Remove_Outliers

March 29, 2023

[611]:
```
1#Import pandas and matplotlib
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import statsmodels.api as sm
from scipy import stats
import seaborn as sns
```

[612]:
```
2#test csv
df=pd.read_csv ('artificial_housing_data.csv')
df.head()
```

[612]:

	timestamp	house_id	house_size	temperature	humidity	precipitation	wind_speed	solar_irradiance	week_of_the_year	hour_of_the_day	day_of_the_week	wday__0	wday__1	wday__2	wday__3	wday__4	wday__5	wday__6	consumption
0	2014-12-01 00:00:00+00:00	house_0	38.4	12.856301	0.227995	1.272970	4.708708	195.588130	49	0	0	1	0	0	0	0	0	0	77.184583
1	2014-12-01 01:00:00+00:00	house_0	38.4	12.126253	0.220464	2.814100	3.156671	203.112272	49	1	0	1	0	0	0	0	0	0	72.301535
2	2014-12-01 02:00:00+00:00	house_0	38.4	15.277380	0.361294	0.515568	3.490243	204.453061	49	2	0	1	0	0	0	0	0	0	68.666249
3	2014-12-01 03:00:00+00:00	house_0	38.4	12.817692	0.236057	1.920968	3.191047	192.645952	49	3	0	1	0	0	0	0	0	0	
4	2014-12-01 04:00:00+00:00	house_0	38.4	14.343213	0.051376	2.292260	3.142263	196.727594	49	4	0	1	0	0	0	0	0	0	

```
3        0        0        0    58.396602
4        0        0        0    76.230163
```

[613]:
```
3#check the shape of dataFrame
df.shape
```

[613]:
```
(218925, 19)
```

[614]:
```
4#descriptive_state
df.describe
```

[614]:
```
<bound method NDFrame.describe of                          timestamp  house_id
house_size  temperature  \
0       2014-12-01 00:00:00+00:00   house_0      38.400    12.856301
1       2014-12-01 01:00:00+00:00   house_0      38.400    12.126253
2       2014-12-01 02:00:00+00:00   house_0      38.400    15.277380
3       2014-12-01 03:00:00+00:00   house_0      38.400    12.817692
4       2014-12-01 04:00:00+00:00   house_0      38.400    14.343213
…                             …       …          …           …
218920  2015-11-30 19:00:00+00:00  house_24      50.025     8.784783
218921  2015-11-30 20:00:00+00:00  house_24      50.025     7.578867
218922  2015-11-30 21:00:00+00:00  house_24      50.025     6.030384
218923  2015-11-30 22:00:00+00:00  house_24      50.025     8.921952
218924  2015-11-30 23:00:00+00:00  house_24      50.025     6.267010

        humidity  precipitation  wind_speed  solar_irradiance  \
0       0.227995       1.272970    4.708708        195.588130
1       0.220464       2.814100    3.156671        203.112272
2       0.361294       0.515568    3.490243        204.453061
3       0.236057       1.920968    3.191047        192.645952
4       0.051376       2.292260    3.142263        196.727594
…            …              …           …                 …
218920  0.187472       1.499202    3.123499        197.511497
218921  0.120572       0.003390    2.539654        194.567294
218922  0.290202       2.695812    3.646082        193.759270
218923  0.241852       0.987437    3.273055        193.294319
218924  0.007762       2.824886    3.344415        197.644169

        week_of_the_year  hour_of_the_day  day_of_the_week  wday__0  wday__1  \
0                     49                0                0        1        0
1                     49                1                0        1        0
2                     49                2                0        1        0
3                     49                3                0        1        0
4                     49                4                0        1        0
…                    …                 …                …        …        …
218920                49               19                0        1        0
218921                49               20                0        1        0
```

```
218922              49               21               0        1        0
218923              49               22               0        1        0
218924              49               23               0        1        0

        wday__2  wday__3  wday__4  wday__5  wday__6  consumption
0             0        0        0        0        0    77.184583
1             0        0        0        0        0    72.301535
2             0        0        0        0        0    68.666249
3             0        0        0        0        0    58.396602
4             0        0        0        0        0    76.230163
…           …        …        …        …        …           …
218920        0        0        0        0        0   101.813038
218921        0        0        0        0        0    99.244315
218922        0        0        0        0        0    83.341239
218923        0        0        0        0        0    91.493841
218924        0        0        0        0        0    74.526816

[218925 rows x 19 columns]>
```

