Develop a decision tree model to analyze the voltage and current patterns across the three phases of the transmission lines to detect faults

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

import warnings

from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import accuracy_score, precision_score,
recall_score, f1_score, confusion_matrix, classification_report

binary_data = pd.read_csv('detect_dataset.csv')

binary_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 12001 entries, 0 to 12000
Data columns (total 9 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   Output (S)  12001 non-null  int64
 1   Ia          12001 non-null  float64
 2   Ib          12001 non-null  float64
 3   Ic          12001 non-null  float64
 4   Va          12001 non-null  float64
 5   Vb          12001 non-null  float64
 6   Vc          12001 non-null  float64
 7   Unnamed: 7  0 non-null      float64
 8   Unnamed: 8  0 non-null      float64
dtypes: float64(8), int64(1)
memory usage: 843.9 KB
```

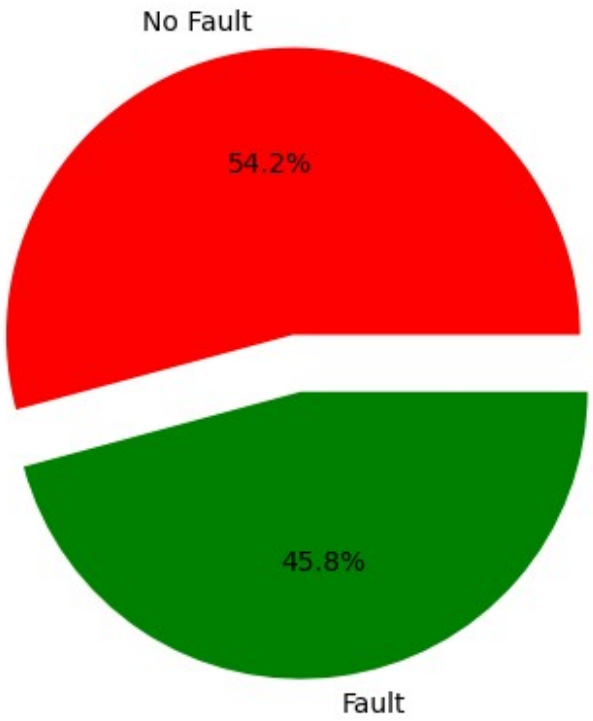
```
binary_data.head()
```

```
   Output (S)          Ia        Ib          Ic        Va        Vb
Vc  \
0           0 -170.472196  9.219613  161.252583  0.054490 -0.659921
0.605431
1           0 -122.235754  6.168667  116.067087  0.102000 -0.628612
0.526202
2           0  -90.161474  3.813632   86.347841  0.141026 -0.605277
0.464251
3           0  -79.904916  2.398803   77.506112  0.156272 -0.602235
```

```
0.445963
4           0  -63.885255  0.590667   63.294587  0.180451 -0.591501
0.411050

   Unnamed: 7  Unnamed: 8
0         NaN         NaN
1         NaN         NaN
2         NaN         NaN
3         NaN         NaN
4         NaN         NaN
```

```
#Columns 7 and 8 contain no information, so we drop them
binary_data.drop(binary_data.iloc[:,[7,8]], axis=1, inplace=True)

sns.heatmap(binary_data.corr(), annot=True, cmap='Blues')
plt.show()
```


```
plt.pie(x=binary_data['Output (S)'].value_counts(), labels=['No
Fault', 'Fault'],
        explode = [0, 0.2],autopct= '%1.1f%%', colors=['r', 'g'])
plt.show()
```



Model Building - Binary Classifier

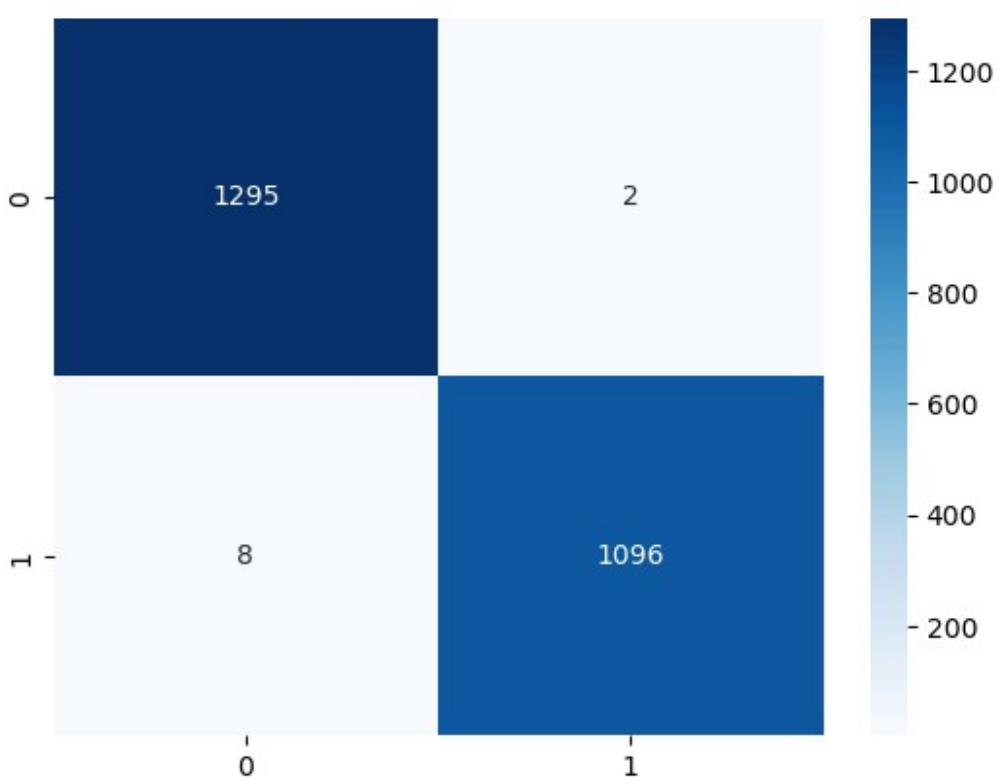
```
y = binary_data.iloc[:,0]
X = binary_data.iloc[:,1:7]

X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.20, random_state=1)
X_train.shape, X_test.shape, y_train.shape, y_test.shape
```

```
((9600, 6), (2401, 6), (9600,), (2401,))
```

```
### import libraries
#### decision tree - to solve classification problems and categorize
objects depending on their learning features.

from sklearn.tree import DecisionTreeClassifier

model = DecisionTreeClassifier()

model.fit(X_train, y_train)
```

```
DecisionTreeClassifier()
```

```
y_pred = model.predict(X_test)

sns.heatmap(confusion_matrix(y_test, y_pred), annot=True,
cmap='Blues', fmt='.4g')
plt.show()
```




```
print(f'Accuracy Score: {accuracy_score(y_test, y_pred)*100:.03f}%')
print(f'Precision Score: {precision_score(y_test, y_pred)*100:.03f}%')
print(f'Recall Score: {recall_score(y_test, y_pred)*100:.03f}%')
```

```
Accuracy Score: 99.584%
Precision Score: 99.818%
Recall Score: 99.275%
```

```
### check fit of the model

new_data = {
    'Ia': [-120],
    'Ib': [90],
    'Ic':[30],
    'Va':[-0.9],
    'Vb':[0.5],
    'Vc':[0.4]
}

# Convert new data to DataFrame
new_df = pd.DataFrame(new_data)

y = model.predict(new_df)

# Display the predicted budget class
print("Fault occured:(0-No , 1:Y): ", y[0])
```

```
Fault occured:(0-No , 1:Y):  0
```

```
### check fit of the model
### check fit of the model
##286.5347198,61.598669,-46.89645534,-0.376998625,0.473361332,-
0.096362707,,
new_data = {
    'Ia': [286.5347198],
    'Ib': [61.598669],
    'Ic':[-46.89645534],
    'Va':[-0.376998625],
    'Vb':[0.473361332],
    'Vc':[-0.096362707]
}

# Convert new data to DataFrame
new_df = pd.DataFrame(new_data)

y = model.predict(new_df)

# Display the predicted budget class
print("Fault occured:(0-No , 1:Y): ", y[0])
```

```
Fault occured:(0-No , 1:Y):  1
```