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Import all requred libraries or make sure they are installed in your machine

Tweepy library is a Twitter Warper used to simplify the calls to Twitter API

Make sure you have 'textblob' installed

- pip install textblob for mac and nltk
- python -m textblob.download_corpora

In [35]:

```
import datetime as date
import errno
import json
import locale
import os
import re
import time
import tweepy
import pandas as pd
import numpy as np      # For number computing
from tweepy import OAuthHandler
from collections import OrderedDict
import itertools
from textblob import TextBlob
import vincent
```

Task 1: Identify one or more suitable web APIs

API Chosen:

A single API that was chosen for this assignment which is the Twitter API Data will be collected based on searched tweets using the API. https://developer.twitter.com/en/docs/api-reference-index (https://developer.twitter.com/en/docs/api-reference-index)

The API is requres two keys and two tokens to work:

```
consumer_key = "DUE3dfu56GG5layWupqs9MOMx"
consumer_secret = "uBLozGejSbs0J7zKaBwnd8Gyp9G11TQNP8PCFvHKiCKyD6fxPV"
# -----------------------------------------------------------------
access_token = "234579885-lc0ETaZdS06IS2KXV1wJWsFW8yA94DTTQusrNCT2"
access_token_secret = "hlDpkTV6iIxZDd8sW7JFOWnarFdUqW8cQ9TtUszGqLMnS"
```

The API rate limit window duration is 15 minutes when your calls get blocked.

Task 2: Collect data your chosen API(s)

Collecting Data - Functions needed:

The following 4 functions were written to allow us to search - with key words, save data to a file, and reload the data back for anaylsis calls of the API as only limited data is available per call.

In [36]:

```
"""Access keys and tokens for our Twitter App"""
consumer_key = "DUE3dfu56GG5layWupqs9MOMx"
consumer_secret = "uBLozGejSbs0J7zKaBwnd8Gyp9G11TQNP8PCFvHKiCKyD6fxPV"
access_token = "234579885-lc0ETaZdS06IS2KXV1wJWsFW8yA94DTTQusrNCT2"
access_token_secret = "hlDpkTV6iIxZDd8sW7JFOWnarFdUqW8cQ9TtUszGqLMnS"
""" Authanticate the app in order to access the tweets """
auth = OAuthHandler(consumer_key, consumer_secret)
auth.set_access_token(access_token, access_token_secret)
api = tweepy.API(auth, wait_on_rate_limit=True, wait_on_rate_limit_notify=True
)


def write_tweets(tweets):
    """
    Function that appends tweets to a file.
    The attribute _json (with a leading underscore), which is not the raw JSON
string, but a dictionary.
    """
    try:

        """
        If file exists load its data and add the new tweets to it
        """
        if os.path.exists(file_name):
             with open(file_name, 'r') as f:
                temp = json.load(f)
                """
                remove the old file and create a new one which contains update
d data
                """
                os.remove(file_name)
                """
                create a new file and add the data to it.
                """
                with open(file_name, 'a') as f:
                    for tweet in tweets:
                        temp.append(tweet)
                    json.dump(temp, f, indent=4)
                    f.close()
                    print('Done saving data to the file')
                    return True
        else:
             with open(file_name, 'a') as f:
                json.dump(tweets, f, indent=4)
                f.close()
                print('Done saving data to the file')
                return True

    except BaseException as error:
        print("Error save_data: ", str(error))
        time.sleep(5)


# This will return a formatted data with -n to get older dates
def get_older_date(n=0):
    # YYYY-MM-DD - n => minus n-days
    return f"{date.datetime.now().year:d}-{date.datetime.now().month:d}-{date.
datetime.now().day - n:d}"
# retrun a data in the follwoing format <YYYY-MM-DD>
def format_date(formate_data):
    return f"{formate_data.year:d}-{formate_data.month:d}-{formate_data.day:d}
"

# load tweets using the N of key word(s) with a limit_q_size => # of tweets gi
ven back
"""
 - api.search ... tell the api that you want to search for tweets which allows
us to access up to
one week old tweets.
- q= ... takes in a list of key word(s)
- since and until ... are the dates limit ex: 2018-03-10 to 2018-03-16 etc up
to one week
lang ... is the tweets language you are searching for.
"""
def load_Tweets(key_words, limit_q_size):
    allTweets = [] # Store the tweets
    for tweet in tweepy.Cursor(
            api.search,
            q=key_words,
            since=get_older_date(7),
            until=get_older_date(),
            lang="en").items(limit=limit_q_size):

            """ create a list of tweets """
            allTweets.append(tweet._json)

    """ pass the list of tweets to be saved into a file"""
    print('allTweets size: ', len(allTweets))
    write_tweets(allTweets)
```

Run the main to excuit the code

The following valivales will determin what we want to do the analysis on:

- key word(s) to search for.
- The size of the data set.
- The file name to be save into.

```
# For example
  key_words = ['Donald Trump','FBI']
  limit_q_size = 10
  file_name = 'twitterData.json'
```

Use the data gathered in the file included with the submitted assignment

In [37]:

```
file_name = 'twitterData.json'
```

OR uncommanit this block to downlaod new tweets

In [38]:

```
# if __name__ == '__main__':
#     """
#     if the file exists delete it and load the new tweets ... else create one
and load tweets
#     check for errors as well.
#     """
#     # Query key word(s), limit number, and file name
#     key_words = ['Donald Trump','FBI']
#     limit_q_size = 1000
#     # Try to load tweets if no errors occures
#     try:
#         if os.path.exists(file_name):
#             print('adding data to existing file...')
#             load_Tweets(key_words, limit_q_size)
#         else:
#             print('creating a file...')
#             load_Tweets(key_words, limit_q_size)
#    # if an error ... print it
#     except OSError as e:
#         print('file: ' % e)
#         if e.errno != errno.ENOENT:  # errno.ENOENT = no such file or direct
ory
#             raise  # re-raise exception if a different error occurred
```

Task 3: Load the saved tweets for and prepaer it for data analysis

The out-put is an list of size [limit_q_size] tweets

- Parsing Raw Data: The data is return as JSON object. The object contains a lot of features, not all of them will be used. Selected ones are chosen for the analysis:

Created_at	Text	Retweet_count	Lang	verified	source
Date	Tweet	Number	Language of the tweet	True/False	Device Type

In [39]:

```
def read_tweets():
    print('opening file to read...')
    try:
        if os.path.exists(file_name):
            with open(file_name, 'r') as f:
                return json.load(f)

    except OSError as e:
        print('no file to read : ' % e)
        if e.errno != errno.ENOENT:  # errno.ENOENT = no such file or director
y
            raise  # re-raise exception if a different error occurred
```

```
""" Display the data we collected """
def display_data(stored_tweets):
    # Create a data-fram
    data = pd.DataFrame()

    print('array size: %d ' % (len(stored_tweets)))
    print('++++++++++++++++++++++++++++++++++++')
    """
    use the locale to format the followers value with , separation for easy re
ading
    """
    locale.setlocale(locale.LC_NUMERIC, 'en_US')

    # Create the headings of the dictionary
    dic_keys = ('created_at','tweet_text','text_length','retweet_count','lang'
,'formated_followers','screen_name','verified','source')


    # Create mutiple lists to hold the data extracted from each tweet
    created_at = []
    text = []
    text_length = []
    retweet_count = []
    lang = []
    formated_followers = []
    screen_name = []
    verified = []
    source = []

    """ loop through all tweets and add them to their list """
    for eachTweet in stored_tweets:

        created_at.append(eachTweet['created_at'][0:20])
        text.append(eachTweet['text'])
        text_length.append(len(eachTweet['text']))
        retweet_count_vale = locale.format('%d', eachTweet['retweet_count'], g
rouping=True)
        retweet_count.append(eachTweet['retweet_count'])
        lang.append(eachTweet['lang'])
        formated_followers.append(eachTweet['user']['followers_count'])

        """" User object inside the main Tweet JOSN object"""

        screen_name.append((eachTweet['user']['screen_name']))
        verified.append('✅' if eachTweet['user']['verified'] else 'False')
        """
        Tokenize the source url to get the name of the device

        The url is contructed as follow:
        "<a href=\"http://twitter.com/download/android\" rel=\"nofollow\">Twit
ter for Android</a>"

        We split the url into two tokenizes and we grap the frist one and remo
ve the 'hert' closeing tag from
        the end => </a>
        """
        url = eachTweet['source'].split('rel=\"nofollow">')[1]
        source.append(url[:-4])
        """
         Create a dictionary to hold the data for all tweet
         and format it with titles - keys - to be used
         as columns names for the data frame table
        """
        # group all values in a list for preparation to merge them into the di
ctionary
        dic_values = (created_at,text,text_length,retweet_count,lang,formated_
followers,screen_name,verified,source)
        data_frame_dic = dict(zip(dic_keys, dic_values))

        """
         use the panda Dataframe to save and display data in a table
        """
        df = data.from_dict(data_frame_dic)
    display(df[:10])
    # retrun the dictionary and df for later use
    return (data_frame_dic),(df)
    print('++++++++++++++++++++++++++++++++++')
```

Read and display the data in a Data Frame from the JSON file

In [40]:

```
""" Load the data from the file and pass an array to the display as @para to t
he display_data function."""
data_dic, data_df = display_data(read_tweets())
```

```
opening file to read...
array size: 3245
++++++++++++++++++++++++++++++++++
```

	created_at	formated_followers	lang	retweet_count	screen_name	sourc
0	Sun Mar 25 23:57:52	135	en	878	LocoRub	Twitter Web Client
1	Sun Mar 25 23:57:28	3973	en	878	CommonSenseGuy2	Twitter for Androi
2	Sun Mar 25 23:57:03	8400	en	878	Virgini25568889	Twitter for iPhone
3	Sun Mar 25	1511	en	878	Michael55531686	Twitter for

	23:56:51					Androi
4	Sun Mar 25 23:56:34	105	en	878	RTR2233	Twitter Web Client
5	Sun Mar 25 23:56:09	5538	en	7445	jewbaby57	Twitter for iPhone
6	Sun Mar 25 23:55:16	336	en	878	kevinspencersm2	Twitter for iPhone
7	Sun Mar 25 23:54:40	496	en	878	Laurel_Loflund	Twitter for iPhone
8	Sun Mar 25 23:54:12	2039	en	878	pamtrader	Twitter Web Client
9	Sun Mar 25 23:53:29	5509	en	878	ariendeau	Twitter for iPhone

Missing Data

looking for missing data if exsitsed

In [41]:

```
data_df.isnull().sum() # no missing values in the dataset
```

Out[41]:

```
created_at             0
formated_followers     0
lang                   0
retweet_count          0
screen_name            0
source                 0
text_length            0
tweet_text             0
verified               0
dtype: int64
```

In [42]:

```
# Show Data types in df.
data_df.dtypes.value_counts()
```

Out[42]:

```
object    6
int64     3
dtype: int64
```

There is no null values in the dataset which means we do not have N/A (not available).

The final Pre-processing step is to get mean and max in the data fram.

In [43]:

```
data_mean_in_df = data_df.mean()
print(data_mean_in_df)
```

```
formated_followers    2383.024961
retweet_count         1622.979969
text_length            139.585824
dtype: float64
```

In [44]:

```
data_max_in_df = data_df.max()
print(data_max_in_df)
```

```
created_at                                                     Sun Mar 25 23:5
7:52
formated_followers                                                           1
84116
lang                                                                          
en
retweet_count                                                                 
10341
screen_name                                                           zeldaad
ams55
source                                                                Twitter
rific
text_length                                                                   
144
tweet_text                     “Not in my worst nightmares did I ever dream
m...
verified                                                                      
✅
dtype: object
```

Task 5: Analyse and summarise of the cleaned dataset

Descriptive Statistics Initially of the Data Set containing all data:

In [45]:

```
print("data_df Descriptive Stats:\n")
print(data_df.describe())
```

```
data_df Descriptive Stats:

       formated_followers  retweet_count  text_length
count         3245.000000    3245.000000  3245.000000
mean          2383.024961    1622.979969   139.585824
std           8024.377085    2232.364543     3.379206
min              2.000000       0.000000    87.000000
25%            239.000000     878.000000   140.000000
50%            804.000000     886.000000   140.000000
75%           2419.000000     996.000000   140.000000
max         184116.000000   10341.000000   144.000000
```

In [46]:

```
def get_tweet_sentiment(tweets):
    # empty list to store parsed tweets
    parsed_tweet = []
    '''
    Utility function to classify sentiment of passed tweet
    using textblob's sentiment method
    '''
    for tweet in tweets:
        # create TextBlob object of passed tweet text
        analysis = TextBlob(tweet)
        # set sentiment
        if analysis.sentiment.polarity > 0:
            parsed_tweet.append('positive')
        elif analysis.sentiment.polarity == 0:
            parsed_tweet.append('neutral')
        else:
            parsed_tweet.append('negative')
    return parsed_tweet
```

Sentiment analysis of tweets text

In [47]:

```
# Get all tweets text into a list
all_tweets = data_dic['tweet_text']
# Create a pandas dataframe for tweets:
tweet_text = pd.DataFrame.from_dict(all_tweets)
tweets = pd.DataFrame.from_dict(tweet_text)
# set the columns name
tweets.columns = ['Tweets']
display(tweets[:10]) # Display the df data
```

	Tweets
0	RT @RealJack: Despite MAJOR red flags...\n\nTh...
1	RT @RealJack: Despite MAJOR red flags...\n\nTh...
2	RT @RealJack: Despite MAJOR red flags...\n\nTh...
3	RT @RealJack: Despite MAJOR red flags...\n\nTh...
4	RT @RealJack: Despite MAJOR red flags...\n\nTh...
5	RT @ClintonMSix14: This is the person who turn...
6	RT @RealJack: Despite MAJOR red flags...\n\nTh...
7	RT @RealJack: Despite MAJOR red flags...\n\nTh...
8	RT @RealJack: Despite MAJOR red flags...\n\nTh...
9	RT @RealJack: Despite MAJOR red flags...\n\nTh...

Analysis the tweets text using TextBlob for Positive, Negative or Neutral tweets text contents

In [48]:

```
# saving sentiment of tweet
tweets = get_tweet_sentiment(all_tweets)
print('Total number of tweets: ', len(tweets))
# picking positive tweets from tweets
ptweets = [tweet for tweet in tweets if tweet == 'positive']

# percentage of positive tweets
pos_percetage = (100*len(ptweets)/len(tweets))
print("Positive tweets percentage: {} %".format(pos_percetage))

# picking negative tweets from tweets
ntweets = [tweet for tweet in tweets if tweet == 'negative']
# percentage of negative tweets
neg_percetage = (100*len(ntweets)/len(tweets))
print("Negative tweets percentage: {} %".format(neg_percetage))
# percentage of neutral tweets
neut_percetage = 100*(len(tweets) - neg_percetage - pos_percetage)/len(tweets)
print("Neutral tweets percentage: {} %".format(neut_percetage))
```

```
Total number of tweets:  3245
Positive tweets percentage: 3.9445300462249615 %
Negative tweets percentage: 80.2773497688752 %
Neutral tweets percentage: 97.40456456656086 %
```

In [49]:

```
# create a df to display the resutl of the total tweet's sentiment
tweets_status = pd.DataFrame({"Positive%":[pos_percetage],
                          "Negative%":[neg_percetage],
                          "Neutral%":[neut_percetage]})
display(tweets_status)
```

	Negative%	Neutral%	Positive%
0	80.27735	97.404565	3.94453

So we now have a well organized/represented data in table

Graphs Plotting

In [50]:

```
import matplotlib
import matplotlib.pyplot as plt
%matplotlib inline
```

Show a represention of the tweets content in terms of positive, negative or neutral.

- The result is calcualted using textblob library which uses text mining and analysis

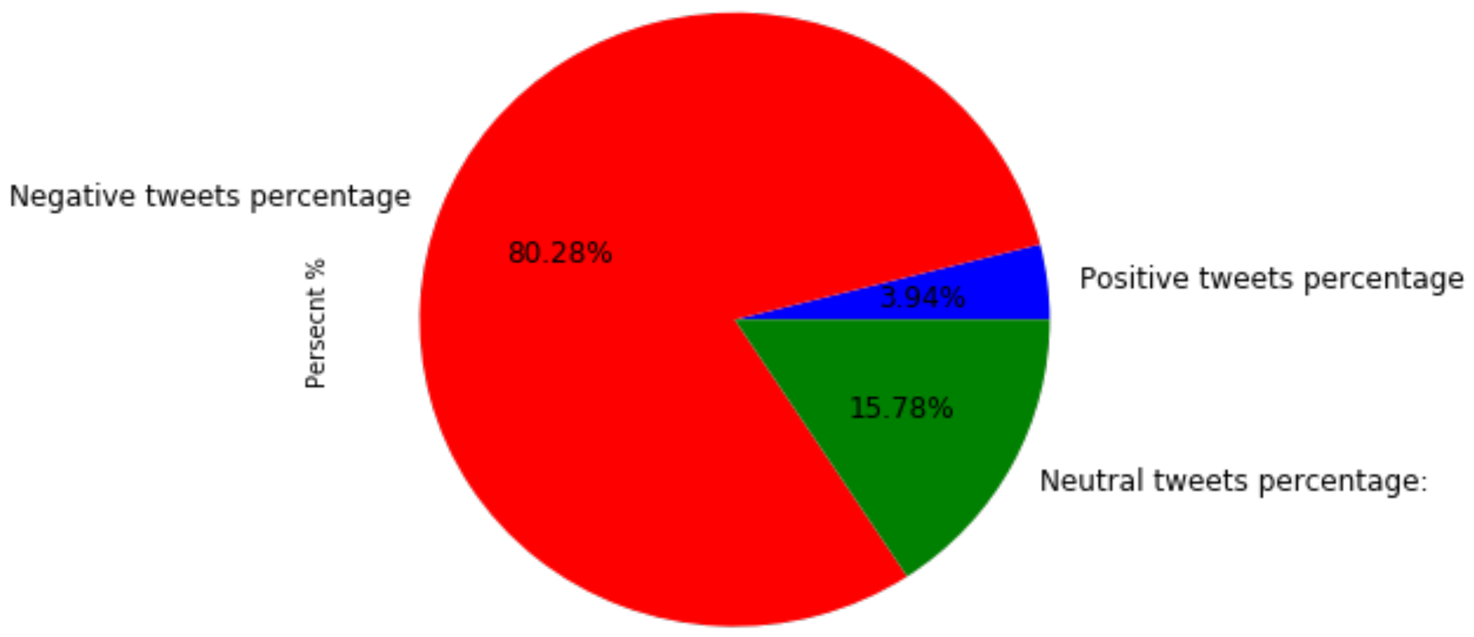
In [51]:

```
# Create a list of tweets fellings tags:
total_number_of_tweets_status = [len(ptweets),len(ntweets),(len(tweets) - len(
ntweets) - len(ptweets))]

lables = ['Positive tweets percentage','Negative tweets percentage','Neutral t
weets percentage:']
my_colors = 'brg'  #red, green, blue
"""
# The plot.pie does not allow negative values:
# we check if the neut_percetage is negative which usual is when the data samp
le is small.
# if so we use the abs() fucntion to convert the value to a positive and plot
the pie chart
"""

if neut_percetage < 0:
    total_number_of_tweets_status[2] = abs(neut_percetage)
    print(total_number_of_tweets_status[0])
    series = pd.Series([pos_percetage,neg_percetage,neut_percetage],
                   index=lables,
                   name='Persecnt %')
else:
    series = pd.Series(total_number_of_tweets_status,
                   index=lables,
                   name='Persecnt %')
#  Display Pie chart of the results:
series.plot.pie(fontsize=12, autopct='%.2f%%', figsize=(6, 6),colors=my_colors
)
```

```
Out[51]:
<matplotlib.axes._subplots.AxesSubplot at 0x1a1f7527f0>
```



The Pie Chart represent the data in its own way which differ than the above df table we have in the

```
display(tweets_status)
```

Show a pie chart represention of the devices the tweet's was sent from. In our case IPhone vs. Android

The result is obtained from the

```
data_dic['source'] # dictionary
```

In [52]:

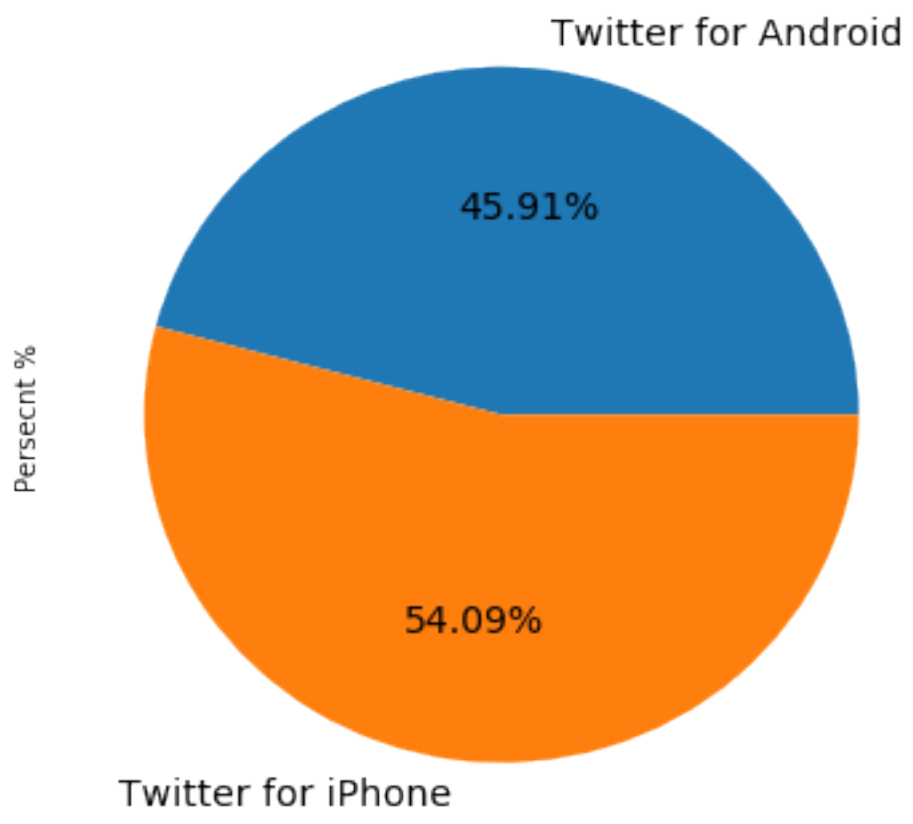
```
# create two lists to hold the data for each device
source_android = []
source_iphone = []

lables = ['Twitter for Android','Twitter for iPhone']
# loop over the source and only take IPhone or Android
for source in data_dic['source']:
    if source == 'Twitter for Android':
        source_android.append(source)
    elif source == 'Twitter for iPhone':
        source_iphone.append(source)

series = pd.Series([len(source_android),len(source_iphone)],
                   index=lables,
                   name='Persecnt %')
#  Display Pie chart:
series.plot.pie(fontsize=14, autopct='%.2f%%', figsize=(6, 6))
```

Out[52]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1f49fe10>
```

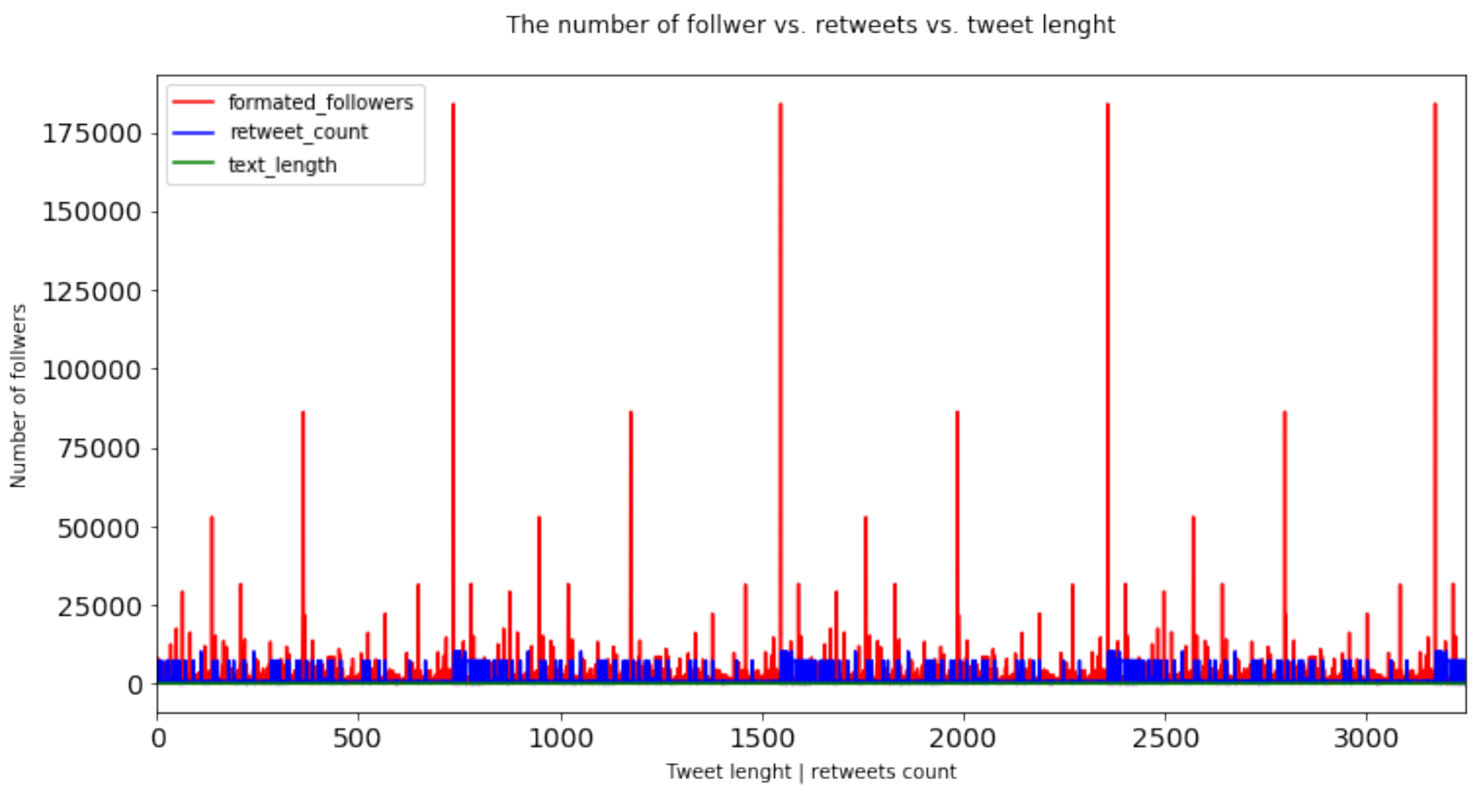


Show the number of follwer VS. retweets VS. tweet lenght in a plot.

In [53]:

```
plt.figure()
my_colors = 'rbg'  #red, green ,color=my_colors
data_df.plot(fontsize=14,figsize=(12, 6),color=my_colors)
plt.title("The number of follwer vs. retweets vs. tweet lenght\n")
plt.ylabel("Number of follwers")
plt.xlabel("Tweet lenght | retweets count")
plt.show()
```

```
<matplotlib.figure.Figure at 0x1a1f8e0550>
```



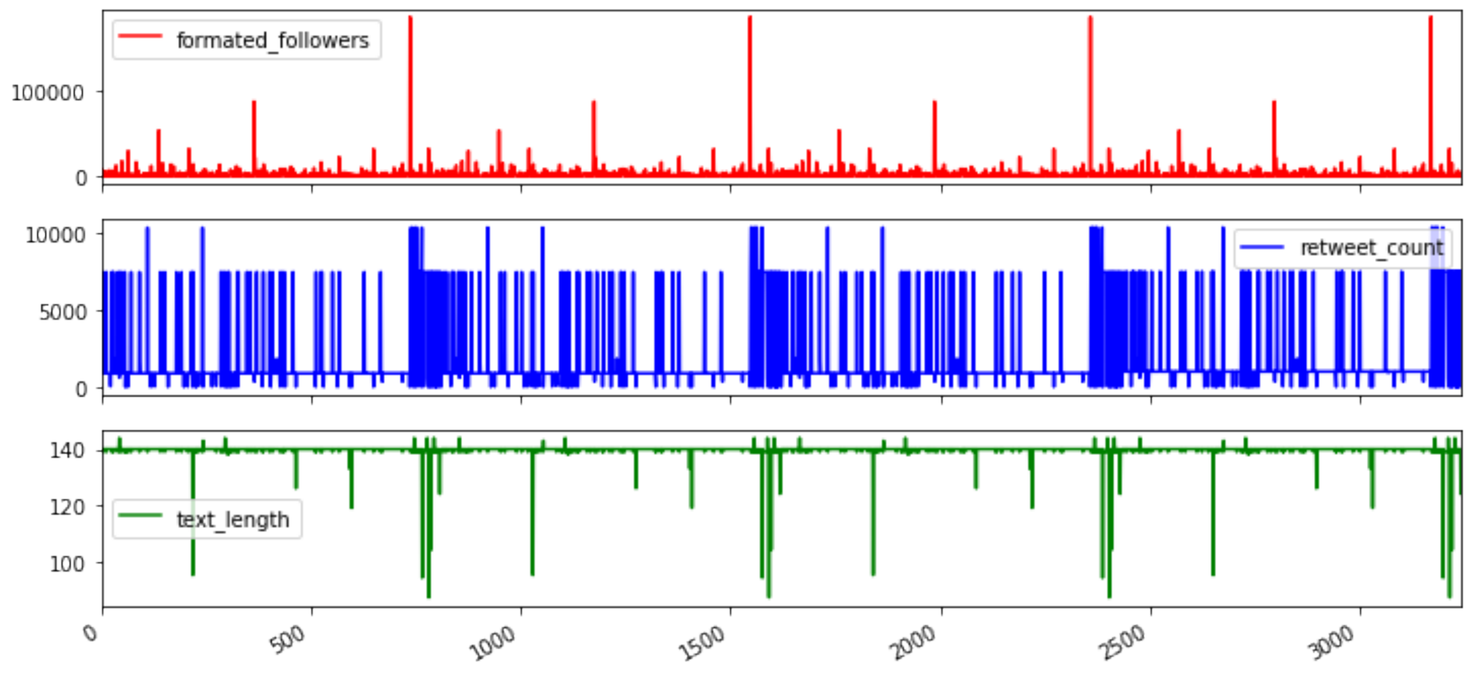
Show each value in its own subplots

In [54]:

```
my_colors = 'rbg'  #red, green ,color=my_colors
data_df.plot(subplots=True, figsize=(12, 6),color=my_colors)
```

Out[54]:

```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x1a1ec7e1
60>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x1a1ddf66
30>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x1a1dc2b4
70>], dtype=object)
```

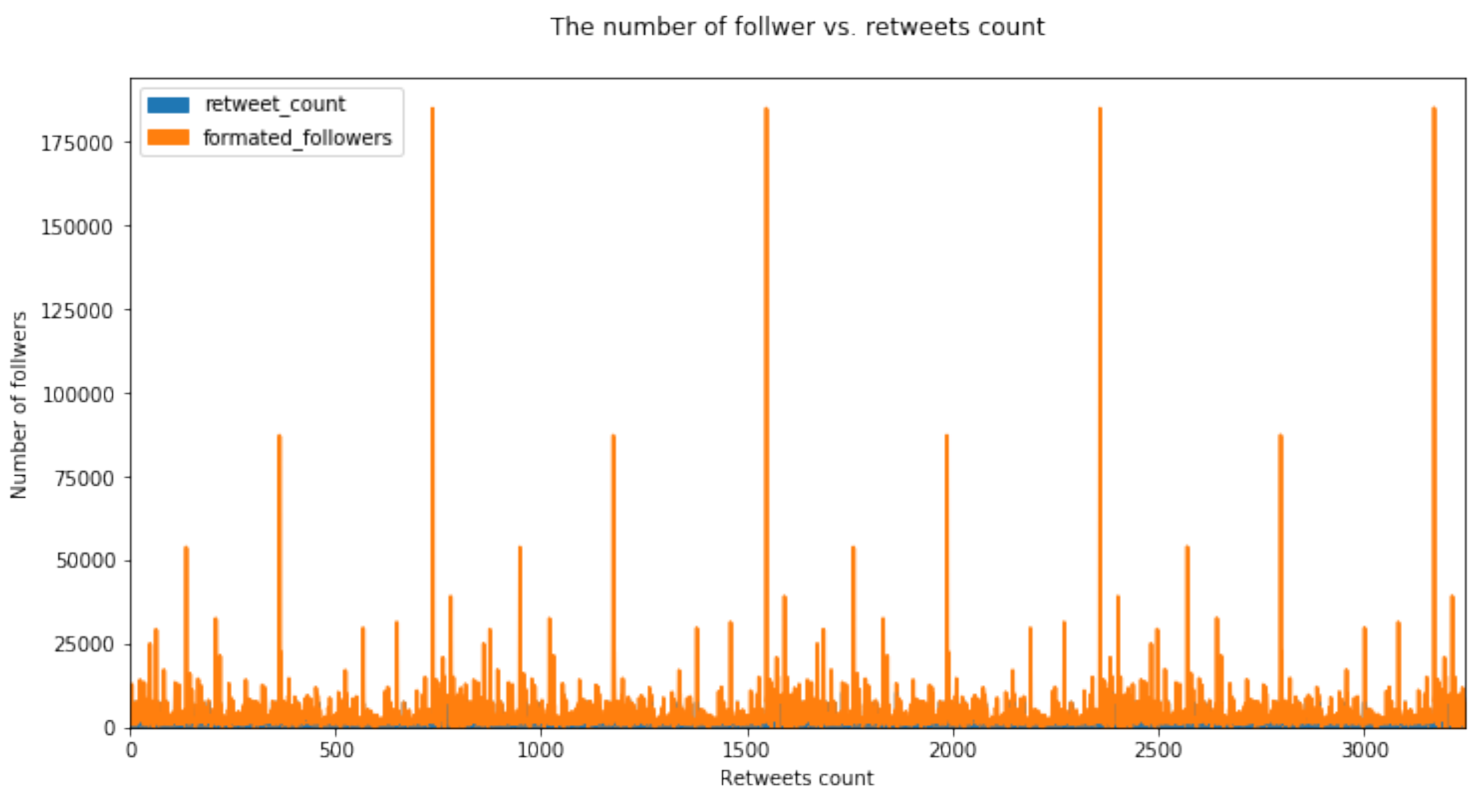


Compare the retweet count VS. Number of followers

In [55]:

```
simplified_data = data_df[["retweet_count", "formated_followers"]] # extract r
etweet_count and formated_followers data for analysis and visualisation
plt.figure()
simplified_data.plot.area(figsize=(12,6));
plt.title("The number of follwer vs. retweets count\n")
plt.ylabel("Number of follwers")
plt.xlabel("Retweets count")
plt.show()
```

```
<matplotlib.figure.Figure at 0x1a1e3b1e80>
```

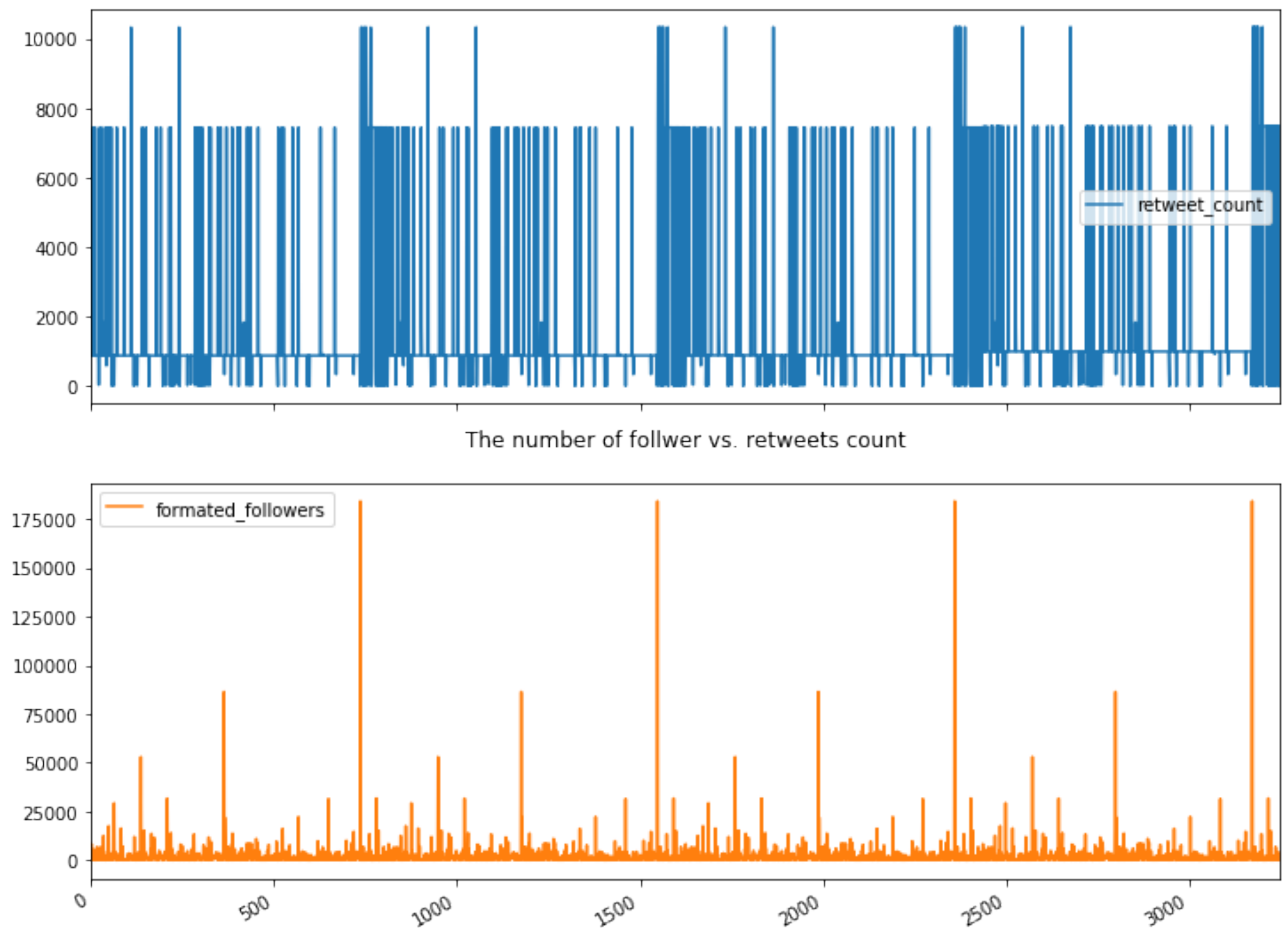


Show the number of retweet's VS. number of followers

In [56]:

```
simplified_data = data_df[["retweet_count", "formated_followers"]] # extract r
etweet_count and formated_followers data for analysis and visualisation
plt.figure()
simplified_data.plot(subplots=True, figsize=(12, 10))
plt.title("The number of follwer vs. retweets count\n")
# plt.ylabel("Number of follwers")
# plt.xlabel("Retweets count")
plt.show()
```

```
<matplotlib.figure.Figure at 0x1a1f902588>
```

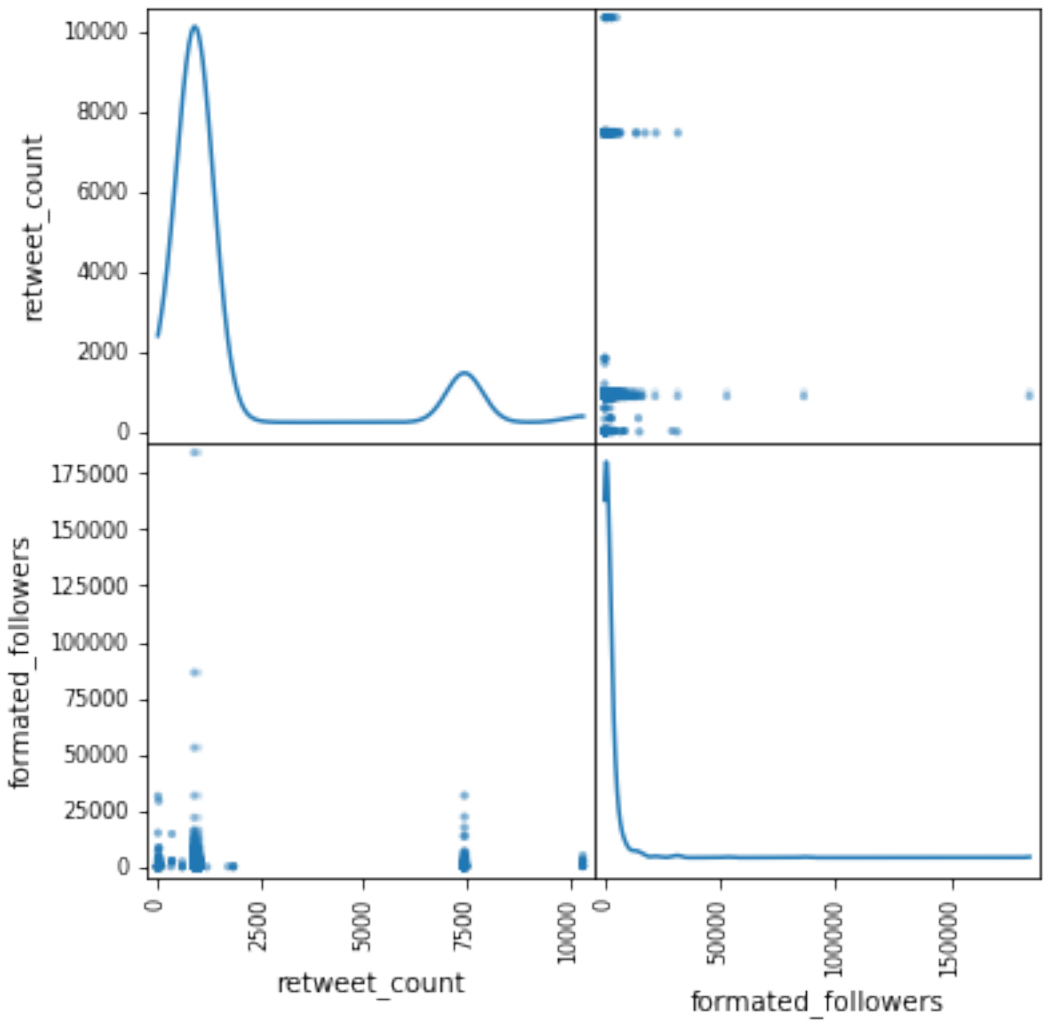


In [57]:

```
from pandas.plotting import scatter_matrix as scatter
scatter(simplified_data, alpha=0.2, figsize=(6, 6), diagonal='kde')
```

Out[57]:

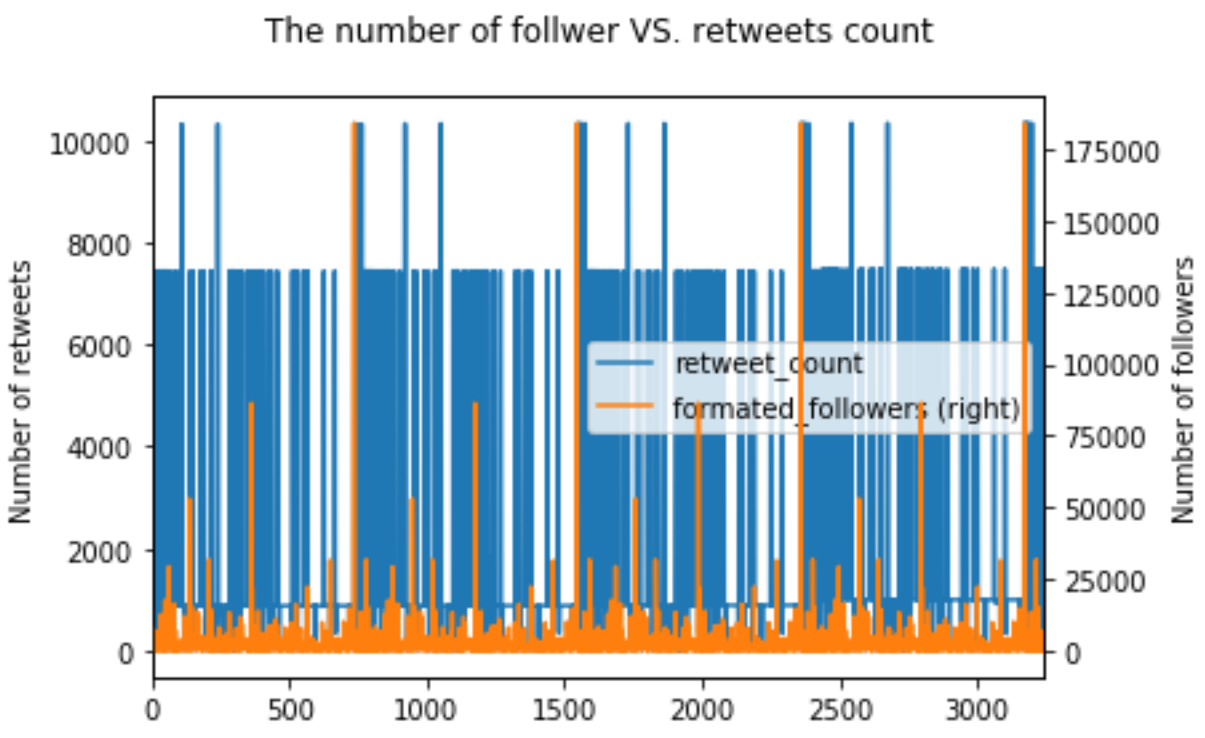
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x1a1dfd5
b00>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x1a1e8e3
588>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x1a1df65
400>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x1a1df83
4e0>]], dtype=object)
```



In [58]:

```
ax = simplified_data.plot(secondary_y=['formated_followers'])
ax.set_ylabel("Number of retweets")
ax.right_ax.set_ylabel("Number of followers")

plt.title("The number of follwer VS. retweets count\n")
plt.show()
```



In [59]:

```
import collections
import nltk
from nltk.tokenize import RegexpTokenizer
from nltk.corpus import stopwords
```

Download the stopwords package from the nltk_data if not donwloaded:

In [60]:

```
nltk.download('stopwords')
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     /Users/mohsenqaysi/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

Out[60]:

```
True
```

In [61]:

```
tokenizer = RegexpTokenizer(r'\w+')
tokens = tokenizer.tokenize(''.join(all_tweets))

stopWords = set(stopwords.words('english'))
wordsFiltered = []
for w in tokens:
    # Remove the RT and https tag which occureces in most tweets
    if w =='RT'or w == 'https' or w== 'the' or  w == 'The':
        pass
    elif w not in stopWords:
        wordsFiltered.append(w)

wordcount = collections.Counter(wordsFiltered)
# Find top 10 terms
df = pd.DataFrame(wordcount.most_common(10),
                  columns=['Word', 'Frequency']).set_index('Word')
df
```

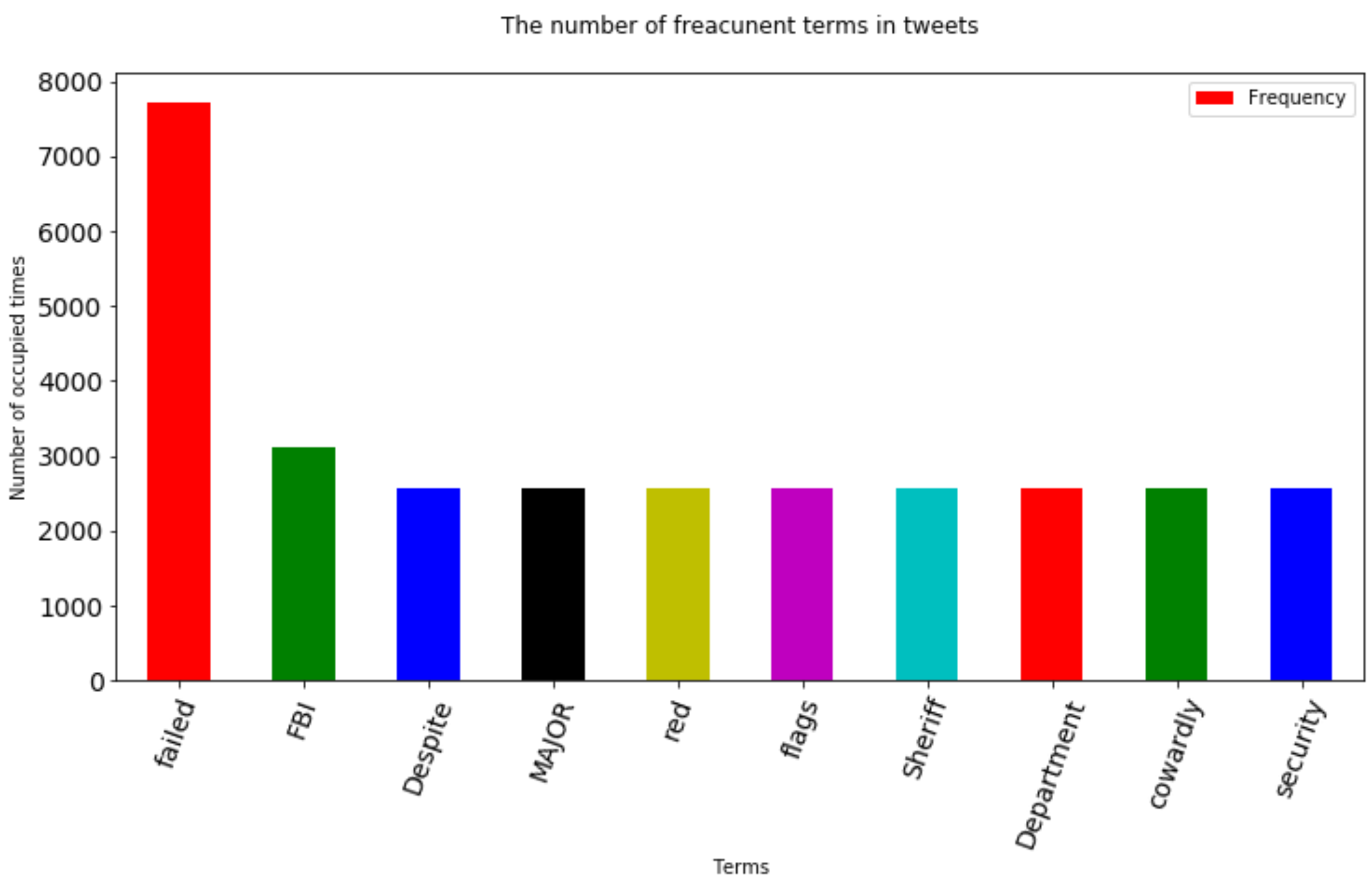
Out[61]:

	Frequency
Word	
failed	7727
FBI	3105
Despite	2577
MAJOR	2577
red	2577
flags	2577
Sheriff	2577
Department	2577
cowardly	2573
security	2573

In [62]:

```
plt.figure()
my_colors = 'rgbkymc'  #red, green, blue, black, etc.
df.plot.bar(fontsize=14,rot=70 ,figsize=(12,6),color=my_colors)
plt.title("The number of freacunent terms in tweets\n")
plt.ylabel("Number of occupied times")
plt.xlabel("Terms")
plt.show()
```

```
<matplotlib.figure.Figure at 0x1a1e839860>
```



Tentative Conclusion

Further in-depth studies and tests could be carried out to make statistically significant results. However, there doesn't seem to be much of a relationship between:

- The number of followers you have and the retweets you will get.
- The tweet contex (Positive, Negative or Neutral tweet) and the retweets it gets by followers.
- The number of IPhone users are greater most of the time. I am assuming most of the tweets are from the USA becuase I user the following key words ['Donald Trump','FBI']. Further analysis could be caried to verify that using the tweet place or Geo, but most users are disabled this feature.

Despiset the fact that not everyone agree or like the way Donald Trump go about doing things, many people on social media also dislike him and the text mining and analysis proved that with over 80% of our data sample shows negative tweets.

Finally:

- We can see that many users uses phone devices to tweets, we can carry further analysis to find out the age range and gender to understand how they think and from where ther tweets(location: cofe shop, gym, etc)
- Further analysis can be done to pair the most freacunet terms/words in pair to see how the users feel about a certint topic or issue.
- Extract the most common terms from positive or negative and further understand the users emotions.