SNEHAL KOTHAWADE B2 BATCH

In [1]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [4]:

```
df = pd.read_csv("uber.csv")
df
```

Out[4]:

	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passen
0	24238194	2015-05-07 19:52:06.0000003	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.723217	
1	27835199	2009-07-17 20:04:56.0000002	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.750325	
2	44984355	2009-08-24 21:45:00.00000061	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	40.772647	
3	25894730	2009-06-26 08:22:21.0000001	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	40.803349	
4	17610152	2014-08-28 17:47:00.000000188	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	40.761247	
...	...	...	...	...	...	...	...	...	
199995	42598914	2012-10-28 10:49:00.00000053	3.0	2012-10-28 10:49:00 UTC	-73.987042	40.739367	-73.986525	40.740297	
199996	16382965	2014-03-14 01:09:00.0000008	7.5	2014-03-14 01:09:00 UTC	-73.984722	40.736837	-74.006672	40.739620	
199997	27804658	2009-06-29 00:42:00.00000078	30.9	2009-06-29 00:42:00 UTC	-73.986017	40.756487	-73.858957	40.692588	
199998	20259894	2015-05-20 14:56:25.0000004	14.5	2015-05-20 14:56:25 UTC	-73.997124	40.725452	-73.983215	40.695415	
199999	11951496	2010-05-15 04:08:00.00000076	14.1	2010-05-15 04:08:00 UTC	-73.984395	40.720077	-73.985508	40.768793	

200000 rows × 9 columns

In [5]:

```
df.head()
```

Out[5]:

	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_c
0	24238194	2015-05-07 19:52:06.0000003	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.723217	
1	27835199	2009-07-17 20:04:56.0000002	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.750325	
2	44984355	2009-08-24 21:45:00.00000061	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	40.772647	
3	25894730	2009-06-26 08:22:21.0000001	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	40.803349	
4	17610152	2014-08-28 17:47:00.000000188	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	40.761247	

In [6]:

```
1 df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200000 entries, 0 to 199999
Data columns (total 9 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   Unnamed: 0         200000 non-null  int64  
 1   key                200000 non-null  object 
 2   fare_amount        200000 non-null  float64
 3   pickup_datetime    200000 non-null  object 
 4   pickup_longitude   200000 non-null  float64
 5   pickup_latitude    200000 non-null  float64
 6   dropoff_longitude  199999 non-null  float64
 7   dropoff_latitude   199999 non-null  float64
 8   passenger_count    200000 non-null  int64  
dtypes: float64(5), int64(2), object(2)
memory usage: 13.7+ MB
```

In [7]:

```
1 df.columns
```

Out[7]:

```
Index(['Unnamed: 0', 'key', 'fare_amount', 'pickup_datetime',
       'pickup_longitude', 'pickup_latitude', 'dropoff_longitude',
       'dropoff_latitude', 'passenger_count'],
      dtype='object')
```

In [8]:

```
1 df =df.drop(['Unnamed: 0', 'key'], axis =1)
```

In [9]:

```
1 df.head()
```

Out[9]:

	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
0	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.723217	1
1	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.750325	1
2	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	40.772647	1
3	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	40.803349	3
4	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	40.761247	5

In [10]:

```
1 df.shape
```

Out[10]:

```
(200000, 7)
```

In [11]:

```
1 df.dtypes
```

Out[11]:

```
fare_amount          float64
pickup_datetime       object
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count        int64
dtype: object
```

In [12]:

```
1 df.describe()
```

Out[12]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
count	200000.000000	200000.000000	200000.000000	199999.000000	199999.000000	200000.000000
mean	11.359955	-72.527638	39.935885	-72.525292	39.923890	1.684535
std	9.901776	11.437787	7.720539	13.117408	6.794829	1.385997
min	-52.000000	-1340.648410	-74.015515	-3356.666300	-881.985513	0.000000
25%	6.000000	-73.992065	40.734796	-73.991407	40.733823	1.000000
50%	8.500000	-73.981823	40.752592	-73.980093	40.753042	1.000000
75%	12.500000	-73.967154	40.767158	-73.963658	40.768001	2.000000
max	499.000000	57.418457	1644.421482	1153.572603	872.697628	208.000000

In [13]:

