

In [26]:

```
import tweepy
import pandas as pd
import csv
import networkx as nx
import matplotlib.pyplot as plt
import community
```

In [2]:

```
consumer_key = 'REDACTED'
consumer_secret = 'REDACTED'
access_token = 'REDACTED'
access_token_secret = 'REDACTED'
```

In [3]:

```
auth = tweepy.OAuthHandler(consumer_key, consumer_secret)
auth.set_access_token(access_token, access_token_secret)
api = tweepy.API(auth, wait_on_rate_limit=True)
```

In [4]:

```
user=api.get_user(screen_name='nammi_suraj')
print("My account is :" ,user.screen_name)
source_user=user.id
print('my account id is :', source_user )
```

My account is : nammi_suraj
 my account id is : 850946013263273987

In [5]:

```
friends=api.get_follower_ids(screen_name='nammi_suraj')
#fof=api.get_follower_ids(friends)
print('followers of main user ', source_user,':', friends)
```

followers of main user 850946013263273987 : [768168025937752064, 1620606686670065664, 1423771899222536193, 1502090100498661376, 1320633302525513728, 624845023, 1272032230827716609, 2889473923, 1186503108735709184, 769066987918155777, 1203972326083006464, 398056342, 1148614255396024320]

In [6]:

```
print(friends)
df=pd.DataFrame(columns=[ 'source','target'])
df['target']=friends
df['source']=source_user
#print(df)
```

[768168025937752064, 1620606686670065664, 1423771899222536193, 1502090100498661376, 132063302525513728, 624845023, 1272032230827716609, 2889473923, 1186503108735709184, 769066987918155777, 1203972326083006464, 398056342, 1148614255396024320]

	source	target
0	850946013263273987	768168025937752064
1	850946013263273987	1620606686670065664
2	850946013263273987	1423771899222536193
3	850946013263273987	1502090100498661376
4	850946013263273987	1320633302525513728
5	850946013263273987	624845023
6	850946013263273987	1272032230827716609
7	850946013263273987	2889473923
8	850946013263273987	1186503108735709184
9	850946013263273987	769066987918155777

```
10 850946013263273987 1203972326083006464
11 850946013263273987           398056342
12 850946013263273987 1148614255396024320
```

