```
In [1]: ! pip install --user scipy wordcloud nltk seaborn textblob
```

```
Requirement already satisfied: scipy in c:\users\admin\anaconda3\lib\site-packages
(1.9.1)
Requirement already satisfied: wordcloud in c:\users\admin\appdata\roaming\python\pyt
hon39\site-packages (1.9.2)
Requirement already satisfied: nltk in c:\users\admin\anaconda3\lib\site-packages (3.
7)
Requirement already satisfied: seaborn in c:\users\admin\anaconda3\lib\site-packages
(0.11.2)
Requirement already satisfied: textblob in c:\users\admin\appdata\roaming\python\pyth
on39\site-packages (0.17.1)
Requirement already satisfied: numpy<1.25.0,>=1.18.5 in c:\users\admin\anaconda3\lib
\site-packages (from scipy) (1.23.5)
Requirement already satisfied: pillow in c:\users\admin\anaconda3\lib\site-packages
(from wordcloud) (9.2.0)
Requirement already satisfied: matplotlib in c:\users\admin\anaconda3\lib\site-packag
es (from wordcloud) (3.5.2)
Requirement already satisfied: regex>=2021.8.3 in c:\users\admin\anaconda3\lib\site-p
ackages (from nltk) (2022.7.9)
Requirement already satisfied: tqdm in c:\users\admin\anaconda3\lib\site-packages (fr
om nltk) (4.64.1)
Requirement already satisfied: joblib in c:\users\admin\anaconda3\lib\site-packages
(from nltk) (1.2.0)
Requirement already satisfied: click in c:\users\admin\anaconda3\lib\site-packages (f
rom nltk) (8.1.7)
Requirement already satisfied: pandas>=0.23 in c:\users\admin\anaconda3\lib\site-pack
ages (from seaborn) (2.1.2)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\admin\anaconda3\lib\site
-packages (from matplotlib->wordcloud) (4.25.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\admin\anaconda3\lib\site
-packages (from matplotlib->wordcloud) (1.4.2)
Requirement already satisfied: pyparsing>=2.2.1 in c:\users\admin\anaconda3\lib\site-
packages (from matplotlib->wordcloud) (3.0.9)
Requirement already satisfied: packaging>=20.0 in c:\users\admin\anaconda3\lib\site-p
ackages (from matplotlib->wordcloud) (21.3)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\admin\anaconda3\lib\s
ite-packages (from matplotlib->wordcloud) (2.8.2)
Requirement already satisfied: cycler>=0.10 in c:\users\admin\anaconda3\lib\site-pack
ages (from matplotlib->wordcloud) (0.11.0)
Requirement already satisfied: pytz>=2020.1 in c:\users\admin\anaconda3\lib\site-pack
ages (from pandas>=0.23->seaborn) (2022.1)
Requirement already satisfied: tzdata>=2022.1 in c:\users\admin\anaconda3\lib\site-pa
ckages (from pandas>=0.23->seaborn) (2023.3)
Requirement already satisfied: colorama in c:\users\admin\anaconda3\lib\site-packages
(from click->nltk) (0.4.5)
Requirement already satisfied: six>=1.5 in c:\users\admin\anaconda3\lib\site-packages
(from python-dateutil>=2.7->matplotlib->wordcloud) (1.16.0)
```

Summary of the Program

Library Installation:

> Installed required libraries: scipy, wordcloud, nltk, seaborn, and textblob.

Data Loading and Exploration:

> Loaded tweet data from a CSV file using Pandas. Explored dataset information, including column names and data types.

Text Preprocessing:

> Converted tweets to lowercase. Removed Twitter usernames, URLs, and special characters. Handled emojis and contractions. Tokenized and applied stemming using NLTK's Porter Stemmer. Removed stop words.

Data Visualization:

> Created a pie chart to visualize the distribution of positive and negative sentiments. Generated word clouds for positive and negative sentiments to highlight frequently used words.

Feature Extraction:

> Used the bag-of-words approach to convert text into numerical vectors. Employed CountVectorizer from scikit-learn to create a matrix of word occurrences.

Model Training:

> Split the dataset into training and testing sets. Trained a Multinomial Naive Bayes classifier on the training data.

Model Evaluation:

> Assessed the model's performance on the testing set.

Model Saving:

> Saved the trained Naive Bayes model and CountVectorizer using joblib.

Model Loading and Prediction:

> Loaded the saved model and CountVectorizer. |Demonstrated how to make predictions on new preprocessed data.

In [2]:
```
import numpy as np
import pandas as pd
import json, nltk
import matplotlib.pyplot as plt
from wordcloud import WordCloud
import seaborn as sns
# nltk.download('wordnet')   # for Lemmatization
```

In [3]:
```
total_data=pd.read_csv('train (1).csv',encoding='ISO-8859-1')
```

In [4]:
```
total_data.head(5)
```

Out[4]:

	ItemID	Sentiment	SentimentText
0	1	0	is so sad for my APL frie...
1	2	0	I missed the New Moon trail...
2	3	1	omg its already 7:30 :O
3	4	0	.. Omgaga. Im sooo im gunna CRy. I'...
4	5	0	i think mi bf is cheating on me!!! ...

In [5]:
```
tweet = total_data.columns.values[2]
sentiment = total_data.columns.values[1]
tweet,sentiment
```

Out[5]:
```
('SentimentText', 'Sentiment')
```

In [6]:
```
total_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 99989 entries, 0 to 99988
Data columns (total 3 columns):
 #   Column         Non-Null Count  Dtype 
---  ------         --------------  ----- 
 0   ItemID         99989 non-null  int64 
 1   Sentiment      99989 non-null  int64 
 2   SentimentText  99989 non-null  object
dtypes: int64(2), object(1)
memory usage: 2.3+ MB
```

Preprocessiong

Convert every tweets to lower case

Remove Twitter username Remove punctuations, numbers and special characters Convert more than 2 letter repetitions to 2 letter (example (wooooooow --> woow)) Remove extra spaces Remove URLs Emoji analysis Handle contractions words " can't " >> " can not " " won't " >> " will not " " should't " >> " should not " Tokenization (Optional) Remove Stop words (Optional) Text Normalization (Stemming / Lemmatization)

In [7]:
```
import re
def emoji(tweet):
    # Smile -- :), : ), :-), (:, ( :, (-:, :') , :O
    tweet = re.sub(r'(:\s?\)|:-\)|\(\s?:|\(-:|:\'\)|:O)', ' positiveemoji ', tweet)
    # Laugh -- :D, : D, :-D, xD, x-D, XD, X-D
    tweet = re.sub(r'(:\s?D|:-D|x-?D|X-?D)', ' positiveemoji ', tweet)
    # Love -- <3, :*
    tweet = re.sub(r'(<3|:\*)', ' positiveemoji ', tweet)
    # Wink -- ;-), ;), ;-D, ;D, (;,  (-; , @-)
    tweet = re.sub(r'(;-?\)|;-?D|\(-?;|@-\))', ' positiveemoji ', tweet)
    # Sad -- :-(, : (, :(, ):, )-:, :-/ , :-|
    tweet = re.sub(r'(:\s?\(|:-\(|\)\s?:|\)-:|:-/|:-\|)', ' negetiveemoji ', tweet)
    # Cry -- :,(, :'(, :"(
    tweet = re.sub(r'(:,\(|:\'\(|:"\()', ' negetiveemoji ', tweet)
    return tweet
```

In [8]:
```
import re

def process_tweet(tweet):
    tweet = tweet.lower()                                               # Lowercases the
    tweet = re.sub('@[^\s]+', '', tweet)                                # Removes usernc
    tweet = re.sub('((www\.[^\s]+)|(https?://[^\s]+))', ' ', tweet)    # Remove URLs
    tweet = re.sub(r"\d+", " ", str(tweet))                             # Removes all di
    tweet = re.sub('&quot;'," ", tweet)                                 # Remove (&quot;
    tweet = emoji(tweet)                                                # Replaces Emoji
    tweet = re.sub(r"\b[a-zA-Z]\b", "", str(tweet))                     # Removes all si
    tweet = re.sub(r"[^\w\s]", " ", str(tweet))                         # Removes all pu
    tweet = re.sub(r'(.)\1+', r'\1\1', tweet)                           # Convert more t
    tweet = re.sub(r"\s+", " ", str(tweet))                             # Replaces doubl
    return tweet
```

In [9]:
```
total_data['processed_tweet'] = np.vectorize(process_tweet)(total_data[tweet])
# or total_data['processed_tweet'] = np.vectorize(process_tweet)(total_data['Sentiment
```

In [10]:
```
total_data['Sentiment'].nunique()
```

Out[10]:
```
2
```

In [11]:
```
total_data.head(10)
```

Out[11]:

	ItemID	Sentiment	SentimentText	processed_tweet
0	1	0	is so sad for my APL frie...	is so sad for my apl friend
1	2	0	I missed the New Moon trail...	missed the new moon trailer
2	3	1	omg its already 7:30 :O	omg its already
3	4	0	.. Omgaga. Im sooo im gunna CRy. I'...	omgaga im soo im gunna cry ve been at this de...
4	5	0	i think mi bf is cheating on me!!! ...	think mi bf is cheating on me t_t
5	6	0	or i just worry too much?	or just worry too much
6	7	1	Juuuuuuuuuuuuuuuuussssst Chillin!!	juusst chillin
7	8	0	Sunny Again Work Tomorrow :-| ...	sunny again work tomorrow negetiveemoji tv to...
8	9	1	handed in my uniform today . i miss you ...	handed in my uniform today miss you already
9	10	1	hmmmm.... i wonder how she my number @-)	hmm wonder how she my number

In [12]:
```
tokenized_tweet = total_data['processed_tweet'].apply(lambda x: x.split())
tokenized_tweet.head()
```

```
Out[12]: 0                   [is, so, sad, for, my, apl, friend]
         1                     [missed, the, new, moon, trailer]
         2                                   [omg, its, already]
         3    [omgaga, im, soo, im, gunna, cry, ve, been, at...
         4           [think, mi, bf, is, cheating, on, me, t_t]
         Name: processed_tweet, dtype: object
```

```
In [13]: from nltk.stem.porter import *
         stemmer = PorterStemmer()

         tokenized_tweet = tokenized_tweet.apply(lambda x: [stemmer.stem(i) for i in x])
         tokenized_tweet.head()
```

```
Out[13]: 0                   [is, so, sad, for, my, apl, friend]
         1                       [miss, the, new, moon, trailer]
         2                                    [omg, it, alreadi]
         3    [omgaga, im, soo, im, gunna, cri, ve, been, at...
         4              [think, mi, bf, is, cheat, on, me, t_t]
         Name: processed_tweet, dtype: object
```

```
In [14]: tokenized_tweet
```

```
Out[14]: 0                        [is, so, sad, for, my, apl, friend]
         1                            [miss, the, new, moon, trailer]
         2                                         [omg, it, alreadi]
         3         [omgaga, im, soo, im, gunna, cri, ve, been, at...
         4                   [think, mi, bf, is, cheat, on, me, t_t]
                                         ...
         99984     [seem, like, repeat, problem, hope, you, re, a...
         99985     [arr, we, both, repli, to, each, other, over, ...
         99986                                    [ya, thought, so]
         99987         [ye, ye, glad, you, had, more, fun, with, me]
         99988                                   [haha, ye, you, do]
         Name: processed_tweet, Length: 99989, dtype: object
```

```
In [15]: stop_words = {"i", "me", "my", "myself", "we", "our", "ours", "ourselves",
                     "you", "your", "yours", "yourself", "yourselves", "he", "him",
                     "his", "himself", "she", "her", "hers", "herself", "it", "its",
                     "itself", "they", "them", "their", "theirs", "themselves", "what",
                     "which", "who", "whom", "this", "that", "these", "those", "am", "is",
                     "are", "was", "were", "be", "been", "being", "have", "has", "had",
                     "having", "do", "does", "did", "doing", "a", "an", "the", "and",
                     "but", "if", "or", "because", "as", "until", "while", "of", "at",
                     "by", "for", "with", "about", "against", "between", "into", "through",
                     "during", "before", "after", "above", "below", "to", "from", "up",
                     "down", "in", "out", "on", "off", "over", "under", "again", "further",
                     "then", "once", "here", "there", "when", "where", "why", "how", "all",
                     "any", "both", "each", "few", "more", "most", "other", "some", "such",
                     "only", "own", "same", "so", "than", "too", "very",
                     "can", "will", "just", "should", "now"}
```

```
In [16]: nltk.download('stopwords')
         from nltk.corpus import stopwords
         stop_words=set(stopwords.words('english'))
         stop_words
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\Admin\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

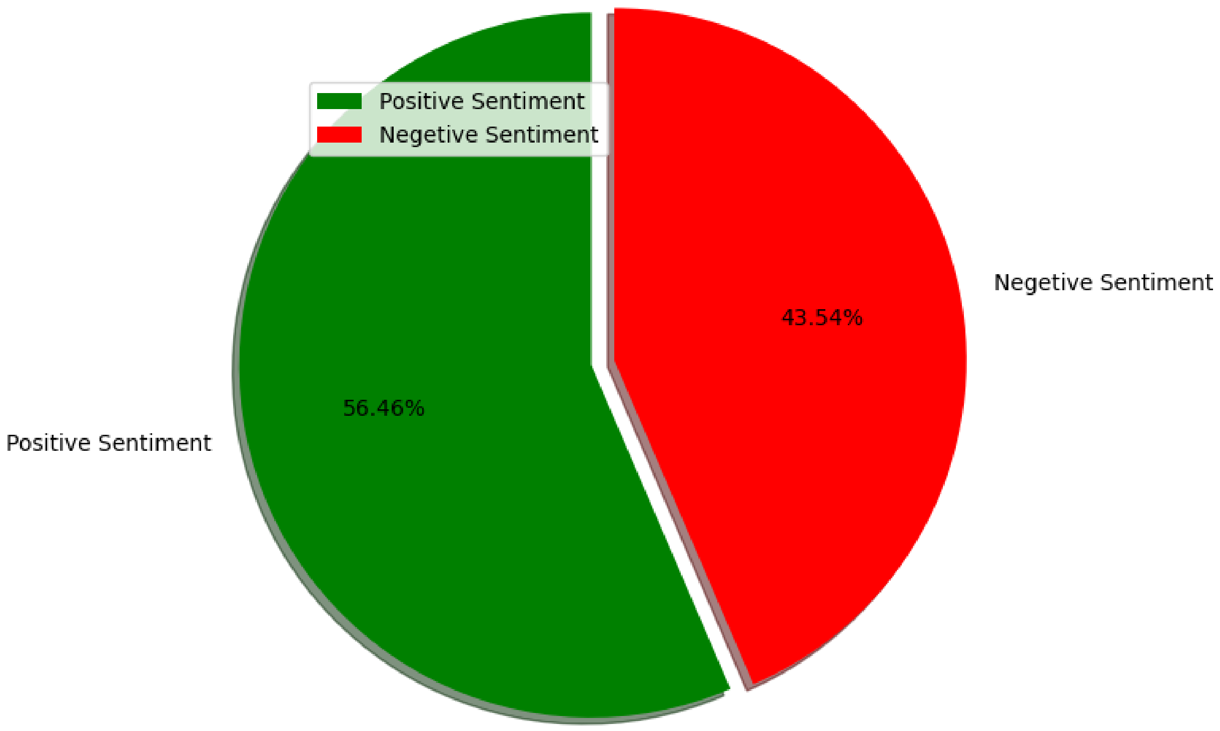
```
Out[16]: {'a',
          'about',
          'above',
          'after',
          'again',
          'against',
          'ain',
          'all',
          'am',
          'an',
          'and',
          'any',
          'are',
          'aren',
          "aren't",
          'as',
          'at',
          'be',
          'because',
          'been',
          'before',
          'being',
          'below',
          'between',
          'both',
          'but',
          'by',
          'can',
          'couldn',
          "couldn't",
          'd',
          'did',
          'didn',
          "didn't",
          'do',
          'does',
          'doesn',
          "doesn't",
          'doing',
          'don',
          "don't",
          'down',
          'during',
          'each',
          'few',
          'for',
          'from',
          'further',
          'had',
          'hadn',
          "hadn't",
          'has',
          'hasn',
          "hasn't",
          'have',
          'haven',
          "haven't",
          'having',
          'he',
          'her',
 'here',
 'hers',
 'herself',
 'him',
 'himself',
 'his',
 'how',
 'i',
 'if',
 'in',
 'into',
 'is',
 'isn',
 "isn't",
 'it',
 "it's",
 'its',
 'itself',
 'just',
 'll',
 'm',
 'ma',
 'me',
 'mightn',
 "mightn't",
 'more',
 'most',
 'mustn',
 "mustn't",
 'my',
 'myself',
 'needn',
 "needn't",
 'no',
 'nor',
 'not',
 'now',
 'o',
 'of',
 'off',
 'on',
 'once',
 'only',
 'or',
 'other',
 'our',
 'ours',
 'ourselves',
 'out',
 'over',
 'own',
 're',
 's',
 'same',
 'shan',
 "shan't",
 'she',
 "she's",
 'should',
 "should've",
          'shouldn',
          "shouldn't",
          'so',
          'some',
          'such',
          't',
          'than',
          'that',
          "that'll",
          'the',
          'their',
          'theirs',
          'them',
          'themselves',
          'then',
          'there',
          'these',
          'they',
          'this',
          'those',
          'through',
          'to',
          'too',
          'under',
          'until',
          'up',
          've',
          'very',
          'was',
          'wasn',
          "wasn't",
          'we',
          'were',
          'weren',
          "weren't",
          'what',
          'when',
          'where',
          'which',
          'while',
          'who',
          'whom',
          'why',
          'will',
          'with',
          'won',
          "won't",
          'wouldn',
          "wouldn't",
          'y',
          'you',
          "you'd",
          "you'll",
          "you're",
          "you've",
          'your',
          'yours',
          'yourself',
          'yourselves'}
```

```
In [17]: total_data.head()
```

Out[17]:

	ItemID	Sentiment	SentimentText	processed_tweet
0	1	0	is so sad for my APL frie...	is so sad for my apl friend
1	2	0	I missed the New Moon trail...	missed the new moon trailer
2	3	1	omg its already 7:30 :O	omg its already
3	4	0	.. Omgaga. Im sooo im gunna CRy. I'...	omgaga im soo im gunna cry ve been at this de...
4	5	0	i think mi bf is cheating on me!!! ...	think mi bf is cheating on me t_t

```
In [18]: sentiments = ['Positive Sentiment', 'Negetive Sentiment']
         slices = [(total_data[sentiment] != 0).sum(), (total_data[sentiment] == 0).sum()]
         colors = ['g', 'r']
         plt.pie(slices, labels = sentiments, colors=colors, startangle=90, shadow = True,
                 explode = (0, 0.1), radius = 1.5, autopct = '%1.2f%%')
         plt.legend()
         plt.show()
```



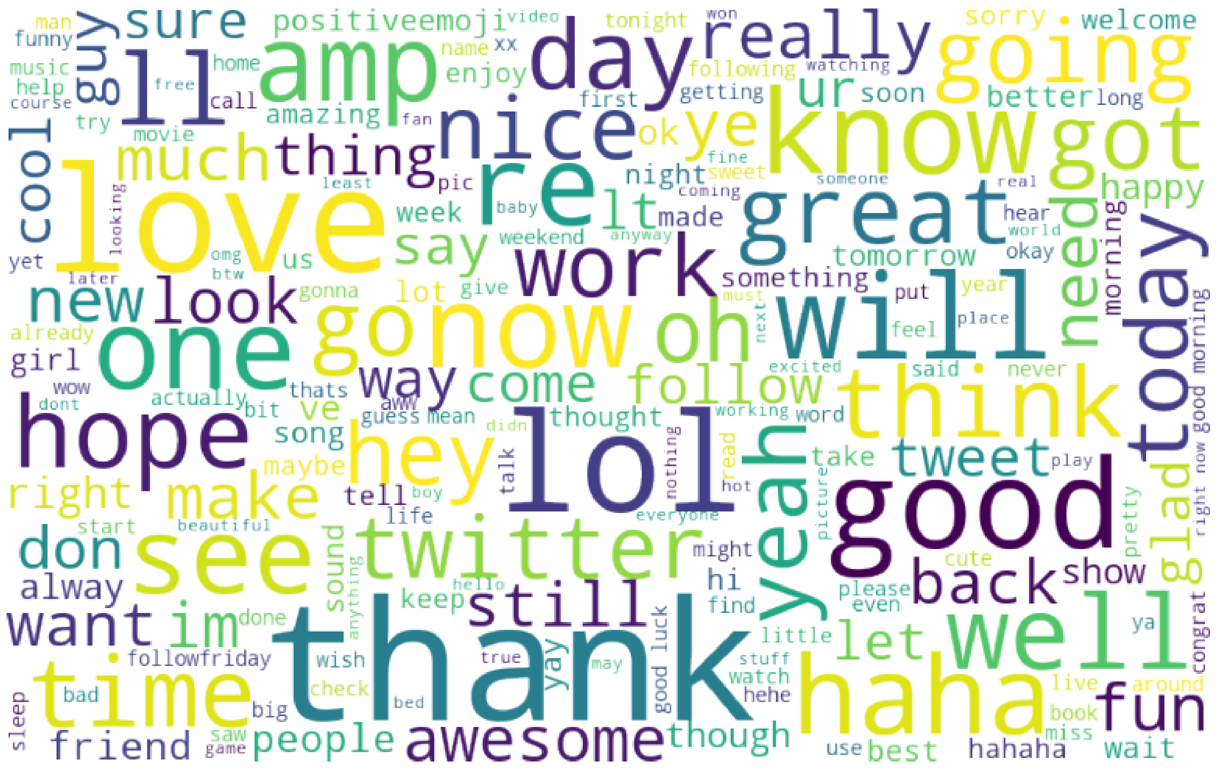
```
In [19]: slices

Out[19]: [56457, 43532]
```

```
In [20]: positive_words =' '.join([text for text in total_data['processed_tweet'][total_data[se
         wordcloud = WordCloud(width=800, height=500, random_state=21,
                       max_font_size=110,background_color="rgba(255, 255, 255, 0)"
                       , mode="RGBA").generate(positive_words)
         plt.figure(dpi=600)
         plt.figure(figsize=(10, 7))
         plt.imshow(wordcloud, interpolation="bilinear")
         plt.axis('off')
plt.title("Most Used Positive Words")
# plt.savefig('assets/positive_words.png')
plt.show()
```

```
<Figure size 3840x2880 with 0 Axes>
```

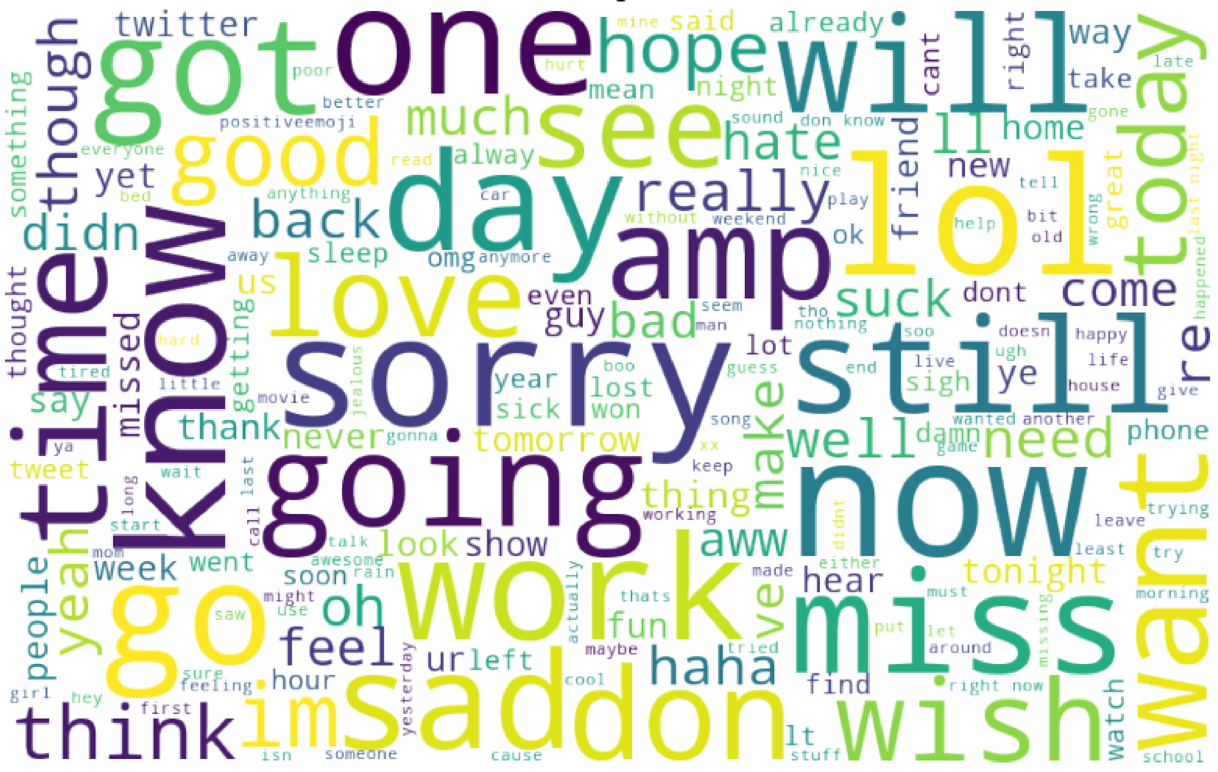
Most Used Positive Words



In [21]:
```
negetive_words =' '.join([text for text in total_data['processed_tweet'][total_data[se
wordcloud = WordCloud(width=800, height=500, random_state=21,
            max_font_size=110,background_color="rgba(255, 255, 255, 0)"
            , mode="RGBA").generate(negetive_words)
plt.figure(dpi=600)
plt.figure(figsize=(10, 7))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis('off')
plt.title("Most Used Negetive Words")
# plt.savefig('assets/negetive_words.png')
plt.show()
```

```
<Figure size 3840x2880 with 0 Axes>
```

Most Used Negetive Words



```
In [22]: #bag of words
```

```
In [23]: from sklearn.feature_extraction.text import CountVectorizer

         count_vectorizer = CountVectorizer(ngram_range=(1,1))    # Unigram
         final_vectorized_data = count_vectorizer.fit_transform(total_data['processed_tweet'])
         final_vectorized_data
```

```
Out[23]: <99989x48958 sparse matrix of type '<class 'numpy.int64'>'
                 with 1079851 stored elements in Compressed Sparse Row format>
```

```
In [24]: from sklearn.model_selection import train_test_split
         X_train, X_test, y_train, y_test = train_test_split(final_vectorized_data, total_data[
                                                             test_size=0.2, random_state=69)
```

```
In [25]: print("X_train_shape : ",X_train.shape)
         print("X_test_shape : ",X_test.shape)
         print("y_train_shape : ",y_train.shape)
         print("y_test_shape : ",y_test.shape)

         X_train_shape :  (79991, 48958)
         X_test_shape :  (19998, 48958)
         y_train_shape :  (79991,)
         y_test_shape :  (19998,)
```

```
In [27]: from sklearn.naive_bayes import MultinomialNB  # Naive Bayes Classifier

         model_naive = MultinomialNB().fit(X_train, y_train)
         predicted_naive = model_naive.predict(X_test)
```

```
In [44]: import joblib
```

```
# Save the model to a file
joblib.dump(model_naive, r"E:\Data Science class\NLP\NLPsentiment_model.pkl")
```

```
Out[44]: ['E:\\Data Science class\\NLP\\NLPsentiment_model.pkl']
```

```
In [43]: loaded_model = joblib.load(r"E:\Data Science class\NLP\NLPsentiment_model.pkl")
```

```
In [34]: import joblib

         # Load the trained model
         # loaded_model = joblib.load(r"C:\Users\ASUS\Downloads\NLP\NLPsentiment_model.pkl")

         # New data
         new_data = ["he killing some1"]   ## this is the input text which we will give to our

         # Preprocess the new data (make sure you have the same preprocessing steps as during t
         new_data_processed = np.vectorize(process_tweet)(new_data)
```

```
In [35]: new_data_processed
```

```
Out[35]: array(['he killing some '], dtype='<U16')
```

```
In [36]: # Vectorize the new data using the same CountVectorizer
         new_data_vectorized = count_vectorizer.transform(new_data_processed)
```

```
In [37]: new_data_vectorized
```

```
Out[37]: <1x48958 sparse matrix of type '<class 'numpy.int64'>'
                 with 3 stored elements in Compressed Sparse Row format>
```

```
In [38]: # Predict sentiment
         predictions = loaded_model.predict(new_data_vectorized)

         print(predictions)
```

```
         [0]
```

```
In [40]: import joblib

         # Save the model to a file
         joblib.dump(count_vectorizer, r"E:\Data Science class\NLP\countvectorizer.pkl")
```

```
Out[40]: ['E:\\Data Science class\\NLP\\countvectorizer.pkl']
```

```
In [ ]:
```