[615]:
```
5#delete unsed data from test
df.drop('timestamp', inplace=True, axis=1)
df.drop('hour_of_the_day', inplace=True, axis=1)
df.drop('day_of_the_week', inplace=True, axis=1)
df.drop('wday__0', inplace=True, axis=1)
df.drop('wday__1', inplace=True, axis=1)
df.drop('wday__2', inplace=True, axis=1)
df.drop('wday__3', inplace=True, axis=1)
df.drop('wday__4', inplace=True, axis=1)
df.drop('wday__5', inplace=True, axis=1)
df.drop('wday__6', inplace=True, axis=1)
df.drop('house_id', inplace=True, axis=1)
df.drop('house_size', inplace=True, axis=1)
df.drop('humidity', inplace=True, axis=1)
df.drop('week_of_the_year', inplace=True, axis=1)
```

[616]:
```
df.describe
```

[616]:
```
<bound method NDFrame.describe of         temperature  precipitation  wind_speed
solar_irradiance  consumption
0         12.856301       1.272970    4.708708        195.588130    77.184583
1         12.126253       2.814100    3.156671        203.112272    72.301535
2         15.277380       0.515568    3.490243        204.453061    68.666249
3         12.817692       1.920968    3.191047        192.645952    58.396602
4         14.343213       2.292260    3.142263        196.727594    76.230163
…               …              …           …                 …           …
218920     8.784783       1.499202    3.123499        197.511497   101.813038
218921     7.578867       0.003390    2.539654        194.567294    99.244315
```

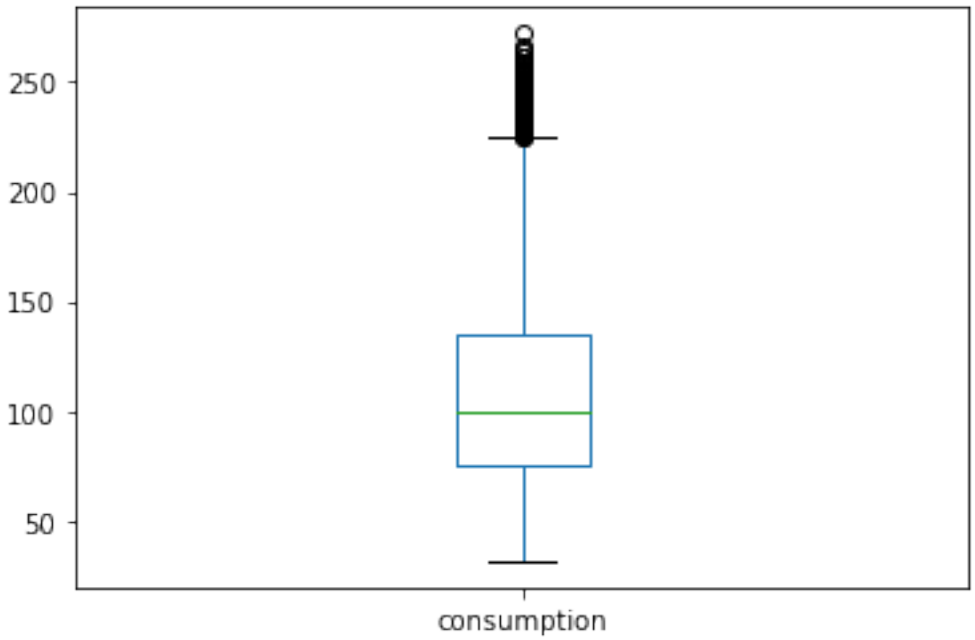
```
218922     6.030384       2.695812    3.646082       193.759270    83.341239
218923     8.921952       0.987437    3.273055       193.294319    91.493841
218924     6.267010       2.824886    3.344415       197.644169    74.526816

[218925 rows x 5 columns]>
```

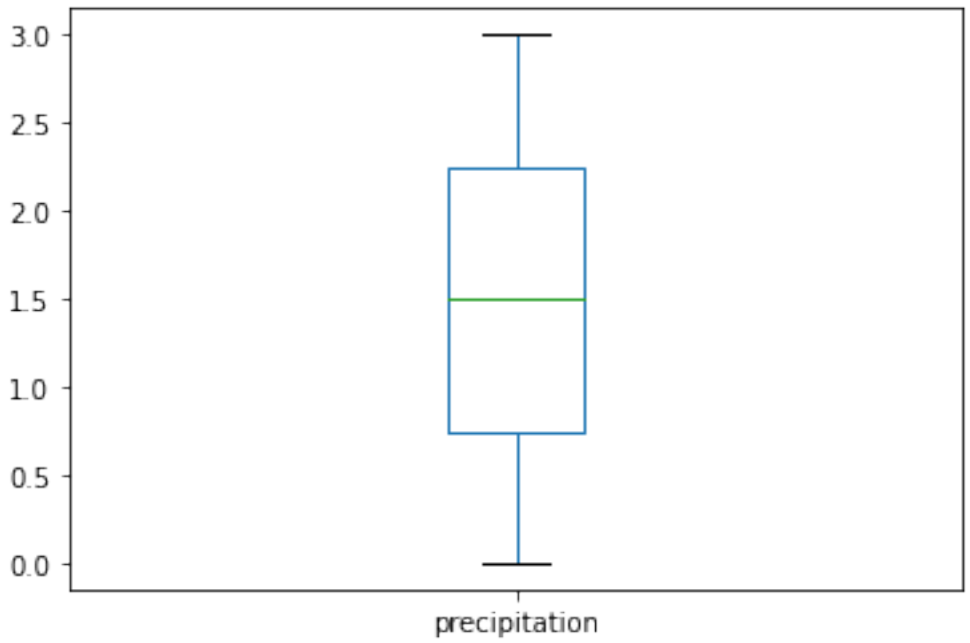
[617]:
```
6#define function called "plot_boxplot"

def plot_boxplot(df,ft):
    df.boxplot(column=[ft])
    plt.grid(False)
    plt.show()
```

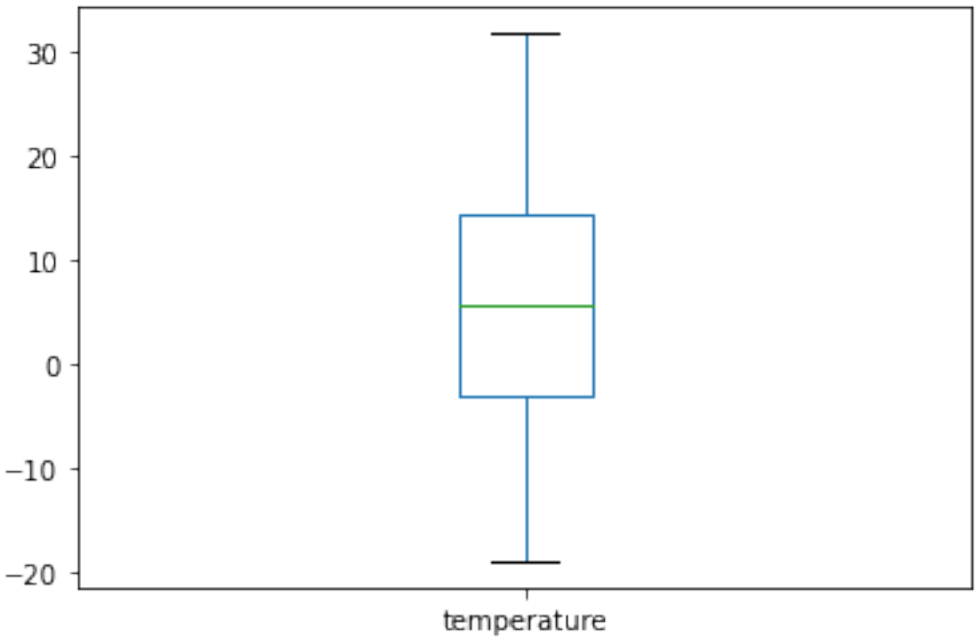
[618]:
```
7#first Feature consumption
plot_boxplot(df,"consumption")
```



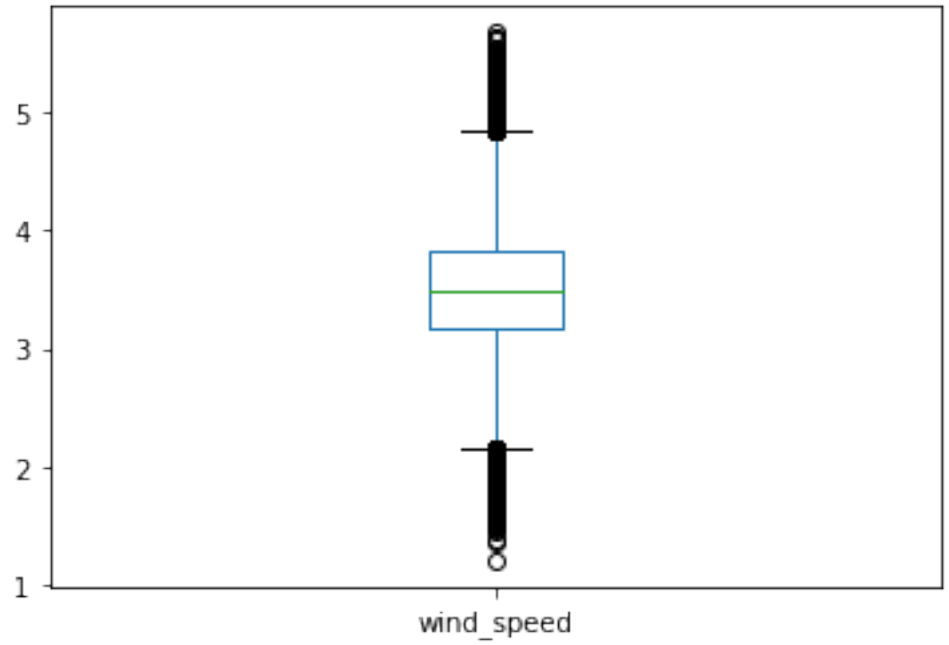
[619]:
```
#second Feature precipitation
plot_boxplot(df,"precipitation")
```



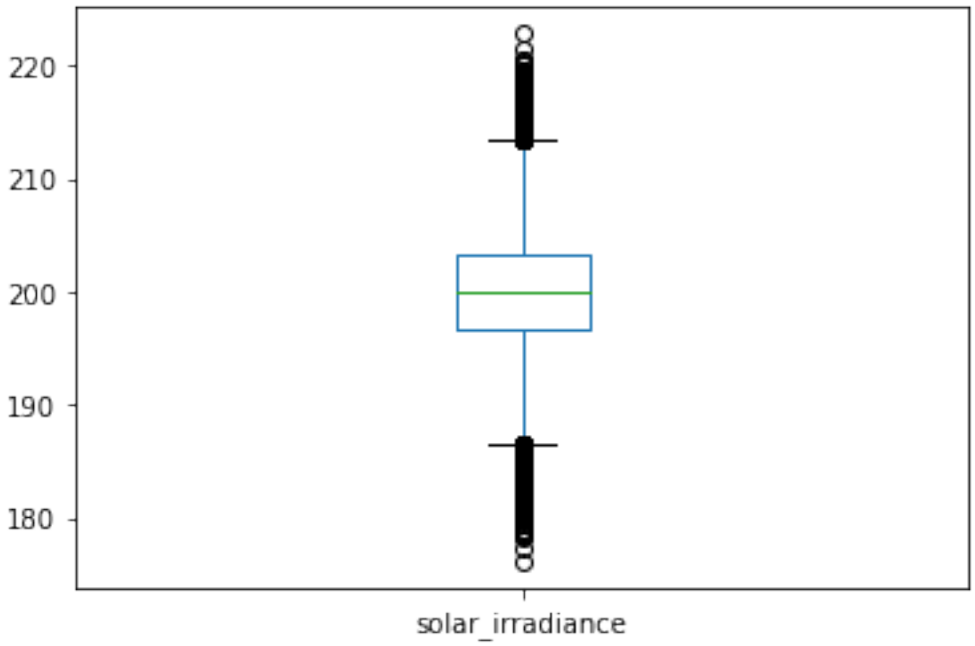
[620]:
```
#Third Feature Tempreture
plot_boxplot(df,"temperature")
```



[621]:
```
#Fourth Feature wind_speed
plot_boxplot(df,"wind_speed")
```



[622]:
```
#Fifth Feature solar_irradiance
plot_boxplot(df,"solar_irradiance")
```



[623]:
```
8#define a function called "outliers" returns a list of index of outliers
#IQR =Q3-Q1
# +/- 1.5* IQR

def outliers (df,ft):
    Q1=df[ft].quantile(0.25)
    Q3=df[ft].quantile(0.75)
    IQR=Q3-Q1

    Lower_bound=Q1-1.5*IQR
    Upper_bound=Q3+1.5*IQR

    ls=df.index[ (df[ft]< Lower_bound) | (df[ft] > Upper_bound)]

    return ls
```

[624]:
```
9# create an empty List to store the outliers from multiple columns

index_list=[]
for feature in ["temperature" ,"wind_speed",␣
 ↪"solar_irradiance","consumption","precipitation"]:

    index_list.extend(outliers(df, feature))
```

[625]:
```
index_list
```

[625]:
```
[84,
 567,
 734,
 795,
 1099,
 1451,
 1710,
 1739,
 1845,
 1989,
 2298,
 2876,
 2956,
 3225,
 3302,
 3349,
 3437,
```

3537,
3964,
3965,
4072,
4161,
4282,
4297,
4482,
4777,
4919,
5024,
5134,
5359,
5535,
5569,
5767,
5902,
6020,
6060,
6080,
6144,
6841,
6982,
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7595,
7654,
7922,
7939,
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9237,
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27161,

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27246,
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32612,
32823,
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138240,
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138634,
138648,
138898,
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139255,
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139406,
139642,
139655,
139773,
140720,
141104,
141294,
141314,
141568,
141849,
142409,
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142810,
142876,
143056,
143192,
143334,
143549,
143551,
143993,
144376,
144534,
144583,
144586,
144685,
145368,
145619,
145761,
145932,
146060,
146349,
146495,
146525,
146650,
146690,
146984,
147142,

147381,
147452,
147456,
147467,
147649,
147941,
147983,
148018,
148123,
148311,
148517,
148608,
148911,
148934,
149039,
149325,
149376,
149749,
149789,
149842,
150093,
150121,
150124,
150146,
150200,
150219,
150355,
150676,
150754,
151205,
151207,
151468,
151484,
151652,
151877,
151952,
152151,
152178,
152185,
152232,
152243,
152394,
152490,
152580,
152632,
152802,
152820,

```
153186,
153208,
153432,
153852,
153865,
153888,
153975,
154227,
154384,
154496,
154518,
154679,
154693,
154716,
154727,
154803,
154816,
154969,
155528,
155616,
156074,
156077,
156376,
156381,
156433,
156471,
156514,
156584,
156984,
157221,
157452,
157506,
157725,
157820,
157996,
158025,
158067,
158080,
158268,
158478,
158603,
159018,
159071,
…]
```

[626]:
```
# define a function called "remove" which returns a cleaned dataframe without␣
↪outliers
```

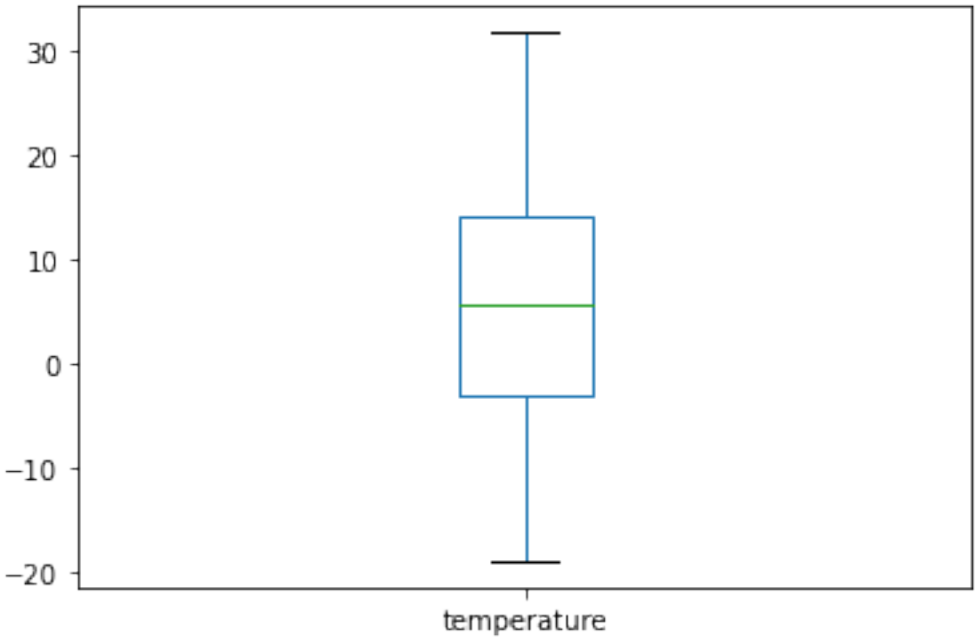
```
def remove(df,ls):
    ls=sorted(set(ls))
    df=df.drop(ls)
    return df
```

[627]:
```
df_cleaned=remove(df, index_list)
```

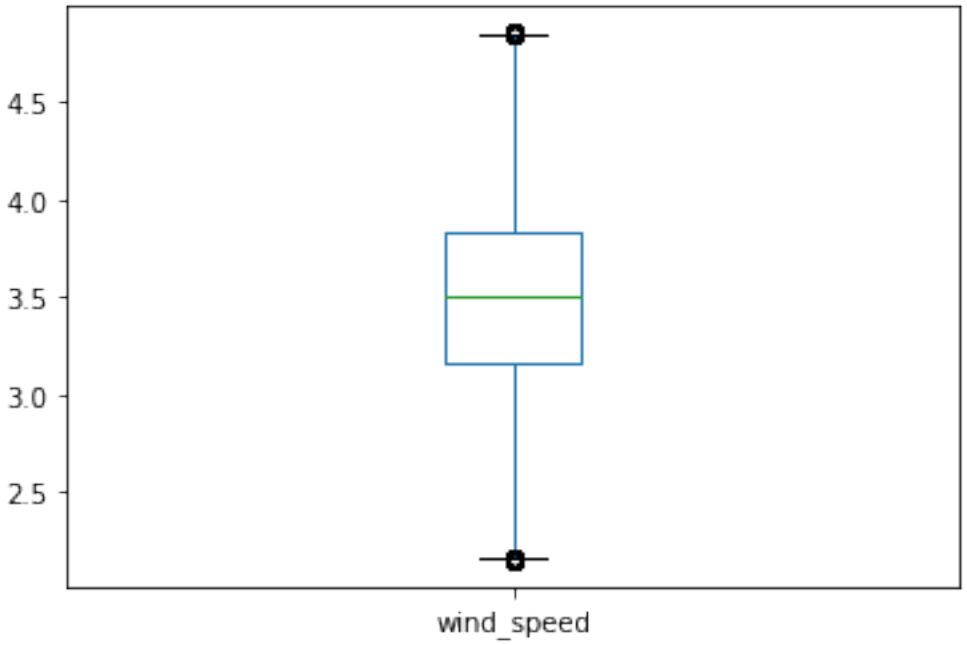
[628]:
```
df_cleaned.shape
```

[628]: (215570, 5)

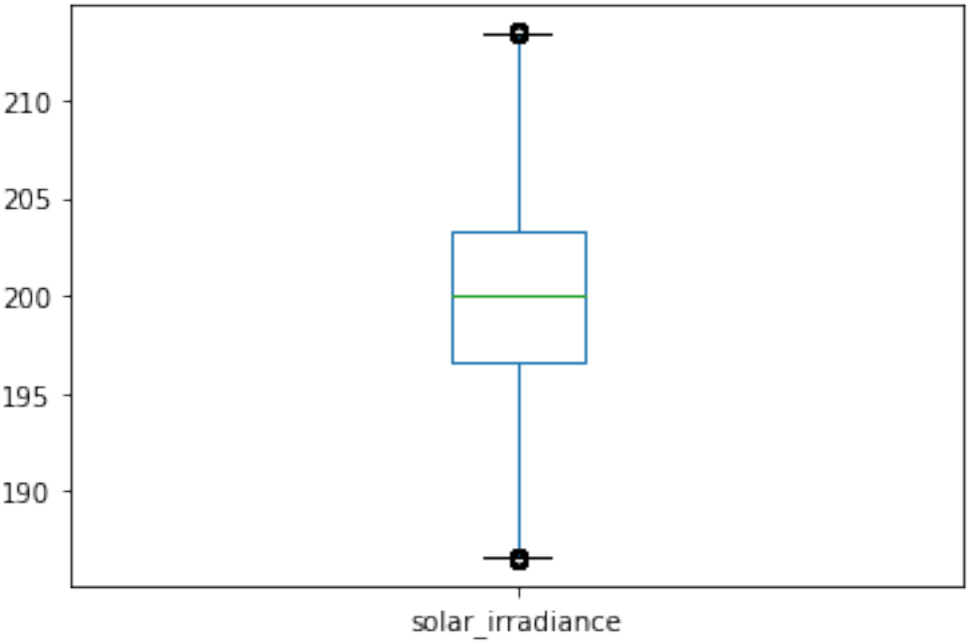
[629]:
```
plot_boxplot(df_cleaned, "temperature")
```



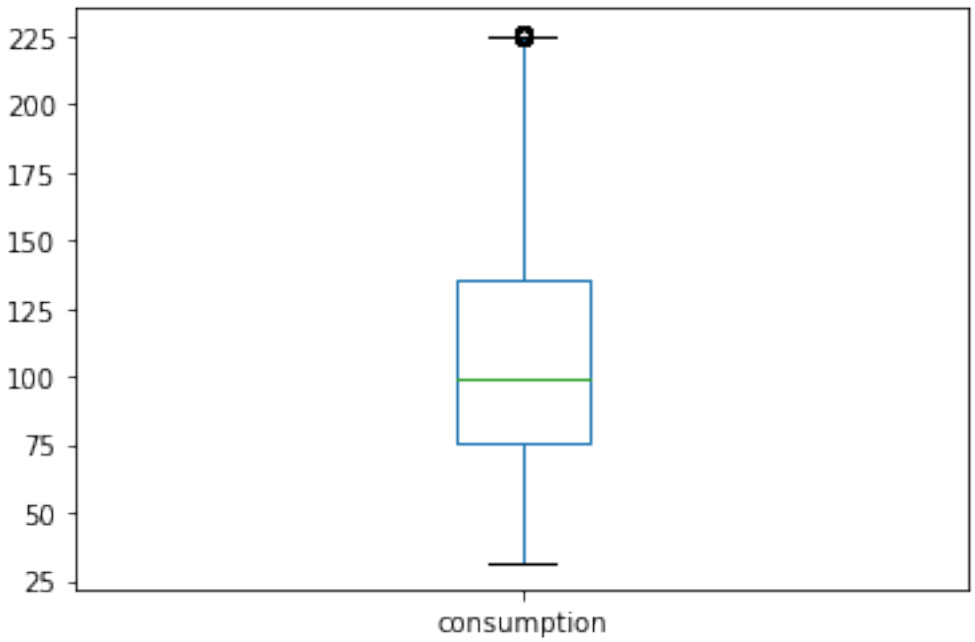
[630]:
```
plot_boxplot(df_cleaned, "wind_speed")
```



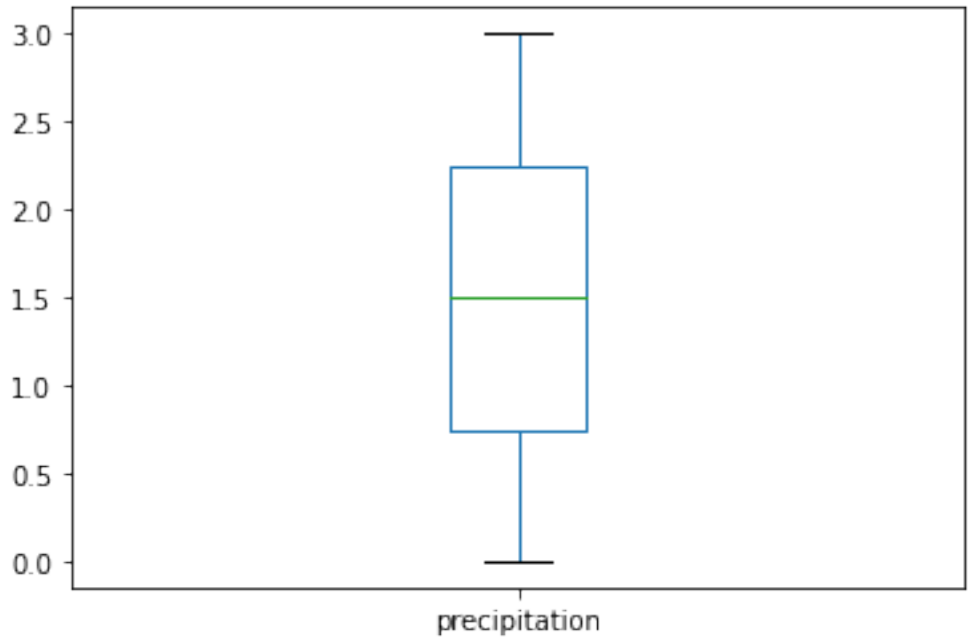
[631]:
```
plot_boxplot(df_cleaned, "solar_irradiance")
```



[632]:
```
plot_boxplot(df_cleaned, "consumption")
```



[633]:
```
plot_boxplot(df_cleaned, "precipitation")
```



[634]:
```
df_cleaned.to_csv( 'artificial_housing_data_cleaned.csv' , index=False)
```

[635]:
```
df=pd.read_csv ('artificial_housing_data_cleaned.csv')
df.head()
```

[635]:

	temperature	precipitation	wind_speed	solar_irradiance	consumption
0	12.856301	1.272970	4.708708	195.588130	77.184583
1	12.126253	2.814100	3.156671	203.112272	72.301535
2	15.277380	0.515568	3.490243	204.453061	68.666249
3	12.817692	1.920968	3.191047	192.645952	58.396602
4	14.343213	2.292260	3.142263	196.727594	76.230163

[636]:
```
df.describe
```

[636]:
```
<bound method NDFrame.describe of         temperature  precipitation  wind_speed
solar_irradiance  consumption
0         12.856301       1.272970    4.708708        195.588130    77.184583
1         12.126253       2.814100    3.156671        203.112272    72.301535
2         15.277380       0.515568    3.490243        204.453061    68.666249
3         12.817692       1.920968    3.191047        192.645952    58.396602
4         14.343213       2.292260    3.142263        196.727594    76.230163
…               …              …           …                …           …
215565     8.784783       1.499202    3.123499        197.511497   101.813038
215566     7.578867       0.003390    2.539654        194.567294    99.244315
215567     6.030384       2.695812    3.646082        193.759270    83.341239
215568     8.921952       0.987437    3.273055        193.294319    91.493841
215569     6.267010       2.824886    3.344415        197.644169    74.526816

[215570 rows x 5 columns]>
```

[637]:
```
11#separate the other attributes from the predicting attribute
X=df.drop(columns='consumption')
X
```

[637]:

	temperature	precipitation	wind_speed	solar_irradiance
0	12.856301	1.272970	4.708708	195.588130
1	12.126253	2.814100	3.156671	203.112272
2	15.277380	0.515568	3.490243	204.453061
3	12.817692	1.920968	3.191047	192.645952
4	14.343213	2.292260	3.142263	196.727594
…	…	…	…	…
215565	8.784783	1.499202	3.123499	197.511497
215566	7.578867	0.003390	2.539654	194.567294
215567	6.030384	2.695812	3.646082	193.759270
215568	8.921952	0.987437	3.273055	193.294319
215569	6.267010	2.824886	3.344415	197.644169

[215570 rows x 4 columns]

[638]:
```
12#separte the predicting attribute into Y for model training
y=df['consumption']
y
```

[638]:
```
0          77.184583
1          72.301535
2          68.666249
3          58.396602
4          76.230163
             …
215565    101.813038
215566     99.244315
215567     83.341239
215568     91.493841
215569     74.526816
Name: consumption, Length: 215570, dtype: float64
```

[639]:
```
13#Implement Ordinary Least Square
x=sm.add_constant(X)
results=sm.OLS(y,X).fit()
results.summary()
```

[639]:
```
<class 'statsmodels.iolib.summary.Summary'>
"""
                                 OLS Regression Results
==============================================================================
=======
Dep. Variable:            consumption   R-squared (uncentered):
0.892
Model:                            OLS   Adj. R-squared (uncentered):
0.892
Method:                 Least Squares   F-statistic:
4.434e+05
Date:                Wed, 29 Mar 2023   Prob (F-statistic):
0.00
Time:                        00:30:30   Log-Likelihood:
-1.0881e+06
No. Observations:              215570   AIC:
2.176e+06
Df Residuals:                  215566   BIC:
2.176e+06
Df Model:                           4
Covariance Type:            nonrobust
==============================================================================
====
                      coef    std err          t      P>|t|      [0.025
0.975]
```

```
------------------------------------------------------------------------------
----
temperature          1.1319      0.007    152.736      0.000       1.117
1.146
precipitation        0.2053      0.094      2.195      0.028       0.022
0.389
wind_speed           0.8409      0.164      5.119      0.000       0.519
1.163
solar_irradiance     0.4879      0.003    163.198      0.000       0.482
0.494
==============================================================================
Omnibus:                    20039.073   Durbin-Watson:                   0.202
Prob(Omnibus):                  0.000   Jarque-Bera (JB):            15225.832
Skew:                           0.555   Prob(JB):                         0.00
Kurtosis:                       2.320   Cond. No.                         405.
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not
contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly
specified.
"""
```

1 importing train_test_split from sklearn

from sklearn.model_selection import train_test_split # splitting the data X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 10000)

[640]:
```
14# importing module
from sklearn.linear_model import LinearRegression
# creating an object of LinearRegression class
LR = LinearRegression()
```

[641]:
```
15# fitting the training data
LR.fit(X_train,y_train)
y_prediction =  LR.predict(X_test)
y_prediction
```

[641]:
```
array([121.08111239, 101.27047624,  88.64856025, …, 114.3980759 ,
       111.0341982 , 121.70550672])
```

[642]:
```
16# r2_score :Pearson correlation coefficient, ideal r2=1
from sklearn.metrics import r2_score
#Checking the R- squared value Or predicting the accuracy score
r_squared=r2_score(y_test,y_prediction)
```

```
r_squared
```

[642]: 0.09875283509840027

[643]:
```
17# Mean Square Error (MSE), ideal MSE=0
from sklearn.metrics import mean_squared_error
mean_sqrt_error=mean_squared_error(y_test,y_prediction)
mean_sqrt_error
```

[643]: 1398.4021374897372

[644]:
```
18#Root mean square error
import sympy
Root_mean_sqrt_error=sympy.sqrt(mean_sqrt_error)
Root_mean_sqrt_error
```

[644]: 37.3952154357979

[ ]: