Machin Learning Assignment No1s- datase

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Title: Predict the price of the Uber ride from a given pickup point to the agreed drop-off location. Perform following tasks: 1. Pre-process the dataset. 2. Identify outliers. 3. Check the correlation. 4. Implement linear regression and random forest regression models. Evaluate the models and compare their respective scores like R2, RMSE, etc. Dataset link: https://www.kaggle.com/datasets/yasserh/uber-fares-datase

In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
```

In [2]:
```
df = pd.read_csv("C:/Users/Pratibha/Downloads/archive.zip")
df
```

Out[2]:

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

200000 rows × 9 columns

1. Pre-process the dataset.

In [3]:
```
df.shape
```

Out[3]:
```
(200000, 9)
```

In [4]:
```
df.head
```

Out[4]:

```
<bound method NDFrame.head of         Unnamed: 0                            key  fare_amount  \
0         24238194    2015-05-07 19:52:06.0000003         7.5
1         27835199    2009-07-17 20:04:56.0000002         7.7
2         44984355   2009-08-24 21:45:00.00000061        12.9
3         25894730    2009-06-26 08:22:21.0000001         5.3
4         17610152  2014-08-28 17:47:00.000000188        16.0
...            ...                            ...         ...
199995    42598914   2012-10-28 10:49:00.00000053         3.0
199996    16382965    2014-03-14 01:09:00.0000008         7.5
199997    27804658   2009-06-29 00:42:00.00000078        30.9
199998    20259894    2015-05-20 14:56:25.0000004        14.5
199999    11951496   2010-05-15 04:08:00.00000076        14.1

                pickup_datetime  pickup_longitude  pickup_latitude  \
0       2015-05-07 19:52:06 UTC        -73.999817        40.738354
1       2009-07-17 20:04:56 UTC        -73.994355        40.728225
2       2009-08-24 21:45:00 UTC        -74.005043        40.740770
3       2009-06-26 08:22:21 UTC        -73.976124        40.790844
4       2014-08-28 17:47:00 UTC        -73.925023        40.744085
...                         ...               ...              ...
199995  2012-10-28 10:49:00 UTC        -73.987042        40.739367
199996  2014-03-14 01:09:00 UTC        -73.984722        40.736837
199997  2009-06-29 00:42:00 UTC        -73.986017        40.756487
199998  2015-05-20 14:56:25 UTC        -73.997124        40.725452
199999  2010-05-15 04:08:00 UTC        -73.984395        40.720077

        dropoff_longitude  dropoff_latitude  passenger_count
0              -73.999512         40.723217                1
1              -73.994710         40.750325                1
2              -73.962565         40.772647                1
3              -73.965316         40.803349                3
4              -73.973082         40.761247                5
...                   ...               ...              ...
199995         -73.986525         40.740297                1
199996         -74.006672         40.739620                1
199997         -73.858957         40.692588                2
199998         -73.983215         40.695415                1
199999         -73.985508         40.768793                1

[200000 rows x 9 columns]>
```

In [5]:

```
df.isnull()
```

Out[5]:

	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	pas
0	False	False	False	False	False	False	False	False	
1	False	False	False	False	False	False	False	False	
2	False	False	False	False	False	False	False	False	
3	False	False	False	False	False	False	False	False	
4	False	False	False	False	False	False	False	False	
...	...	...	...	...	...	...	...	...	
199995	False	False	False	False	False	False	False	False	
199996	False	False	False	False	False	False	False	False	
199997	False	False	False	False	False	False	False	False	
199998	False	False	False	False	False	False	False	False	
199999	False	False	False	False	False	False	False	False	

200000 rows × 9 columns

In [6]:

```
df.drop(columns=["Unnamed: 0", "key"], inplace=True)
df.head()
```

Out[6]:

	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 [7]:

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

Out[7]:

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

In [8]:

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

Out[8]:

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

In [9]:

```
df.pickup_datetime = pd.to_datetime(df.pickup_datetime)
df.dtypes
```

Out[9]:

```
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 [10]:

```
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)
df
```

Out[10]:

	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hou
0	7.5	2015-05-07 19:52:06+00:00	-73.999817	40.738354	-73.999512	40.723217	1	1
1	7.7	2009-07-17 20:04:56+00:00	-73.994355	40.728225	-73.994710	40.750325	1	2
2	12.9	2009-08-24 21:45:00+00:00	-74.005043	40.740770	-73.962565	40.772647	1	2
3	5.3	2009-06-26 08:22:21+00:00	-73.976124	40.790844	-73.965316	40.803349	3	
4	16.0	2014-08-28 17:47:00+00:00	-73.925023	40.744085	-73.973082	40.761247	5	1
...	...	...	...	...	...	...	...	.
199995	3.0	2012-10-28 10:49:00+00:00	-73.987042	40.739367	-73.986525	40.740297	1	1
199996	7.5	2014-03-14 01:09:00+00:00	-73.984722	40.736837	-74.006672	40.739620	1	
199997	30.9	2009-06-29 00:42:00+00:00	-73.986017	40.756487	-73.858957	40.692588	2	
199998	14.5	2015-05-20 14:56:25+00:00	-73.997124	40.725452	-73.983215	40.695415	1	1
199999	14.1	2010-05-15 04:08:00+00:00	-73.984395	40.720077	-73.985508	40.768793	1	

200000 rows × 12 columns

In [11]:

```
df = df.drop(["pickup_datetime"], axis =1)
df
```

Out[11]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day	month	y
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1	19	7	5	2
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1	20	17	7	2
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1	21	24	8	2
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3	8	26	6	2
4	16.0	-73.925023	40.744085	-73.973082	40.761247	5	17	28	8	2
...	...	...	...	...	...	...	...	...	...	
199995	3.0	-73.987042	40.739367	-73.986525	40.740297	1	10	28	10	2
199996	7.5	-73.984722	40.736837	-74.006672	40.739620	1	1	14	3	2
199997	30.9	-73.986017	40.756487	-73.858957	40.692588	2	0	29	6	2
199998	14.5	-73.997124	40.725452	-73.983215	40.695415	1	14	20	5	2
199999	14.1	-73.984395	40.720077	-73.985508	40.768793	1	4	15	5	2

200000 rows × 11 columns

In [15]:

```
from math import *

def distance_formula(longitude1, latitude1, longitude2, latitude2):
    travel_dist = []

    for pos in range (len(longitude1)):
        lon1, lan1, lon2, lan2 = map(radians, [longitude1[pos], latitude1[pos], longitude2[pos], latitude2[pos]
        dist_lon = lon2 - lon1
        dist_lan = lan2 - lan1

        a = sin(dist_lan/2)**2 + cos(lan1) * cos(lan2) * sin(dist_lon/2)**2

        #radius of earth = 6371
        c = 2 * asin(sqrt(a)) * 6371
        travel_dist.append(c)

    return  travel_dist
```

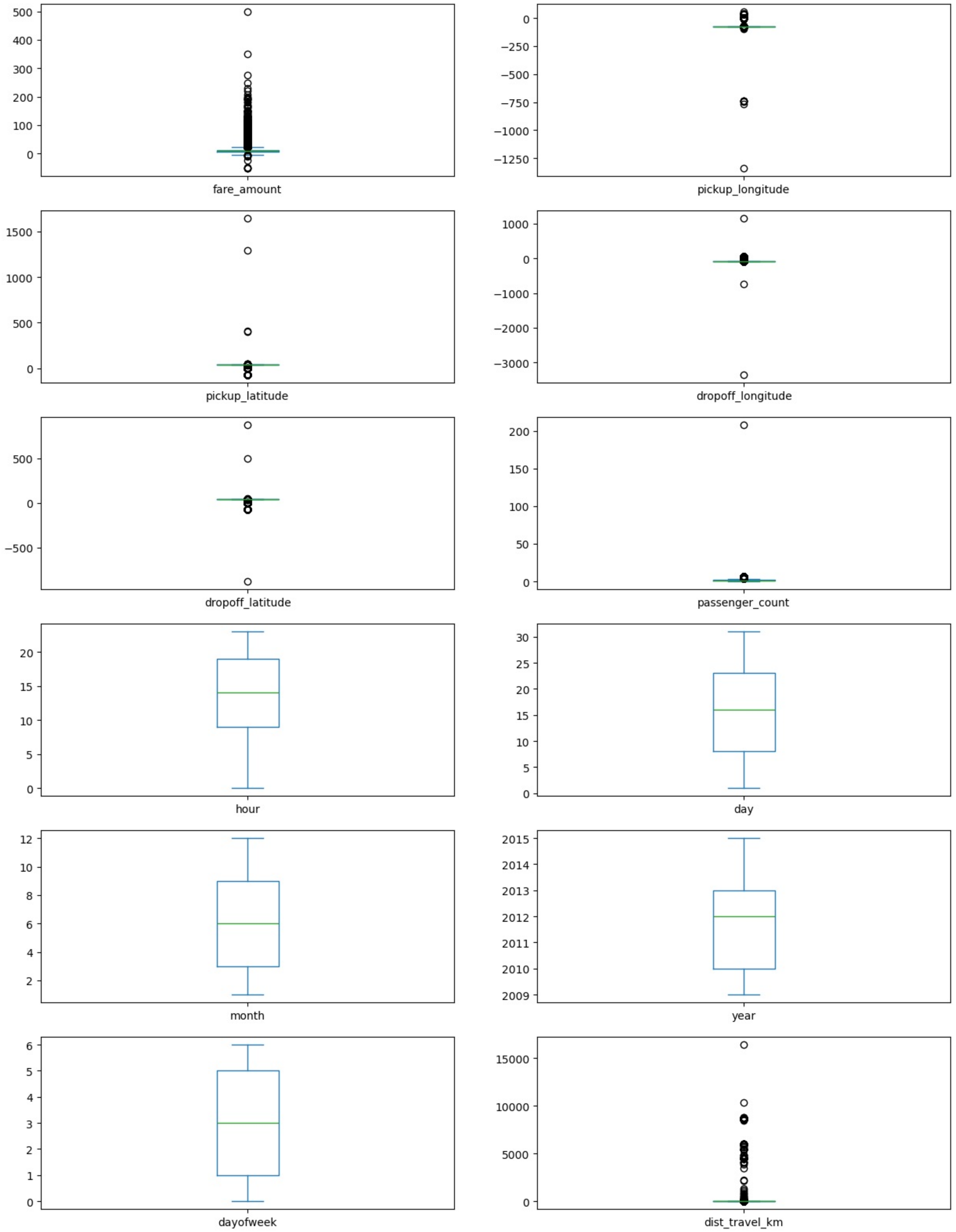
In [16]:

```
df['dist_travel_km'] = distance_formula(df.pickup_longitude.to_numpy(), df.pickup_latitude.to_numpy(), df.dropo
```

2. Identify outliers.

In [17]:

```
df.plot(kind = "box",subplots = True,layout = (6,2),figsize=(15,20)) #Boxplot to check the outliers
plt.show()
```



In [18]:

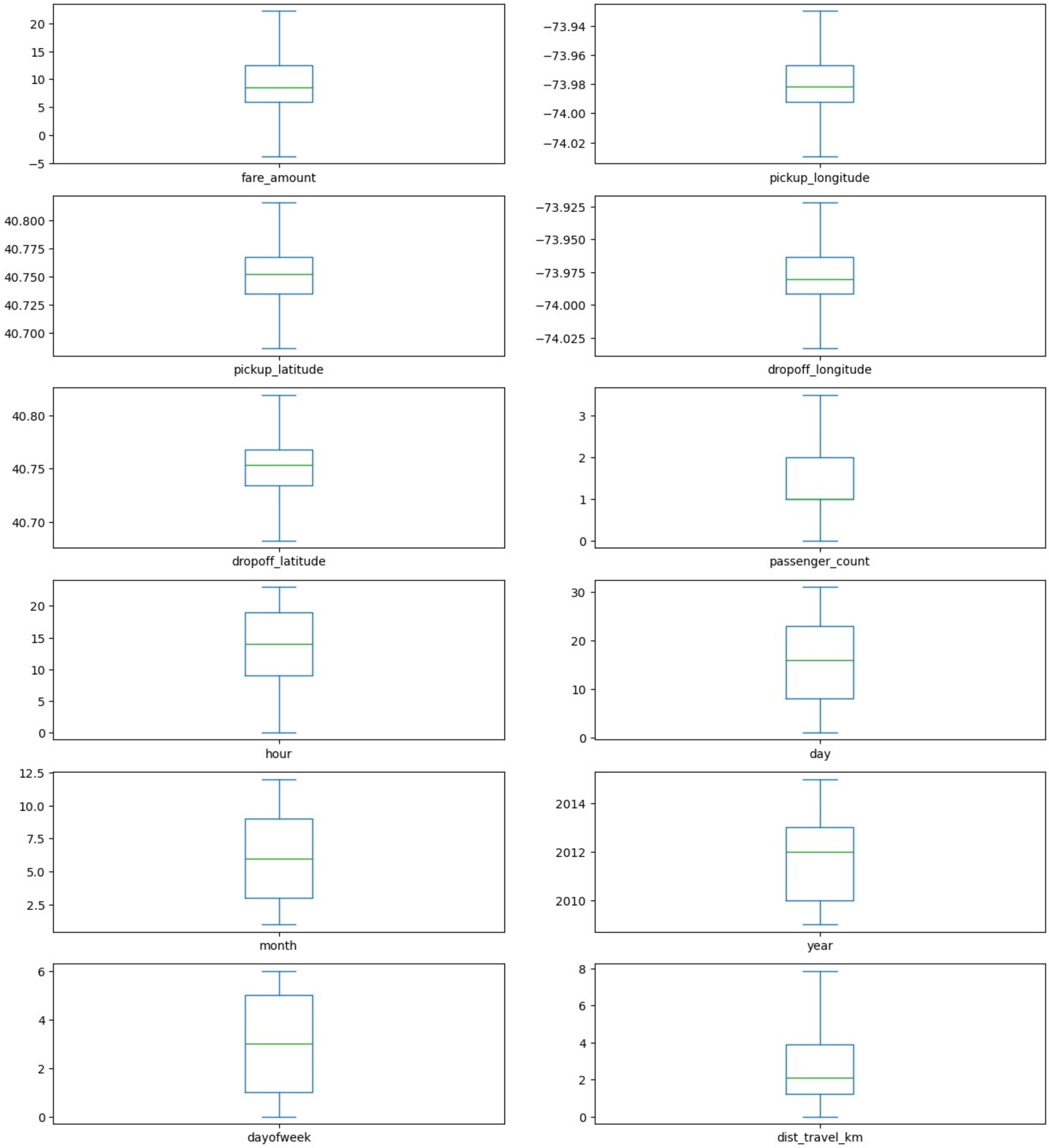
```
def remove_outlier(df1 , col):
    Q1 = df1[col].quantile(0.25)
    Q3 = df1[col].quantile(0.75)
    IQR = Q3 - Q1
    lower_whisker = Q1-1.5*IQR
    upper_whisker = Q3+1.5*IQR
    df[col] = np.clip(df1[col] , lower_whisker , upper_whisker)
    return df1

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

In [19]:

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

In [20]:

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



3. Check the correlation.

In [21]:

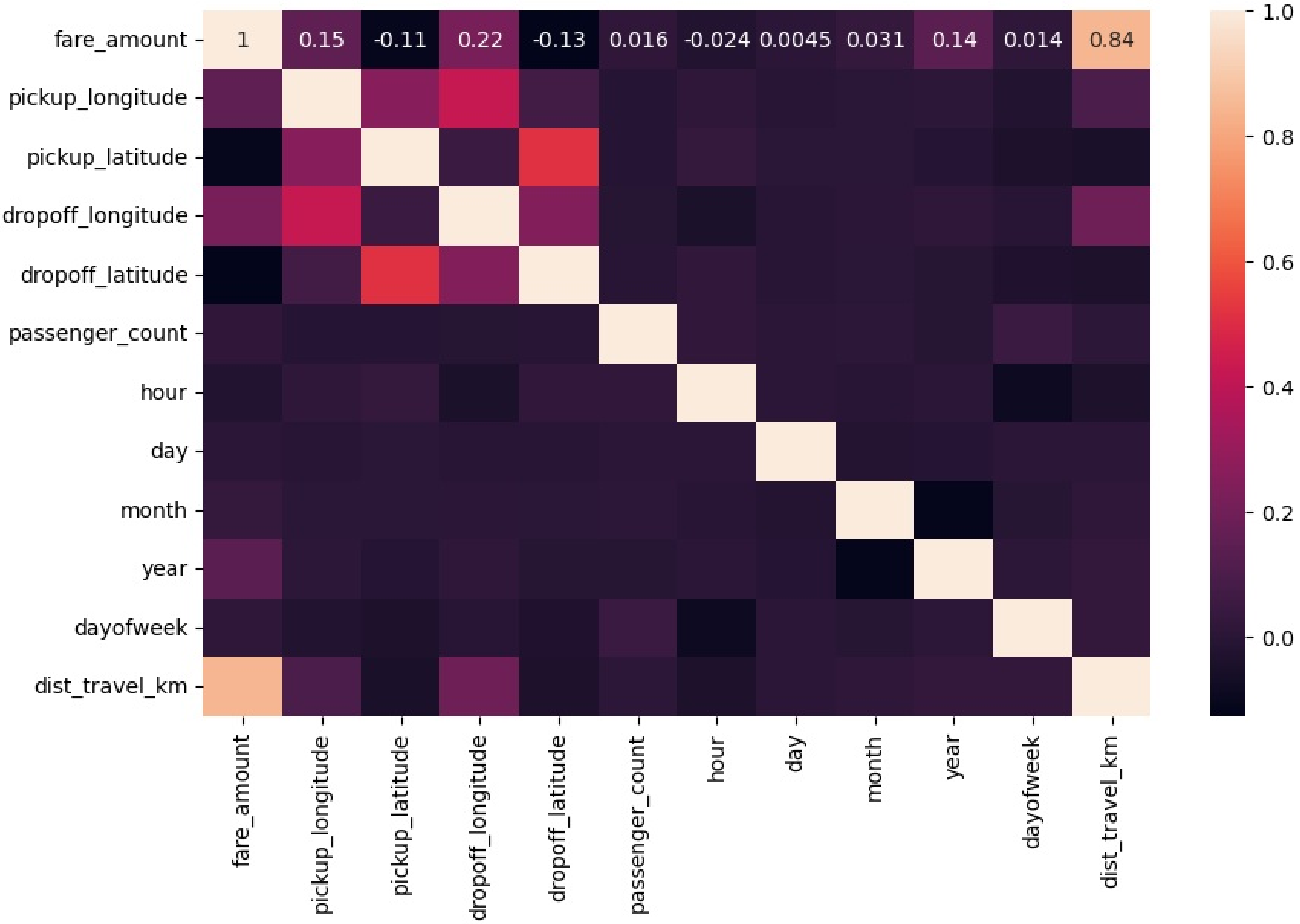
```
corr = df.corr()
corr
```

Out[21]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour
fare_amount	1.000000	0.154069	-0.110842	0.218675	-0.125898	0.015778	-0.023623
pickup_longitude	0.154069	1.000000	0.259497	0.425619	0.073290	-0.013213	0.011579
pickup_latitude	-0.110842	0.259497	1.000000	0.048889	0.515714	-0.012889	0.029681
dropoff_longitude	0.218675	0.425619	0.048889	1.000000	0.245667	-0.009303	-0.046558
dropoff_latitude	-0.125898	0.073290	0.515714	0.245667	1.000000	-0.006308	0.019783
passenger_count	0.015778	-0.013213	-0.012889	-0.009303	-0.006308	1.000000	0.020274
hour	-0.023623	0.011579	0.029681	-0.046558	0.019783	0.020274	1.000000
day	0.004534	-0.003204	-0.001553	-0.004007	-0.003479	0.002712	0.004677
month	0.030817	0.001169	0.001562	0.002391	-0.001193	0.010351	-0.003926
year	0.141277	0.010198	-0.014243	0.011346	-0.009603	-0.009749	0.002156
dayofweek	0.013652	-0.024652	-0.042310	-0.003336	-0.031919	0.048550	-0.086947
dist_travel_km	0.844374	0.098094	-0.046812	0.186531	-0.038900	0.009709	-0.038366

In [22]:
```
fig,axis = plt.subplots(figsize = (10,6))
sns.heatmap(df.corr(),annot = True) #Correlation Heatmap (Light values means highly correlated)
```

Out[22]:
```
<Axes: >
```



4. Implement linear regression and random forest regression models.

In [23]:
```
df_x = df[['pickup_longitude','pickup_latitude','dropoff_longitude','dropoff_latitude','passenger_count','hour'
df_y = df['fare_amount']
```

In [24]:
```
x_train, x_test, y_train, y_test = train_test_split(df_x, df_y, test_size=0.2, random_state=1)
df
```

Out[24]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day	month	y
0	7.50	-73.999817	40.738354	-73.999512	40.723217	1.0	19	7	5	2
1	7.70	-73.994355	40.728225	-73.994710	40.750325	1.0	20	17	7	2
2	12.90	-74.005043	40.740770	-73.962565	40.772647	1.0	21	24	8	2
3	5.30	-73.976124	40.790844	-73.965316	40.803349	3.0	8	26	6	2
4	16.00	-73.929786	40.744085	-73.973082	40.761247	3.5	17	28	8	2
...	...	...	...	...	...	...	...	...	...	
199995	3.00	-73.987042	40.739367	-73.986525	40.740297	1.0	10	28	10	2
199996	7.50	-73.984722	40.736837	-74.006672	40.739620	1.0	1	14	3	2
199997	22.25	-73.986017	40.756487	-73.922036	40.692588	2.0	0	29	6	2
199998	14.50	-73.997124	40.725452	-73.983215	40.695415	1.0	14	20	5	2
199999	14.10	-73.984395	40.720077	-73.985508	40.768793	1.0	4	15	5	2

200000 rows × 12 columns

In [25]:

```
from sklearn.linear_model import LinearRegression

# initialize the linear regression model
reg = LinearRegression()

# Train the model with our training data
reg.fit(x_train, y_train)
```

Out[25]:

```
▾ LinearRegression
LinearRegression()
```

In [26]:

```
y_pred_lin = reg.predict(x_test)
print(y_pred_lin)
```

```
[ 6.27615184  5.09986098  9.43641238 ... 11.07663949 12.15392248
 11.41496075]
```

In [27]:

```
from sklearn.ensemble import RandomForestRegressor
rf = RandomForestRegressor(n_estimators=100)
rf.fit(x_train,y_train)
```

Out[27]:

```
▾ RandomForestRegressor
RandomForestRegressor()
```

In [28]:

```
y_pred_rf = rf.predict(x_test)
print(y_pred_rf)
```

```
[ 4.98    6.5285  9.25   ... 11.5275 11.376  13.13  ]
```