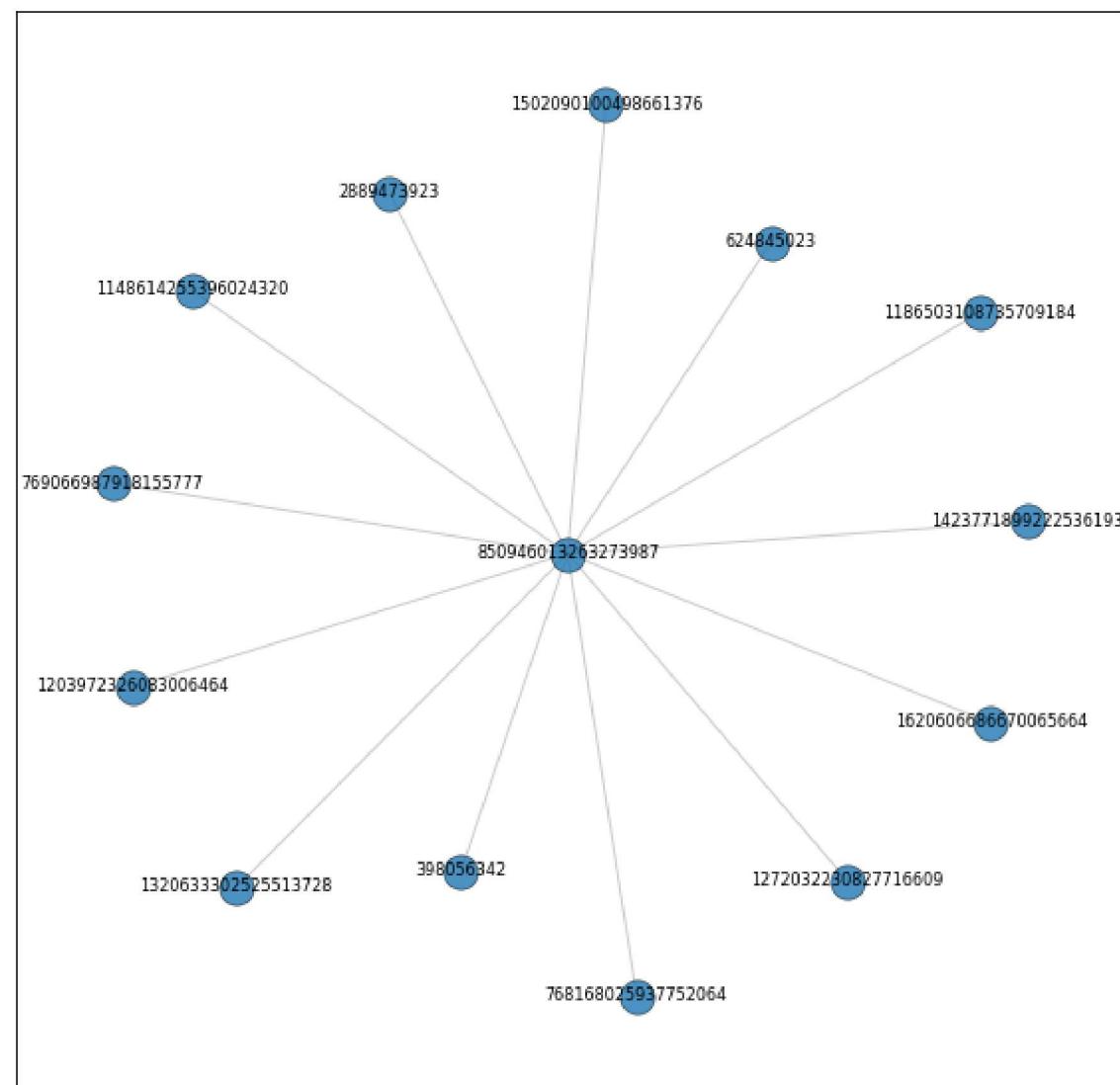
In [7]:

```
#Plotting Network Graph of Source_User and Followers
Graph_source = nx.from_pandas_edgelist(df, 'source', 'target') #converting the df into
pos = nx.spring_layout(Graph_source) #specifying the Layout for visual
```

In [8]:

```
f, ax = plt.subplots(figsize=(10, 10)) #
plt.style.use('ggplot')
nodes = nx.draw_networkx_nodes(Graph_source, pos,
                               alpha=0.8)
nodes.set_edgecolor('k')
nx.draw_networkx_labels(Graph_source, pos, font_size=8)
nx.draw_networkx_edges(Graph_source, pos, width=1.0, alpha=0.2)
```

Out[8]:



In [9]:

```
Graph_source.number_of_nodes() #Number Nodes is Number of followers for the source_user
```

Out[9]: 14

In [10]:

```
#Creating Degree Distribution Table
Graph_source_sorted = pd.DataFrame(sorted(Graph_source.degree, key=lambda x: x[1], reverse=True))
Graph_source_sorted.columns = ['nodes', 'degree']
Graph_source_sorted.head()
```

Out[10]:

	nodes	degree
0	850946013263273987	13
1	768168025937752064	1
2	1620606686670065664	1
3	1423771899222536193	1
4	1502090100498661376	1

In [11]:

```
#creating Dataframe2 to add sources=followers and target=followers of followers
df2=pd.DataFrame(columns=['source','target'])
for i in friends:
    print("the mainuser is",i)
    network_followers=api.get_follower_ids(user_id=i)

    for t in network_followers:
        df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
print("the follower_ids of user ",i," are ",network_followers)
```

the mainuser is 768168025937752064

/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.

df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)