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

Out[13]:

```
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    1
dropoff_latitude     1
passenger_count      0
dtype: int64
```

In [14]:

```
1 df['dropoff_latitude'].fillna(value=df['dropoff_latitude'].mean(), inplace=True)
```

In [15]:

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

Out[15]:

```
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    1
dropoff_latitude     0
passenger_count      0
dtype: int64
```

In [16]:

```
1 df['dropoff_longitude'].fillna(value=df['dropoff_longitude'].median(), inplace=True)
```

In [17]:

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

Out[17]:

```
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
dtype: int64
```

In [18]:

```
df.dtypes
```

Out[18]:

```
fare_amount          float64
pickup_datetime       object
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count        int64
dtype: object
```

In [19]:

```
df.pickup_datetime = pd.to_datetime(df.pickup_datetime, errors='coerce')
```

In [20]:

```
df.dtypes
```

Out[20]:

```
fare_amount                       float64
pickup_datetime      datetime64[ns, UTC]
pickup_longitude                  float64
pickup_latitude                   float64
dropoff_longitude                 float64
dropoff_latitude                  float64
passenger_count                     int64
dtype: object
```

In [21]:

```
df= df.assign(hour = df.pickup_datetime.dt.hour,
              day = df.pickup_datetime.dt.day,
               month = df.pickup_datetime.dt.month,
              year = df.pickup_datetime.dt.year,
              dayofweek = df.pickup_datetime.dt.dayofweek)

```

In [22]:

```
1 df.head
```

Out[22]:

```
<bound method NDFrame.head of         fare_amount           pickup_datetime  pickup_longitude  \
0               7.5 2015-05-07 19:52:06+00:00        -73.999817
1               7.7 2009-07-17 20:04:56+00:00        -73.994355
2              12.9 2009-08-24 21:45:00+00:00        -74.005043
3               5.3 2009-06-26 08:22:21+00:00        -73.976124
4              16.0 2014-08-28 17:47:00+00:00        -73.925023
...             ...                       ...               ...
199995          3.0 2012-10-28 10:49:00+00:00        -73.987042
199996          7.5 2014-03-14 01:09:00+00:00        -73.984722
199997         30.9 2009-06-29 00:42:00+00:00        -73.986017
199998         14.5 2015-05-20 14:56:25+00:00        -73.997124
199999         14.1 2010-05-15 04:08:00+00:00        -73.984395

        pickup_latitude  dropoff_longitude  dropoff_latitude  passenger_count  \
0             40.738354         -73.999512         40.723217                1
1             40.728225         -73.994710         40.750325                1
2             40.740770         -73.962565         40.772647                1
3             40.790844         -73.965316         40.803349                3
4             40.744085         -73.973082         40.761247                5
...                 ...                ...               ...              ...
199995        40.739367         -73.986525         40.740297                1
199996        40.736837         -74.006672         40.739620                1
199997        40.756487         -73.858957         40.692588                2
199998        40.725452         -73.983215         40.695415                1
199999        40.720077         -73.985508         40.768793                1

        hour  day  month  year  dayofweek
0         19    7      5  2015          3
1         20   17      7  2009          4
2         21   24      8  2009          0
3          8   26      6  2009          4
4         17   28      8  2014          3
...      ...  ...    ...   ...        ...
199995    10   28     10  2012          6
199996     1   14      3  2014          4
199997     0   29      6  2009          0
199998    14   20      5  2015          2
199999     4   15      5  2010          5

[200000 rows x 12 columns]>
```

In [41]:

```
df = df.drop('pickup_datetime', axis =1)
```

```
---------------------------------------------------------------------------
KeyError                                  Traceback (most recent call last)
~\AppData\Local\Temp\ipykernel_19836\3060153060.py in <module>
----> 1 df = df.drop('pickup_datetime', axis =1)

C:\ProgramData\Anaconda3\lib\site-packages\pandas\util\_decorators.py in wrapper(*args, **kwargs)
    309                     stacklevel=stacklevel,
    310                 )
--> 311             return func(*args, **kwargs)
    312
    313         return wrapper

C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\frame.py in drop(self, labels, axis, index, columns, level, in
place, errors)
   4955                 weight  1.0     0.8
   4956         """
-> 4957         return super().drop(
   4958             labels=labels,
   4959             axis=axis,

C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\generic.py in drop(self, labels, axis, index, columns, level,
inplace, errors)
   4265         for axis, labels in axes.items():
   4266             if labels is not None:
-> 4267                 obj = obj._drop_axis(labels, axis, level=level, errors=errors)
   4268
   4269         if inplace:

C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\generic.py in _drop_axis(self, labels, axis, level, errors, co
nsolidate, only_slice)
   4309                 new_axis = axis.drop(labels, level=level, errors=errors)
   4310             else:
-> 4311                 new_axis = axis.drop(labels, errors=errors)
   4312             indexer = axis.get_indexer(new_axis)
   4313

C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\indexes\base.py in drop(self, labels, errors)
   6659         if mask.any():
   6660             if errors != "ignore":
-> 6661                 raise KeyError(f"{list(labels[mask])} not found in axis")
   6662             indexer = indexer[~mask]
   6663         return self.delete(indexer)

KeyError: "['pickup_datetime'] not found in axis"
```

In [ ]:

```
df.head
```

In [25]:

```
df.dtypes
```

Out[25]:

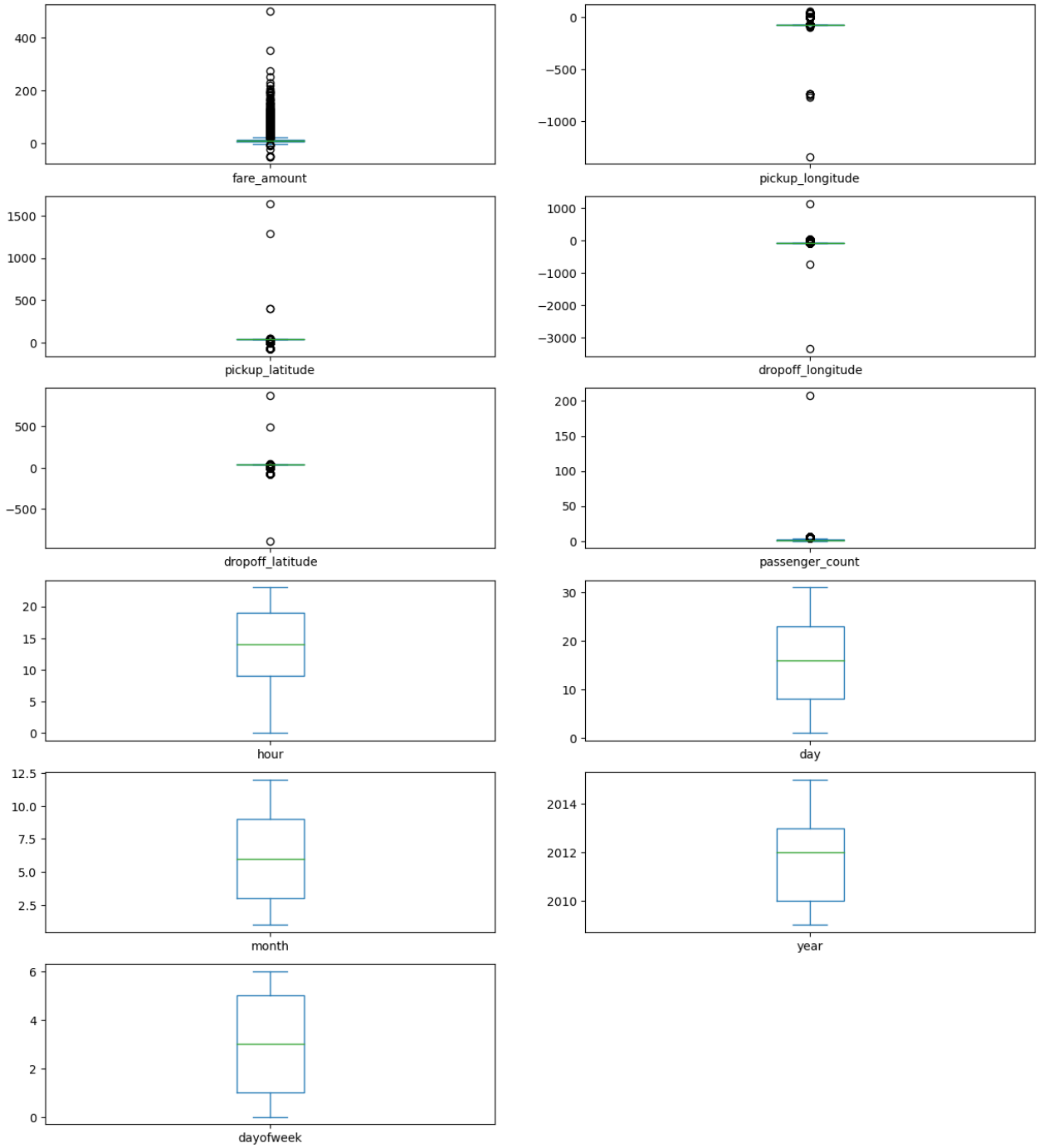
```
fare_amount          float64
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count        int64
hour                   int64
day                    int64
month                  int64
year                   int64
dayofweek              int64
dtype: object
```

In [26]:

```
1 df.plot(kind="box", subplots = True,layout =(7,2),figsize=(15,20))
```

Out[26]:

```
fare_amount            AxesSubplot(0.125,0.786098;0.352273x0.0939024)
pickup_longitude     AxesSubplot(0.547727,0.786098;0.352273x0.0939024)
pickup_latitude        AxesSubplot(0.125,0.673415;0.352273x0.0939024)
dropoff_longitude    AxesSubplot(0.547727,0.673415;0.352273x0.0939024)
dropoff_latitude       AxesSubplot(0.125,0.560732;0.352273x0.0939024)
passenger_count      AxesSubplot(0.547727,0.560732;0.352273x0.0939024)
hour                   AxesSubplot(0.125,0.448049;0.352273x0.0939024)
day                  AxesSubplot(0.547727,0.448049;0.352273x0.0939024)
month                  AxesSubplot(0.125,0.335366;0.352273x0.0939024)
year                 AxesSubplot(0.547727,0.335366;0.352273x0.0939024)
dayofweek              AxesSubplot(0.125,0.222683;0.352273x0.0939024)
dtype: object
```



In [27]:

```
def remove_outlier(df1, col):
    Q1 =df1[col].quantile(0.25)
    Q3= df1[col].quantile (0.75)
    IQR= Q3 - Q1
    lower_whisker= Q1-1.5*IQR
    upper_whisker= Q3+1.5*IQR
    df[col] = np.clip(df1[col], lower_whisker, upper_whisker)
    return df1

def treat_outliers_all(df1, col_list):
    for c in col_list:
        df1 = remove_outlier(df, c)
    return df1
```

In [28]:

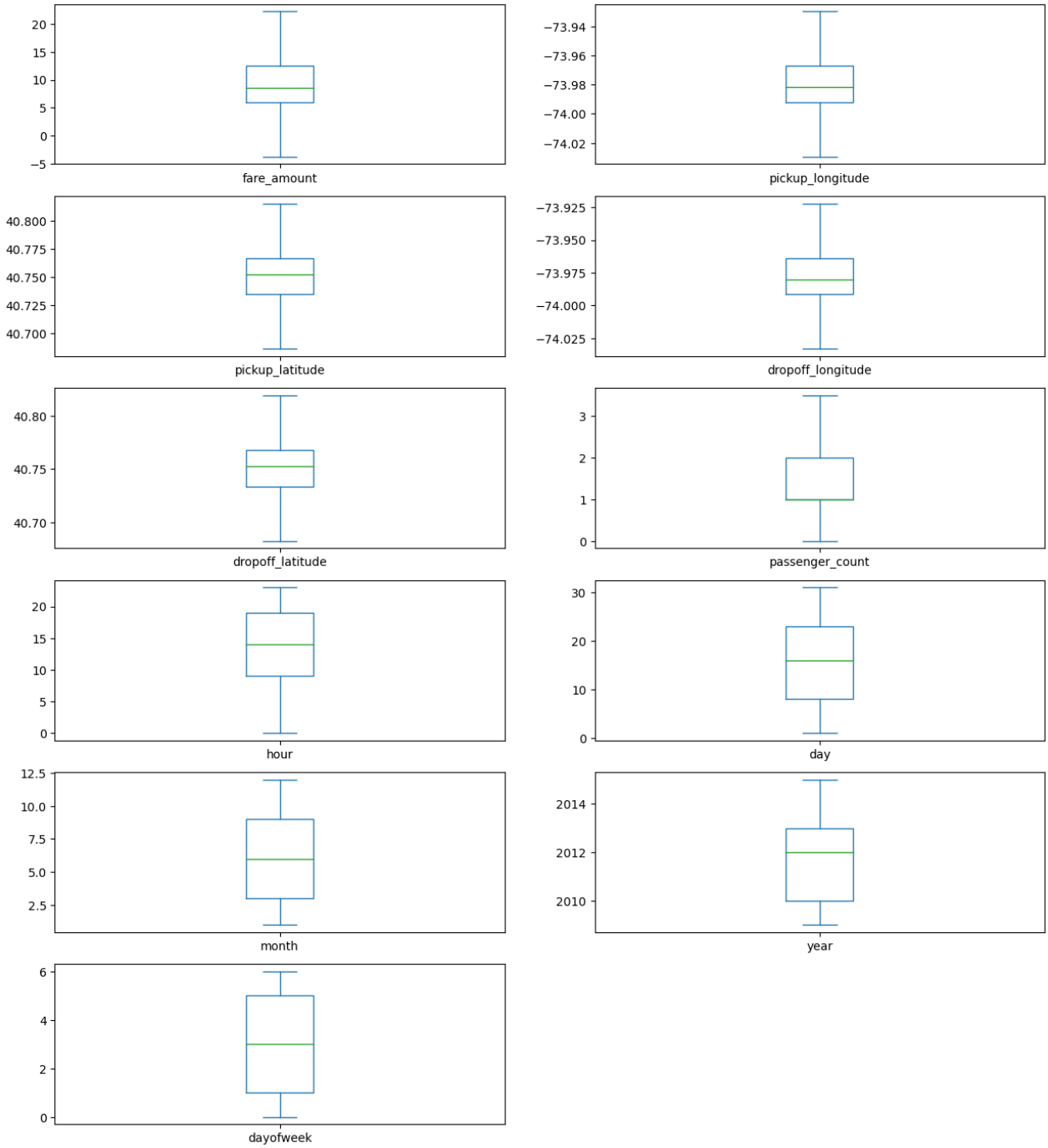
```
df = treat_outliers_all(df,df.iloc[:, 0::])
```

In [29]:

```
df.plot(kind = "box",subplots = True,layout=(7,2),figsize=(15,20))
```

Out[29]:

```
fare_amount            AxesSubplot(0.125,0.786098;0.352273x0.0939024)
pickup_longitude     AxesSubplot(0.547727,0.786098;0.352273x0.0939024)
pickup_latitude        AxesSubplot(0.125,0.673415;0.352273x0.0939024)
dropoff_longitude    AxesSubplot(0.547727,0.673415;0.352273x0.0939024)
dropoff_latitude       AxesSubplot(0.125,0.560732;0.352273x0.0939024)
passenger_count      AxesSubplot(0.547727,0.560732;0.352273x0.0939024)
hour                   AxesSubplot(0.125,0.448049;0.352273x0.0939024)
day                  AxesSubplot(0.547727,0.448049;0.352273x0.0939024)
month                  AxesSubplot(0.125,0.335366;0.352273x0.0939024)
year                 AxesSubplot(0.547727,0.335366;0.352273x0.0939024)
dayofweek              AxesSubplot(0.125,0.222683;0.352273x0.0939024)
dtype: object
```



In [ ]:

```
pip install haversine
```

In [42]:

```
import haversine as hs
travel_dist = []
for pos in range(len(df['pickup_longitude'])):
    long1,lati1,long2,lati2 = [df['pickup_longitude'][pos],df['pickup_latitude'][pos],df['dropoff_longitude'][pos],df['dropoff_
    loc1 =(lati1,long1)
    loc2 =(lati2,long2)
    c = hs.haversine(loc1,loc2)
    travel_dist.append(c)

print(travel_dist)
df['dist_travel_km']= travel_dist
df.head
```

```
IOPub data rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_data_rate_limit`.

Current values:
NotebookApp.iopub_data_rate_limit=1000000.0 (bytes/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

Out[42]:

```
<bound method NDFrame.head of         fare_amount  pickup_longitude  pickup_latitude  dropoff_longitude  \
0              7.50        -73.999817        40.738354         -73.999512
1              7.70        -73.994355        40.728225         -73.994710
2             12.90        -74.005043        40.740770         -73.962565
3              5.30        -73.976124        40.790844         -73.965316
4             16.00        -73.929786        40.744085         -73.973082
...             ...               ...              ...                ...
199995         3.00        -73.987042        40.739367         -73.986525
199996         7.50        -73.984722        40.736837         -74.006672
199997        22.25        -73.986017        40.756487         -73.922036
199998        14.50        -73.997124        40.725452         -73.983215
199999        14.10        -73.984395        40.720077         -73.985508

        dropoff_latitude  passenger_count  hour  day  month  year  dayofweek  \
0              40.723217              1.0    19    7      5  2015          3
1              40.750325              1.0    20   17      7  2009          4
2              40.772647              1.0    21   24      8  2009          0
3              40.803349              3.0     8   26      6  2009          4
4              40.761247              3.5    17   28      8  2014          3
...                  ...              ...   ...  ...    ...   ...        ...
199995         40.740297              1.0    10   28     10  2012          6
199996         40.739620              1.0     1   14      3  2014          4
199997         40.692588              2.0     0   29      6  2009          0
199998         40.695415              1.0    14   20      5  2015          2
199999         40.768793              1.0     4   15      5  2010          5

        dist_travel_km
0         12758.286154
1         12756.625962
2         12754.446942
3         12760.320445
4         12755.985008
...                ...
199995    12756.954766
199996    12758.913797
199997    12751.688525
199998    12755.039558
199999    12754.696728

[200000 rows x 12 columns]>
```

In [43]:

```
df = df.loc[(df.dist_travel_km>=1) |(df.dist_travel_km<=130) ]
print("Remaining obervation:" , df.shape)
```

```
Remaining obervation: (200000, 12)
```

In [44]:

```
incorrect_coordinates =df.loc[(df.pickup_latitude>90) | (df.pickup_latitude< -90)|
                              (df.dropoff_latitude>90) |  (df.dropoff_latitude< -90) |
                              (df.pickup_longitude>180)| (df.pickup_longitude< -180)|
                               (df.dropoff_latitude>90) | (df.dropoff_latitude< -90)
                              ]
```

In [45]:

```
df.drop(incorrect_coordinates, inplace = True, errors ='ignore')
```

In [46]:

```
df.head()
```

Out[46]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day	month	year	dayofweek	dist_t
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1.0	19	7	5	2015	3	1275
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1.0	20	17	7	2009	4	1275
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1.0	21	24	8	2009	0	1275
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3.0	8	26	6	2009	4	1276
4	16.0	-73.929786	40.744085	-73.973082	40.761247	3.5	17	28	8	2014	3	1275

In [47]:

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

Out[47]:

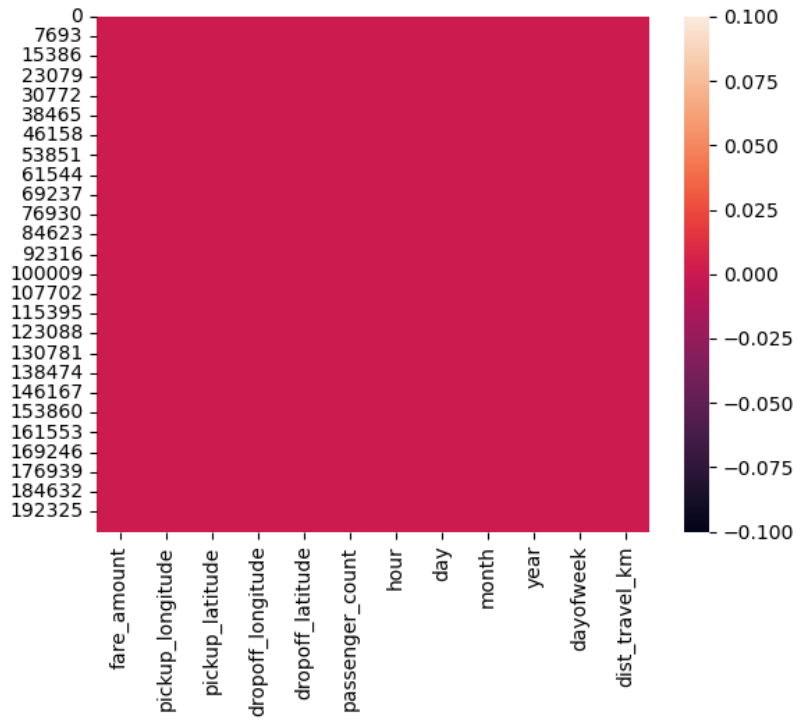
```
fare_amount          0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
hour                 0
day                  0
month                0
year                 0
dayofweek            0
dist_travel_km       0
dtype: int64
```

In [48]:

```
1 sns.heatmap(df.isnull())
```

Out[48]:

<AxesSubplot:>



In [49]:

```
1 corr = df.corr()
```

In [50]:

```
1 corr
```

Out[50]:

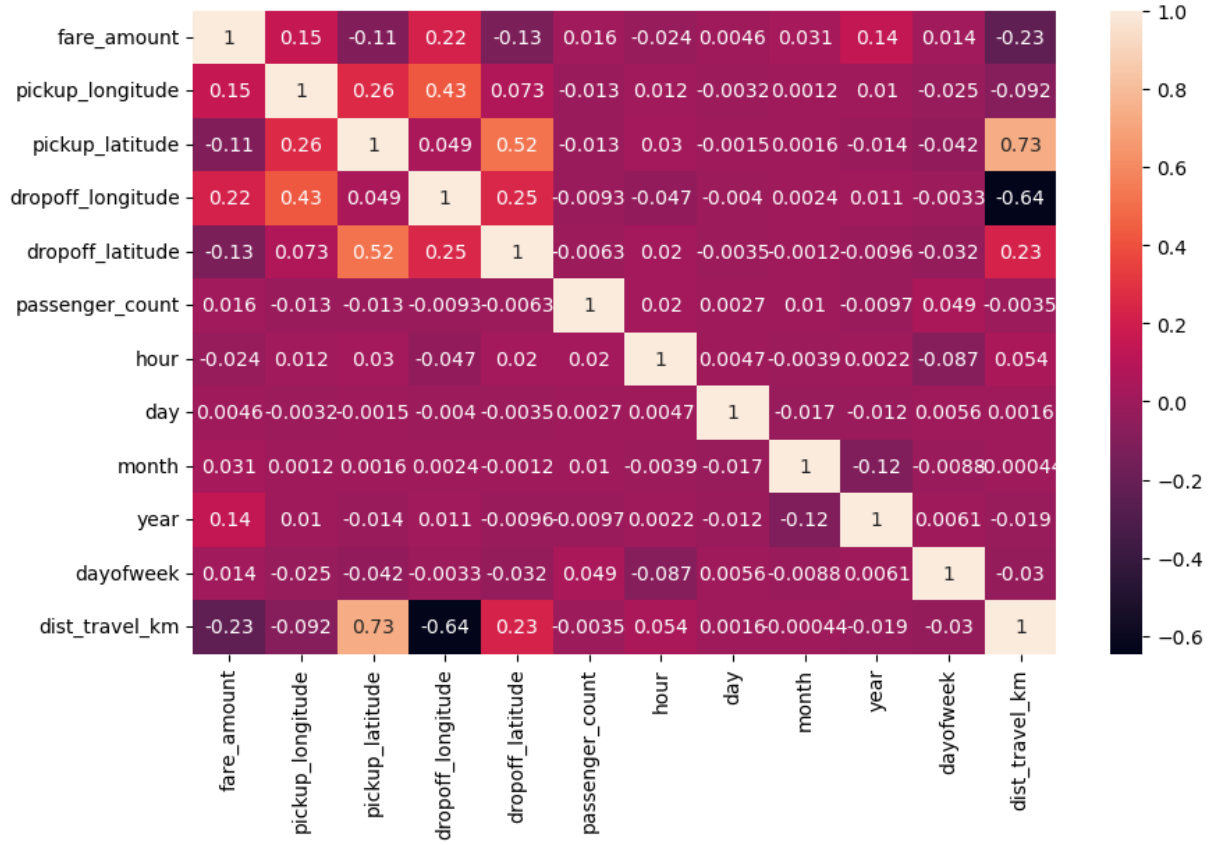
	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day	mo
fare_amount	1.000000	0.154069	-0.110842	0.218675	-0.125898	0.015778	-0.023623	0.004534	0.030
pickup_longitude	0.154069	1.000000	0.259497	0.425619	0.073290	-0.013213	0.011579	-0.003204	0.001
pickup_latitude	-0.110842	0.259497	1.000000	0.048889	0.515714	-0.012889	0.029681	-0.001553	0.001
dropoff_longitude	0.218675	0.425619	0.048889	1.000000	0.245667	-0.009303	-0.046558	-0.004007	0.002
dropoff_latitude	-0.125898	0.073290	0.515714	0.245667	1.000000	-0.006308	0.019783	-0.003479	-0.001
passenger_count	0.015778	-0.013213	-0.012889	-0.009303	-0.006308	1.000000	0.020274	0.002712	0.010
hour	-0.023623	0.011579	0.029681	-0.046558	0.019783	0.020274	1.000000	0.004677	-0.003
day	0.004534	-0.003204	-0.001553	-0.004007	-0.003479	0.002712	0.004677	1.000000	-0.017
month	0.030817	0.001169	0.001562	0.002391	-0.001193	0.010351	-0.003926	-0.017360	1.000
year	0.141277	0.010198	-0.014243	0.011346	-0.009603	-0.009749	0.002156	-0.012170	-0.115
dayofweek	0.013652	-0.024652	-0.042310	-0.003336	-0.031919	0.048550	-0.086947	0.005617	-0.008
dist_travel_km	-0.233982	-0.091832	0.731839	-0.644884	0.227001	-0.003515	0.054475	0.001546	-0.000

In [100]:

```
fig,axis = plt.subplots(figsize= (10,6))
sns.heatmap(df.corr(), annot = True)
```

Out[100]:

<Axes: >



In [51]:

```
df.dtypes
```

Out[51]:

```
fare_amount          float64
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count      float64
hour                   int64
day                    int64
month                  int64
year                   int64
dayofweek              int64
dist_travel_km       float64
dtype: object
```

In [59]:

```
x = df[['pickup_longitude', 'pickup_latitude','dropoff_longitude', 'passenger_count', 'hour', 'day','month', 'year','dayofweek']
```

In [60]:

```
y = df['fare_amount']
```

In [61]:

```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train,y_test = train_test_split(x,y,test_size = 0.33)
```

In [62]:

```
from sklearn.linear_model import LinearRegression
regression = LinearRegression()
```

In [63]:

```
regression.fit(x_train,y_train)
```

Out[63]:

```
LinearRegression()
```

In [65]:

```
regression.intercept_
```

Out[65]:

```
2810.586867670241
```

In [66]:

```
regression.coef_
```

Out[66]:

```
array([ 3.36184179e+01, -1.54274575e+06,  1.54272668e+06,  9.24908560e-02,
        1.12392328e-02,  2.68517483e-03,  6.27287508e-02,  3.78329486e-01,
        1.17565459e-02,  1.38740317e+04])
```

In [67]:

```
prediction = regression.predict(x_test)
```

In [68]:

```
print(prediction)
```

```
[23.55019657 13.25135417  7.99420584 ...  9.33548389  8.53506384
  9.26098324]
```

In [69]:

```
y_test
```

Out[69]:

```
168553    22.25
24295     12.50
54374      3.70
77398     16.00
80636      4.00
          ...
114623     6.10
194330    14.50
52536      4.50
136642    12.00
84566      6.00
Name: fare_amount, Length: 66000, dtype: float64
```

In [72]:

```
from sklearn.metrics import r2_score
```

In [73]:

```
r2_score(y_test,prediction)
```

Out[73]:

```
0.41928436137240455
```

In [74]:

```
from sklearn.metrics import mean_squared_error
```

In [75]:

```
MSE = mean_squared_error(y_test,prediction)
```

In [76]:

```
1 MSE
```

Out[76]:

```
16.961152324796327
```

In [ ]:

```
1
```