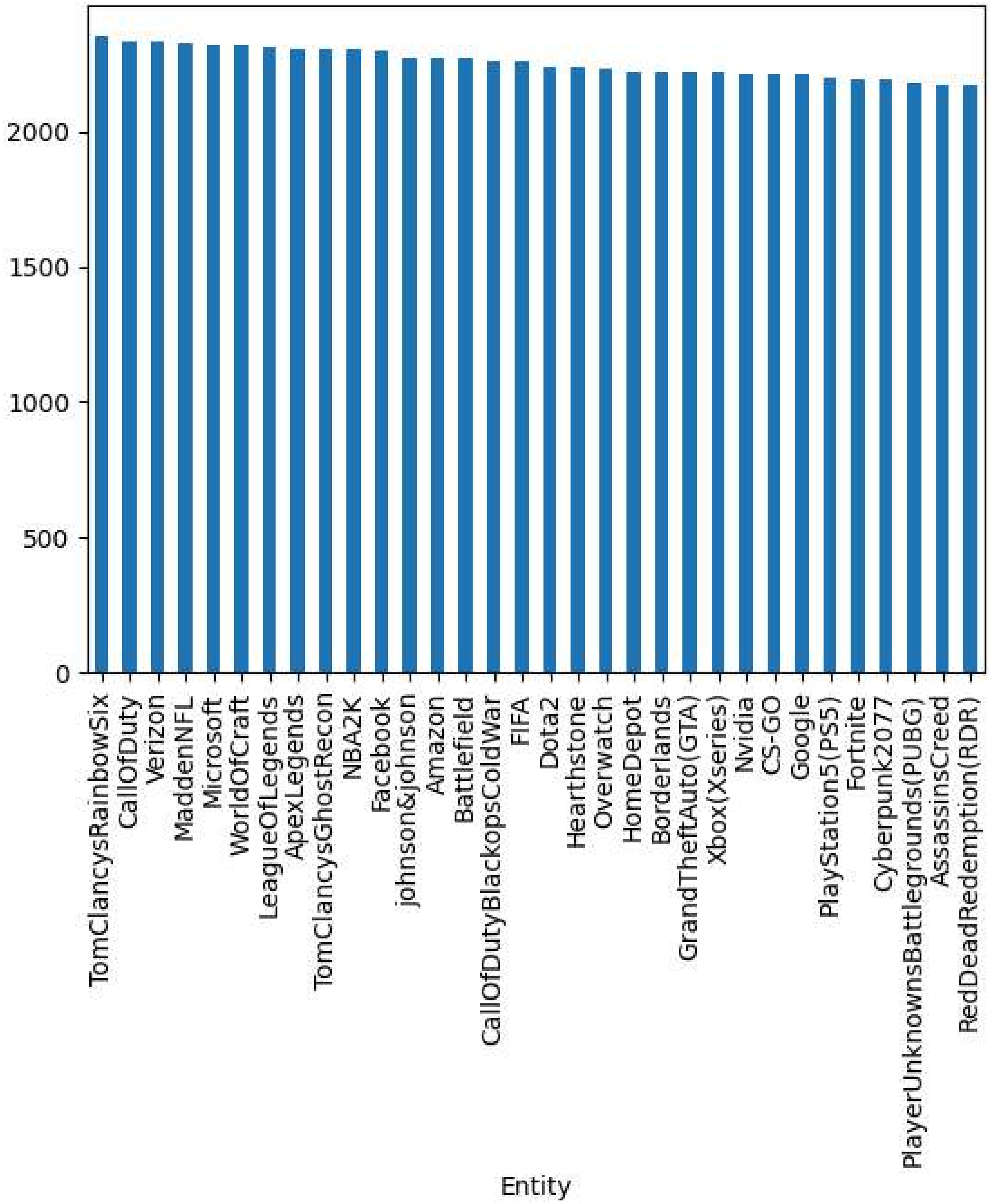
```
In [11]: df['Entity'].value_counts().plot(kind = 'pie')

Out[11]: <Axes: ylabel='count'>
```



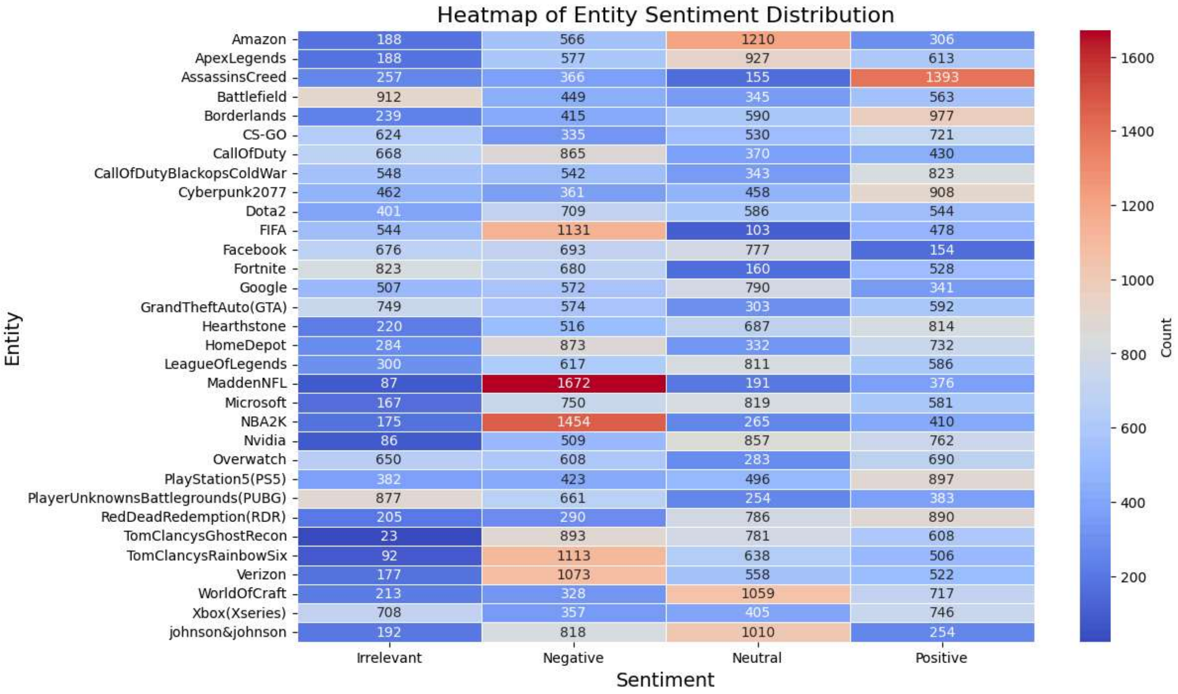
```
In [12]: df['Entity'].value_counts().plot(kind = 'bar')

Out[12]: <Axes: xlabel='Entity'>
```



```
In [13]: crosstab = pd.crosstab(index=df['Entity'], columns=df['Sentiment'])
         plt.figure(figsize=(12, 8))
         sns.heatmap(crosstab, cmap='coolwarm', annot=True, fmt='d', linewidths=.5, cba
         plt.title('Heatmap of Entity Sentiment Distribution', fontsize=16)
         plt.xlabel('Sentiment', fontsize=14)
         plt.ylabel('Entity', fontsize=14)
```

```
Out[13]: Text(120.7222222222222, 0.5, 'Entity')
```



One Hot Encoding the Categorical Variables

In [14]:

```
df2 = pd.get_dummies(df,columns=["Entity","Sentiment"], drop_first=True)
df2
```

Out[14]:

	TweetID	Content	Entity_ApexLegends	Entity_AssassinsCreed	Entity_Battlefield	Entity_B
0	2401	I am coming to the borders and I will kill you...	False	False	False	
1	2401	im getting on borderlands and i will kill you ...	False	False	False	
2	2401	im coming on borderlands and i will murder you...	False	False	False	
3	2401	im getting on borderlands 2 and i will murder ...	False	False	False	
4	2401	im getting into borderlands and i can murder y...	False	False	False	
...	...	...	...	...	...	
987	7516	♥ Suikoden 2\n 1️⃣ Alex Kidd in Miracle World\...	False	False	False	
988	5708	Thank you to Matching funds Home Depot RW paym...	False	False	False	
990	2165	Late night stream with the boys! Come watch so...	False	False	False	
994	4891	⭐ Toronto is the arts and culture capital of ...	False	False	False	
995	4359	tHIS IS ACTUALLY A GOOD MOVE TOT BRING MORE VI...	False	False	False	

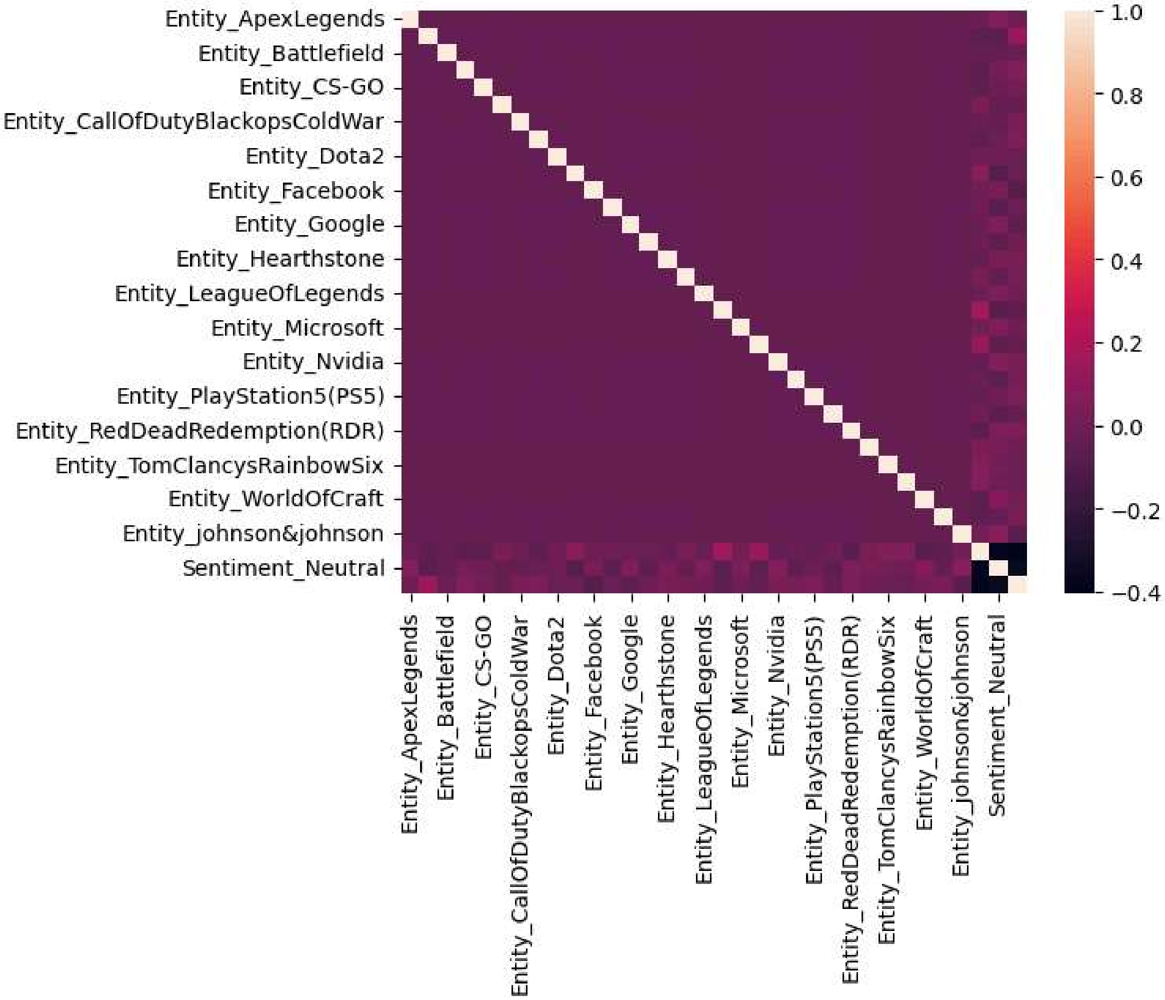
72138 rows × 36 columns

In [15]:

```python
corr = df2.drop(columns=["TweetID","Content"]).corr()
sns.heatmap(corr)
```

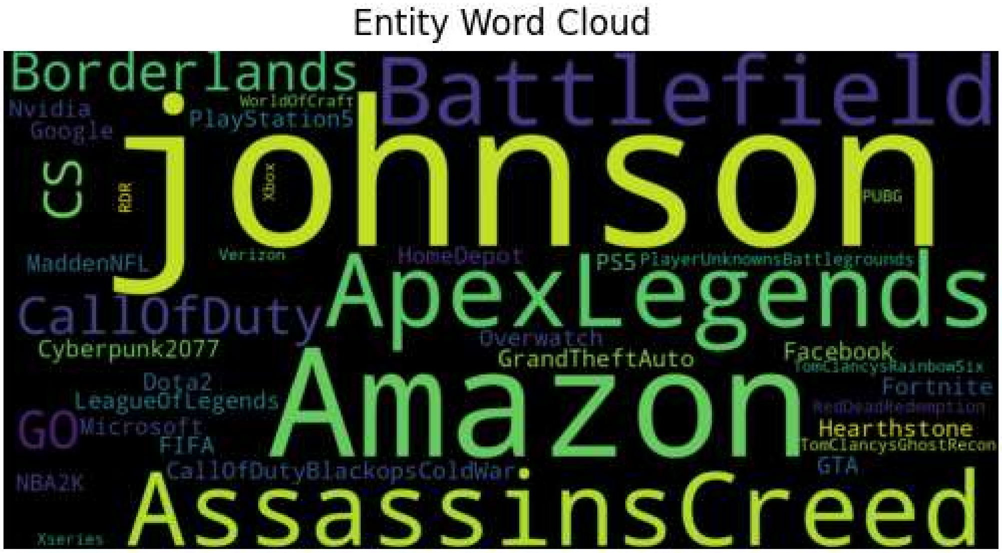
Out[15]:

```
<Axes: >
```



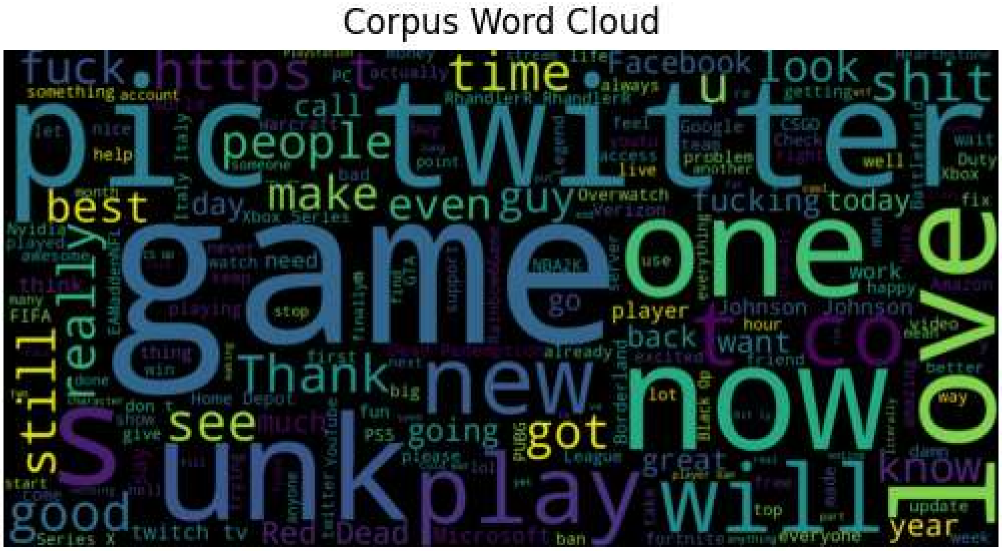
```
In [16]: entity_list = ' '.join(crosstab.index)
         plt.axis('off')
         wc = WordCloud(width=2000, height=1000).generate(entity_list)
         plt.title("Entity Word Cloud")
         plt.imshow(wc, interpolation='bilinear')

Out[16]: <matplotlib.image.AxesImage at 0x7dd3b0087ca0>
```



```
In [17]: corpus = ' '.join(df['Content'])
         plt.axis('off')
         plt.title("Corpus Word Cloud")
         wc2 = WordCloud(width=2000, height=1000).generate(corpus)
         plt.imshow(wc2, interpolation='bilinear')

Out[17]: <matplotlib.image.AxesImage at 0x7dd3ab0c1ea0>
```



Data Pre-Processing

In [18]:

```
#Making sure the text column is of string type
df['Content'] = df['Content'].astype(str)
```

Using RoBERTa: A Robustly Optimized BERT Pretraining Approach

In [19]:

```
#A sample of the entire dataset as the entire set is too large
import random
random.seed(42)
sampled_df = df.sample(n=2000, random_state=random.randint(0, 10000))
sampled_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 2000 entries, 71653 to 31326
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   TweetID    2000 non-null   int64 
 1   Entity     2000 non-null   object
 2   Sentiment  2000 non-null   object
 3   Content    2000 non-null   object
dtypes: int64(1), object(3)
memory usage: 78.1+ KB
```

In [20]:

```
import warnings
warnings.filterwarnings('ignore')
```

In [21]:

```
MODEL = f"cardiffnlp/twitter-roberta-base-sentiment-latest"
tokenizer = AutoTokenizer.from_pretrained(MODEL)
model = AutoModelForSequenceClassification.from_pretrained(MODEL)
```

```
config.json:   0%|          | 0.00/929 [00:00<?, ?B/s]

vocab.json:   0%|          | 0.00/899k [00:00<?, ?B/s]

merges.txt:   0%|          | 0.00/456k [00:00<?, ?B/s]

special_tokens_map.json:   0%|          | 0.00/239 [00:00<?, ?B/s]

pytorch_model.bin:   0%|          | 0.00/501M [00:00<?, ?B/s]

Some weights of the model checkpoint at cardiffnlp/twitter-roberta-base-senti
ment-latest were not used when initializing RobertaForSequenceClassification:
['roberta.pooler.dense.bias', 'roberta.pooler.dense.weight']
- This IS expected if you are initializing RobertaForSequenceClassification f
rom the checkpoint of a model trained on another task or with another archite
cture (e.g. initializing a BertForSequenceClassification model from a BertFor
PreTraining model).
- This IS NOT expected if you are initializing RobertaForSequenceClassificati
on from the checkpoint of a model that you expect to be exactly identical (in
itializing a BertForSequenceClassification model from a BertForSequenceClassi
fication model).
```

In [22]:

```
def polarity_scores_roberta(ex):
    encoded_text = tokenizer(ex, return_tensors='pt')
    output = model(**encoded_text)
    scores = output[0][0].detach().numpy()
    scores = softmax(scores)
    scores_dict = {
        'roberta_neg': scores[0],
        'roberta_neu': scores[1],
        'roberta_pos': scores[2]
    }
    return scores_dict
```

In [23]:

```
res = {}
sampled_df.info()
for i,row in tqdm(sampled_df.iterrows(), total=len(sampled_df)):
    try:
        text = row['Content']
        id = row['TweetID']
        roberta_results = polarity_scores_roberta(text)
        res[id] = {**roberta_results}
    except RuntimeError:
        print(f"Broke for id {id}")
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 2000 entries, 71653 to 31326
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   TweetID    2000 non-null   int64 
 1   Entity     2000 non-null   object
 2   Sentiment  2000 non-null   object
 3   Content    2000 non-null   object
dtypes: int64(1), object(3)
memory usage: 78.1+ KB

  0%|          | 0/2000 [00:00<?, ?it/s]
```

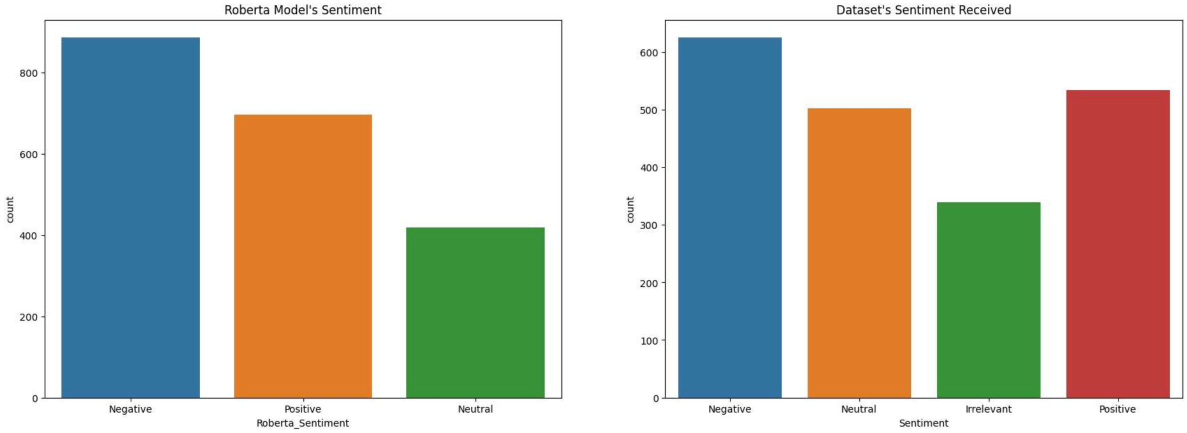
In [24]:

```
results_df = pd.DataFrame(res).transpose()
results_df = results_df.reset_index().rename(columns={'index':'TweetID'})
results_df = results_df.merge(sampled_df)
```

```
In [25]: results_df['Roberta_Sentiment'] = results_df[['roberta_neg', 'roberta_neu', 'r
             lambda x: 'Positive' if x['roberta_pos'] > max(x['roberta_neg'], x['robert
                       else 'Negative' if x['roberta_neg'] > max(x['roberta_pos'], x['r
                       else 'Neutral', axis=1)
         results_df.head()
         results_df["Roberta_Sentiment"].value_counts(), results_df["Sentiment"].value_
```

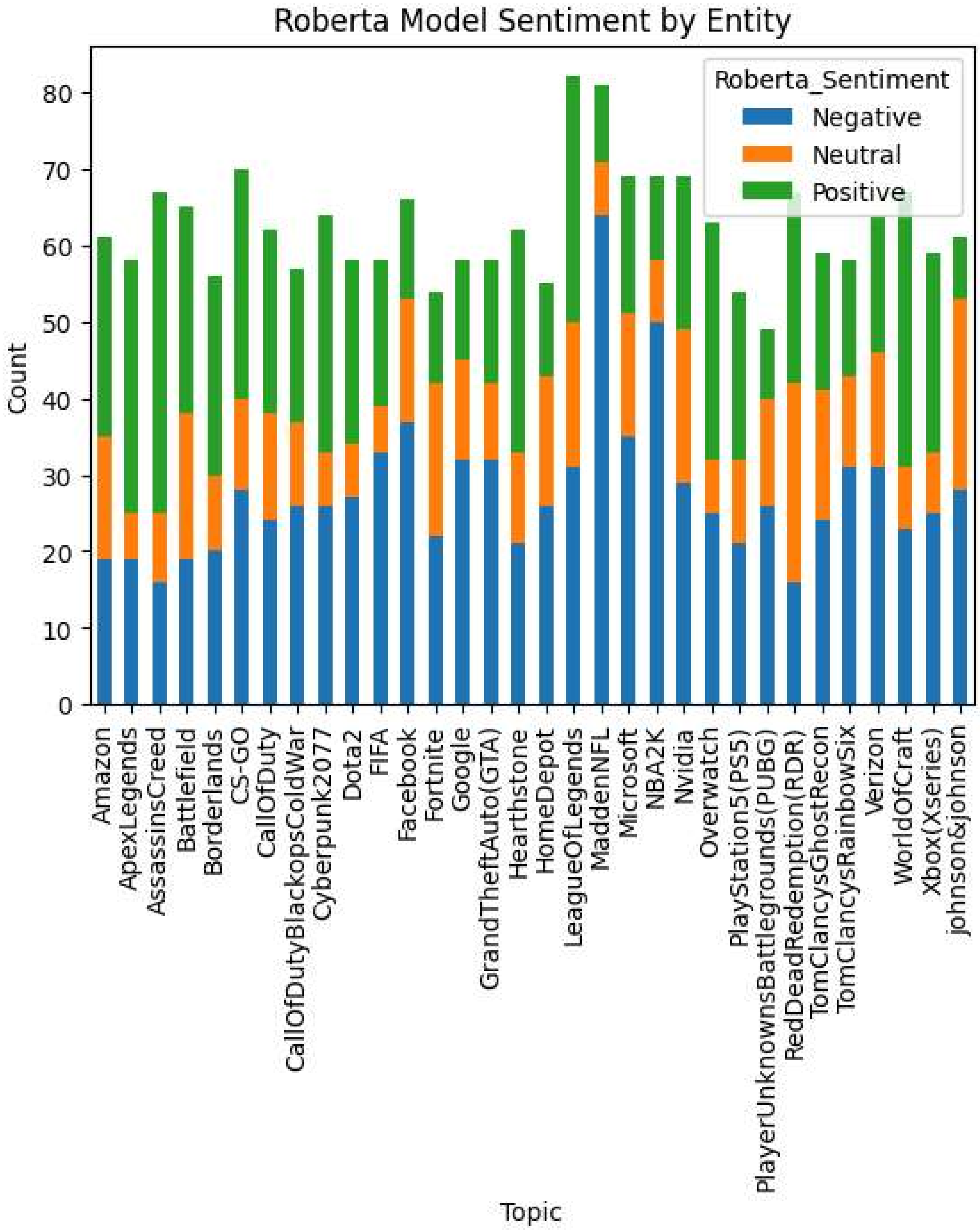
```
Out[25]: (Roberta_Sentiment
          Negative    886
          Positive    696
          Neutral     418
          Name: count, dtype: int64,
          Sentiment
          Negative      625
          Positive      534
          Neutral       502
          Irrelevant    339
          Name: count, dtype: int64)
```

```
In [26]: fig, axs = plt.subplots(1,2, figsize=(21,7))
         sns.countplot(data=results_df, x='Roberta_Sentiment', ax=axs[0])
         sns.countplot(data=results_df, x='Sentiment',ax=axs[1])
         axs[0].set_title("Roberta Model's Sentiment")
         axs[1].set_title("Dataset's Sentiment Received")
         plt.show()
```



In [27]:
```
plt.figure(figsize=(15,8))
sentiment_by_topic = results_df.groupby(['Entity','Roberta_Sentiment']).size()
sentiment_by_topic.plot(kind='bar', stacked=True)
plt.title('Roberta Model Sentiment by Entity')
plt.xlabel('Topic')
plt.ylabel('Count')
plt.show()
```

```
<Figure size 1500x800 with 0 Axes>
```


Roberta Model Sentiment by Entity
Roberta_Sentiment
Negative
Neutral
Positive
Count
Amazon
ApexLegends
AssassinsCreed
Battlefield
Borderlands
CS-GO
CallOfDuty
CallOfDutyBlackopsColdWar
Cyberpunk2077
Dota2
FIFA
Facebook
Fortnite
Google
GrandTheftAuto(GTA)
Hearthstone
HomeDepot
LeagueOfLegends
MaddenNFL
Microsoft
NBA2K
Nvidia
Overwatch
PlayStation5(PS5)
PlayerUnknownsBattlegrounds(PUBG)
RedDeadRedemption(RDR)
TomClancysGhostRecon
TomClancysRainbowSix
Verizon
WorldOfCraft
Xbox(Xseries)
johnson&johnson
Topic