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df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
the follower_ids of user 768168025937752064 are [1169222157517221889, 100727457088411
6481, 979347954308960256, 844170050168934400, 919949058906583040, 869432693016199168, 41
6987018, 2953767150, 376878448]
the mainuser is 1620606686670065664
the follower_ids of user 1620606686670065664 are []
the mainuser is 1423771899222536193
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
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```

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the follower_ids of user 1423771899222536193 are [1578151494330695680, 15740700906597  
78565, 1443997566719365129, 1583694288638156801, 838050284970467328, 156347034259250790  
4, 1331893482483372032, 466536209]  
the mainuser is 1502090100498661376  
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df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)  
the follower_ids of user 1502090100498661376 are [850946013263273987, 148087356028547  
8915]  
the mainuser is 1320633302525513728  
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the follower_ids of user 1320633302525513728 are [850946013263273987]  
the mainuser is 624845023  
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the follower_ids of user 624845023 are [850946013263273987, 1319151683507679232, 1382941744946241538, 1216033508738523136, 1289092098965168129, 919226783739781120, 1276202322230603776, 3186218533]  
the mainuser is 1272032230827716609  
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the follower_ids of user 1272032230827716609 are [850946013263273987, 1268134854211715072, 66136191]  
the mainuser is 2889473923  
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the follower_ids of user 2889473923 are [1323486335194161152, 1255827719201275905, 1245727948876820481, 850946013263273987, 1154049997165363201, 1186192809885229056, 1200431379160457217, 957911272221065216, 876777770612699136, 387728244]
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the follower_ids of user 1186503108735709184 are [3494701213, 982925953251926017, 1275248688684621824, 1256866115013111808, 794576240858435586, 1243218821726359553, 1248011043529297920, 1160118122709278720, 965240223926898690, 494883978, 1213044515516215297, 1215725559134613504, 1205178901846093824, 1225443658859610117, 1179675201891553280, 1211556164325896192, 1168049026228346881, 1382079128, 1001471560773844992, 884764219706556416, 3657335720, 1018128774926397442, 2214058680, 721350140968046592, 1195928871800991745, 1168412846603923457, 1181597809385934850, 1114904594163757056, 4729497019, 830970335293894656, 992591164984430592, 1162991892851642368, 327317601, 1130461794361696256, 1102984520213528577, 1166543550898561025, 1079408362847170566, 955851805719588864]
the mainuser is 769066987918155777
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df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
the follower_ids of user 769066987918155777 are [926448312726593536, 1562778148206710
785, 1525787719406092288, 1376045243691192323, 1371014394935533568, 1328556454530273282,
1330695543446618114, 1297114700929368064, 1275421878883057668, 1268559073135357952, 1249
022896590041088, 1055469666334760961, 1200302067304169472, 1163466764774068227, 24779686
36, 1129484920017965056, 3022457132, 1076807229901131776, 1036144302261301249, 103552665
8843787264, 1007503828248231936, 846095339698446337, 922429435189526529, 2917613286, 991
398532920754176, 955697694294491137, 954923677342035968, 710620920, 925941117358456832,
923435185697300480, 565132407, 922430942345617409, 918381492702658561, 79278319942854656
0, 734923269074235393, 862527817728307200, 856186008211263488, 4330460775, 8235416575681
53601, 856750879, 151432966, 782613147089678338, 770876016080347137, 3142266270, 2729919
072, 765557239117672449, 4515744498, 759259875700535296]
the mainuser is 1203972326083006464
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
```

```
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
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/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
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/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
the follower_ids of user 1203972326083006464 are [850946013263273987, 123907925844353
4336, 1164926300370292736, 985519608873467905]
the mainuser is 398056342
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
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/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
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/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
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```

```
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
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/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
```

```
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
the follower_ids of user 398056342 are [850946013263273987, 1524977930698629121, 1510077965366833152, 1264004648823713792, 1158600633739427840, 1156164262512877568, 1082686793596583936, 1158622032327630849, 1158657845853708290, 1158731456446779398, 1158341288476856321, 1158412170985476097, 1129105351746306049, 1158663997152907264, 1158584045954990081, 1158625275355119616, 1158590673039216640, 1158609595998146567, 1035764432960409600, 1158588906222174213, 987213980182573056, 497769198, 35927341]
the mainuser is 1148614255396024320
the follower_ids of user 1148614255396024320 are [1366385933109526535, 1268042531008245767, 826235053797543936, 1054213057851744256]
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)
/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/446642965.py:8: FutureWarning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.
df2 = df2.append(pd.DataFrame([[t,i]], columns=["target","source"]), ignore_index=True)

```

In [12]:

```
#storing all the Data Extracted using Tweepy into dataframe2
print(df2)
```

	source	target
0	768168025937752064	1169222157517221889
1	768168025937752064	1007274570884116481
2	768168025937752064	979347954308960256
3	768168025937752064	844170050168934400
4	768168025937752064	919949058906583040
..
153	398056342	35927341
154	1148614255396024320	1366385933109526535
155	1148614255396024320	1268042531008245767
156	1148614255396024320	826235053797543936

```
157 1148614255396024320 1054213057851744256
```

[158 rows x 2 columns]

In [13]:

```
#Creating the DataFrame for Network Graph
df3 = df.append(df2, ignore_index=True)
```

/var/folders/r0/mdhjkk_x1qb3m1dwq254h72h0000gn/T/ipykernel_41560/3624097462.py:2: Future Warning: The frame.append method is deprecated and will be removed from pandas in a future version. Use pandas.concat instead.

```
df3 = df.append(df2, ignore_index=True)
```

In [14]:

```
print(df3)
```

	source	target
0	850946013263273987	768168025937752064
1	850946013263273987	1620606686670065664
2	850946013263273987	1423771899222536193
3	850946013263273987	1502090100498661376
4	850946013263273987	1320633302525513728
..
166	398056342	35927341
167	1148614255396024320	1366385933109526535
168	1148614255396024320	1268042531008245767
169	1148614255396024320	826235053797543936
170	1148614255396024320	1054213057851744256

[171 rows x 2 columns]

In [15]:

```
#Creating Network Graph using MAP Tool NetworkX and MatPlot
Graph = nx.from_pandas_edgelist(df3, 'source', 'target') #Turn df into graph
pos = nx.spring_layout(Graph) #specify layout for visual
print(Graph)
```

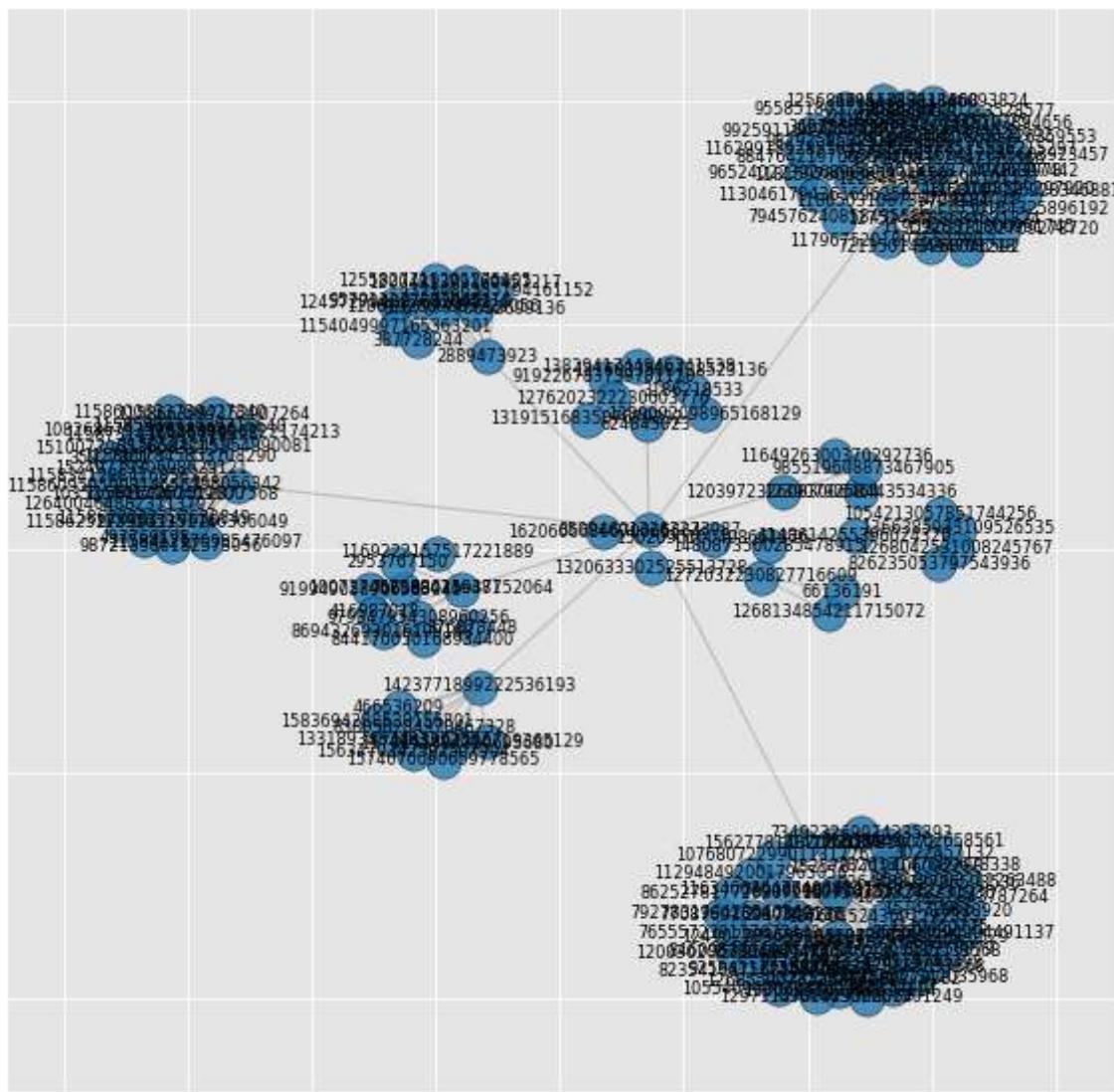
Graph with 165 nodes and 164 edges

In [16]:

```
f, ax = plt.subplots(figsize=(10, 10))
plt.style.use('ggplot')
nodes = nx.draw_networkx_nodes(Graph, pos,
                               alpha=0.8)
nodes.set_edgecolor('k')
nx.draw_networkx_labels(Graph, pos, font_size=8)
nx.draw_networkx_edges(Graph, pos, width=1.0, alpha=0.2)
```

Out[16]:

```
<matplotlib.collections.LineCollection at 0x7f8d90f87ac0>
```



In [18]:

```
#Creating Degree Distribution Table
Graph_sorted = pd.DataFrame(sorted(Graph.degree, key=lambda x: x[1], reverse=True))
Graph_sorted.columns = ['node','degree']
Graph_sorted.head()
Degree_Dist=Graph_sorted.groupby('degree').count()
print(Degree_Dist)
```

degree	node
1	153
2	1
3	1
4	1
5	1
8	1
9	1
10	2
13	1
23	1
39	1
49	1

In [19]:

```
#Creating DataFrame for Network Data
#Saving the data into csv file
print(df3)
df3.to_csv('Network_Suraj.csv', encoding='utf-8')
```

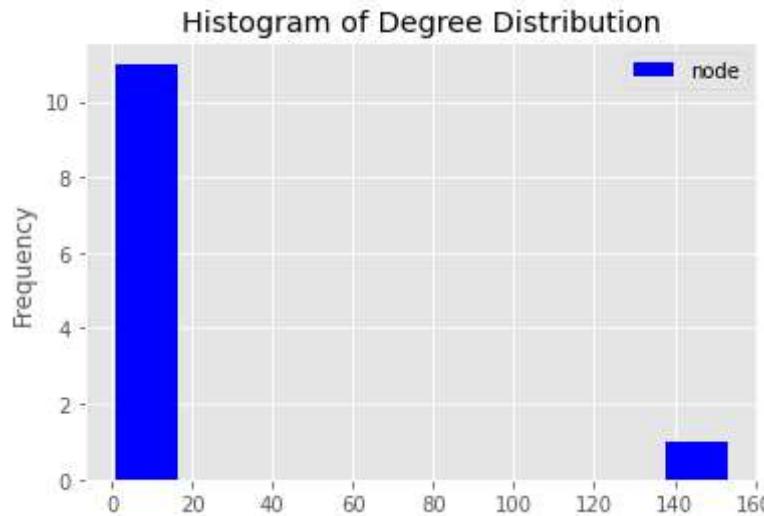
	source	target
0	850946013263273987	768168025937752064
1	850946013263273987	1620606686670065664
2	850946013263273987	1423771899222536193
3	850946013263273987	1502090100498661376
4	850946013263273987	1320633302525513728
..
166	398056342	35927341
167	1148614255396024320	1366385933109526535
168	1148614255396024320	1268042531008245767
169	1148614255396024320	826235053797543936
170	1148614255396024320	1054213057851744256

[171 rows x 2 columns]

In [20]:

```
Degree_Dist.plot.hist(y='node', title='Histogram of Degree Distribution', color='blue')
```

Out[20]:



In [21]:

```
#Calculating betweenness and closeness centrality
Closeness = nx.from_pandas_edgelist(df3, 'source', 'target') #Turn df into graph
pos = nx.spring_layout(Closeness)
between = nx.betweenness_centrality(Closeness)
CC = nx.closeness_centrality(Closeness)

#Creating a dataframe for centrality
df4 = pd.DataFrame.from_dict([between, CC])
df4 = pd.DataFrame.transpose(df4)
df4.columns = ['Betweenness_Centrality', 'Closeness_Centrality']

print(df4)
```

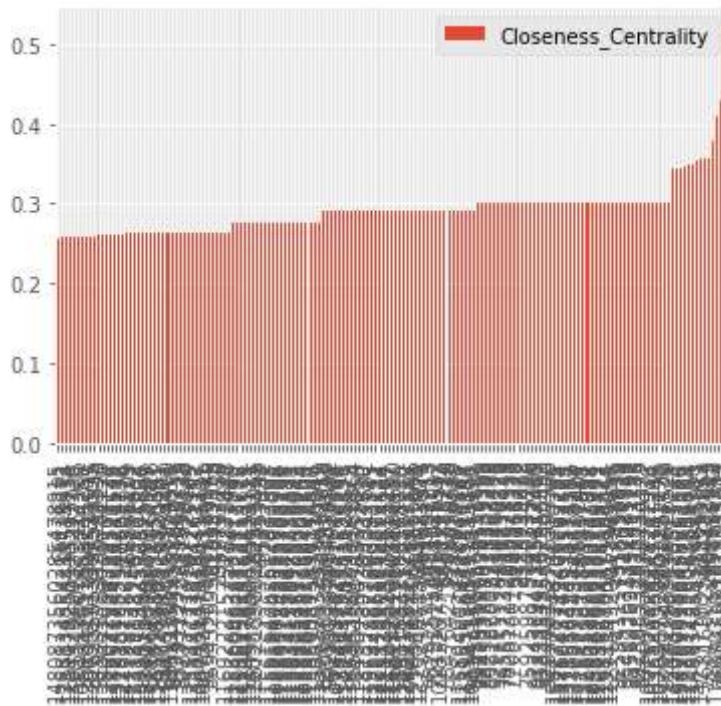
	Betweenness_Centrality	Closeness_Centrality
850946013263273987	0.824630	0.520635
768168025937752064	0.107063	0.356522

1620606686670065664	0.000000	0.343096
1423771899222536193	0.095466	0.354978
1502090100498661376	0.012195	0.344538
...
35927341	0.000000	0.274707
1366385933109526535	0.000000	0.259084
1268042531008245767	0.000000	0.259084
826235053797543936	0.000000	0.259084
1054213057851744256	0.000000	0.259084

[165 rows x 2 columns]

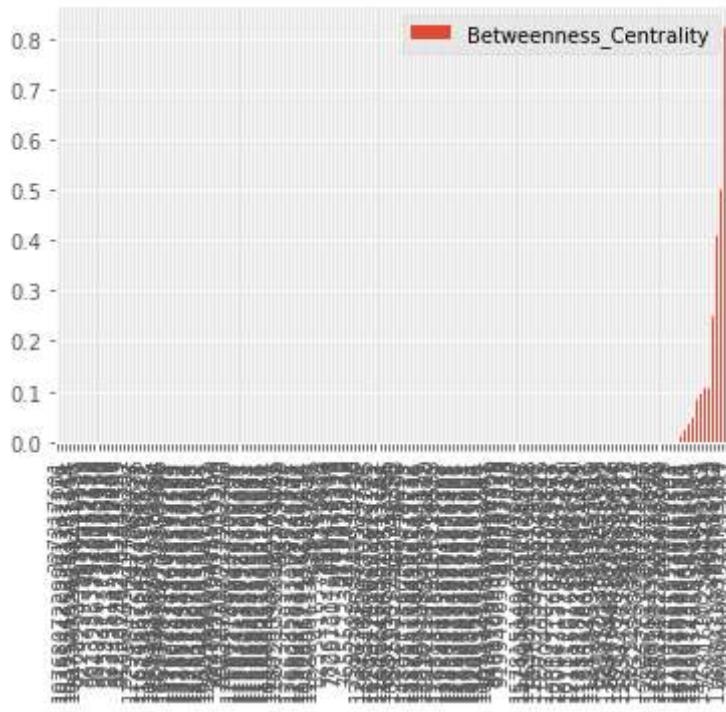
In [22]:

```
#Fetching nodes based in closeness and plotting bar graph
df5 = df4.sort_values('Closeness_Centrality')
df5.plot( y='Closeness_Centrality', kind='bar')
plt.show()
```



In [23]:

```
#Fetching nodes based in betweenness and plotting bar graph
df6 = df4.sort_values('Betweenness_Centrality')
c = '#7eb54e'
df6.plot( y='Betweenness_Centrality', kind='bar')
plt.show()
```



In [30]:

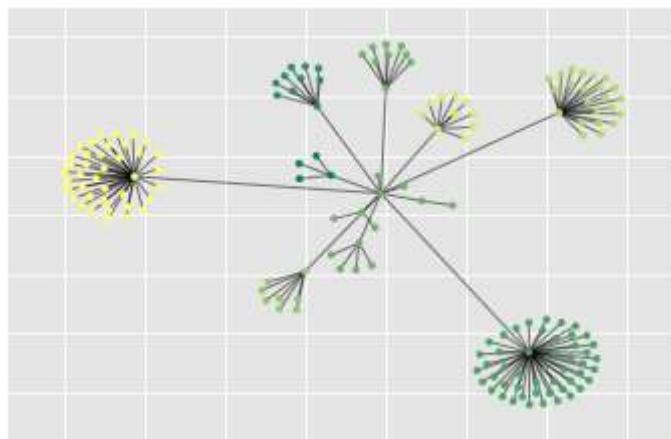
```
#Calculating the modularity and plotting the network graph
Mod_Grp = max((Graph.subgraph(c) for c in nx.connected_components(Graph)), key=len)

partition = community.best_partition(Mod_Grp)
modularity = community.modularity(partition, Mod_Grp)
print('Modularity:', modularity)

colors = [partition[n] for n in Mod_Grp.nodes()]
my_colors = plt.cm.summer
pos = nx.spring_layout(Mod_Grp, seed=10396950)
nx.draw_networkx_nodes(Mod_Grp, pos, node_color=colors, cmap = my_colors, node_size=10
nx.draw_networkx_edges(Mod_Grp, pos, alpha=0.5)

plt.show()
```

Modularity: 0.7643515764425937



In []: