In [3]:
```
#TASK1
import pandas as pd
data = pd.read_csv("titanic.csv")
print(data.head())
```

```
   PassengerId  Survived  Pclass  \
0            1         0       3
1            2         1       1
2            3         1       3
3            4         1       1
4            5         0       3

                                                Name     Sex   Age  SibSp  \
0                            Braund, Mr. Owen Harris    male  22.0      1
1  Cumings, Mrs. John Bradley (Florence Briggs Th...  female  38.0      1
2                             Heikkinen, Miss. Laina  female  26.0      0
3       Futrelle, Mrs. Jacques Heath (Lily May Peel)  female  35.0      1
4                           Allen, Mr. William Henry    male  35.0      0

   Parch            Ticket     Fare Cabin Embarked
0      0         A/5 21171   7.2500   NaN        S
1      0          PC 17599  71.2833   C85        C
2      0  STON/O2. 3101282   7.9250   NaN        S
3      0            113803  53.1000  C123        S
4      0            373450   8.0500   NaN        S
```

In [5]:
```
import pandas as pd
data = pd.read_csv('titanic.csv')
print(data.isnull().sum())
```

```
PassengerId      0
Survived         0
Pclass           0
Name             0
Sex              0
Age            177
SibSp            0
Parch            0
Ticket           0
Fare             0
Cabin          687
Embarked         2
dtype: int64
```

In [9]:
```
import pandas as pd
data = pd.read_csv('titanic.csv')
print(data.select_dtypes(include='object').columns)
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
data['Sex'] = le.fit_transform(data['Sex'])
data = pd.get_dummies(data, columns=['Embarked'], drop_first=True)
print(data.head())
```

```
Index(['Name', 'Sex', 'Ticket', 'Cabin', 'Embarked'], dtype='object')
   PassengerId  Survived  Pclass  \
0            1         0       3
1            2         1       1
2            3         1       3
3            4         1       1
4            5         0       3

                                                Name  Sex   Age  SibSp  Parch  \
0                            Braund, Mr. Owen Harris    1  22.0      1      0
1  Cumings, Mrs. John Bradley (Florence Briggs Th...    0  38.0      1      0
2                             Heikkinen, Miss. Laina    0  26.0      0      0
3       Futrelle, Mrs. Jacques Heath (Lily May Peel)    0  35.0      1      0
4                           Allen, Mr. William Henry    1  35.0      0      0

             Ticket     Fare Cabin  Embarked_Q  Embarked_S
0         A/5 21171   7.2500   NaN       False        True
1          PC 17599  71.2833   C85       False       False
2  STON/O2. 3101282   7.9250   NaN       False        True
3            113803  53.1000  C123       False        True
4            373450   8.0500   NaN       False        True
```

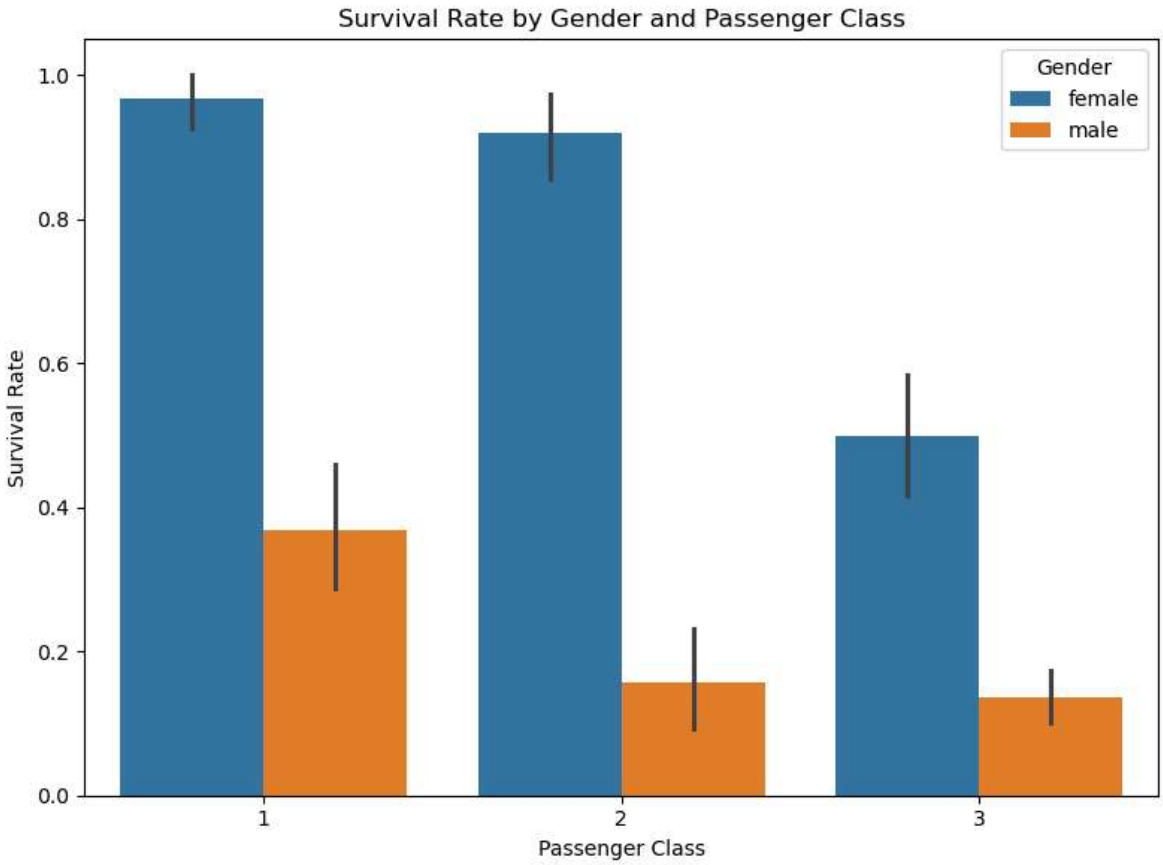
In [11]:
```
import pandas as pd
data = pd.read_csv('titanic.csv')
data.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'], axis=1, inplace=True)

print(data.head())
print(data.columns)
```

```
   Survived  Pclass     Sex   Age  SibSp  Parch     Fare Embarked
0         0       3    male  22.0      1      0   7.2500        S
1         1       1  female  38.0      1      0  71.2833        C
2         1       3  female  26.0      0      0   7.9250        S
3         1       1  female  35.0      1      0  53.1000        S
4         0       3    male  35.0      0      0   8.0500        S
Index(['Survived', 'Pclass', 'Sex', 'Age', 'SibSp', 'Parch', 'Fare',
       'Embarked'],
      dtype='object')
```

In [12]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
data = pd.read_csv('titanic.csv')
plt.figure(figsize=(8, 6))
sns.barplot(data=data, x='Pclass', y='Survived', hue='Sex')

plt.title('Survival Rate by Gender and Passenger Class')
plt.xlabel('Passenger Class')
plt.ylabel('Survival Rate')
plt.legend(title='Gender')
plt.tight_layout()
plt.show()
```



In [13]:
```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier, plot_tree
import matplotlib.pyplot as plt

data = pd.read_csv('titanic.csv')

data.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'], axis=1, inplace=True)

data['Age'].fillna(data['Age'].median(), inplace=True)
data['Embarked'].fillna(data['Embarked'].mode()[0], inplace=True)

data = pd.get_dummies(data, columns=['Sex', 'Embarked'], drop_first=True)

X = data.drop('Survived', axis=1)
y = data['Survived']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_

clf = DecisionTreeClassifier(max_depth=4, random_state=42)
clf.fit(X_train, y_train)

plt.figure(figsize=(15, 8))
plot_tree(clf, feature_names=X.columns, class_names=['Not Survived', 'Survived']
          filled=True, rounded=True)
plt.title("Decision Tree - Titanic Survival")
plt.show()
```

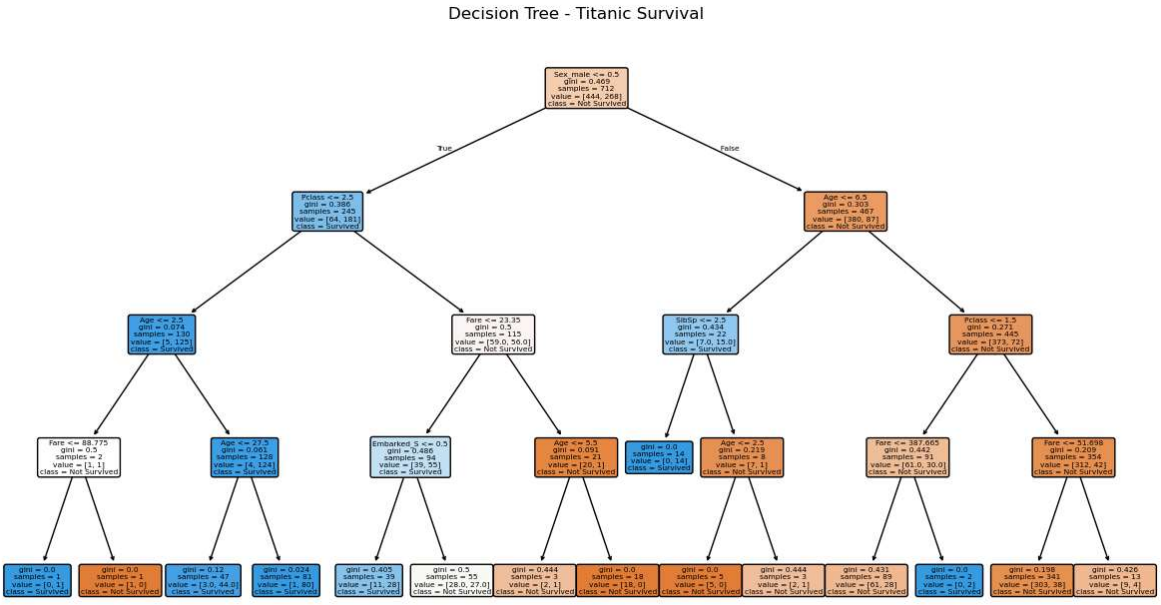
```
C:\Users\india\AppData\Local\Temp\ipykernel_16172\3103371379.py:10: FutureWarnin
g: A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  data['Age'].fillna(data['Age'].median(), inplace=True)
C:\Users\india\AppData\Local\Temp\ipykernel_16172\3103371379.py:11: FutureWarnin
g: A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  data['Embarked'].fillna(data['Embarked'].mode()[0], inplace=True)
```



In [14]:

```python
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score

df = pd.read_csv('titanic.csv')
df = df.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'], axis=1)
df['Age'].fillna(df['Age'].median(), inplace=True)
df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
df = pd.get_dummies(df, columns=['Sex', 'Embarked'], drop_first=True)

X = df.drop('Survived', axis=1)
```

```
y = df['Survived']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_

dt = DecisionTreeClassifier()
dt.fit(X_train, y_train)
dt_acc = accuracy_score(y_test, dt.predict(X_test))

rf = RandomForestClassifier()
rf.fit(X_train, y_train)
rf_acc = accuracy_score(y_test, rf.predict(X_test))

print("Decision Tree Accuracy:", dt_acc)
print("Random Forest Accuracy:", rf_acc)
```

```
C:\Users\india\AppData\Local\Temp\ipykernel_16172\4070511187.py:9: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Age'].fillna(df['Age'].median(), inplace=True)
C:\Users\india\AppData\Local\Temp\ipykernel_16172\4070511187.py:10: FutureWarnin
g: A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
Decision Tree Accuracy: 0.7821229050279329
Random Forest Accuracy: 0.8212290502793296
```

In [18]:

```
import pandas as pd
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score

df = pd.read_csv('titanic.csv')

df.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'], axis=1, inplace=True)

df['Age'].fillna(df['Age'].median(), inplace=True)
df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)

df = pd.get_dummies(df, columns=['Sex', 'Embarked'], drop_first=True)

X = df.drop('Survived', axis=1)
y = df['Survived']
```

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_

rf = RandomForestClassifier(random_state=42)
param_grid = {
    'n_estimators': [50, 100, 150],
    'max_depth': [3, 5, 7],
    'min_samples_split': [2, 4],
    'min_samples_leaf': [1, 2]
}

grid_search = GridSearchCV(estimator=rf, param_grid=param_grid, cv=5, n_jobs=-1)
grid_search.fit(X_train, y_train)

best_rf = grid_search.best_estimator_
y_pred = best_rf.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)

print("Best Parameters:", grid_search.best_params_)
print("Tuned Random Forest Accuracy:", round(accuracy, 4))
```

```
C:\Users\india\AppData\Local\Temp\ipykernel_16172\255269456.py:13: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Age'].fillna(df['Age'].median(), inplace=True)
C:\Users\india\AppData\Local\Temp\ipykernel_16172\255269456.py:14: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
Best Parameters: {'max_depth': 5, 'min_samples_leaf': 1, 'min_samples_split': 2,
'n_estimators': 100}
Tuned Random Forest Accuracy: 0.8156
```

In [19]:

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report
from imblearn.over_sampling import SMOTE

df = pd.read_csv('titanic.csv')

df.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'], axis=1, inplace=True)
```

```
df['Age'].fillna(df['Age'].median(), inplace=True)
df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)

df = pd.get_dummies(df, columns=['Sex', 'Embarked'], drop_first=True)

X = df.drop('Survived', axis=1)
y = df['Survived']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_

smote = SMOTE(random_state=42)
X_resampled, y_resampled = smote.fit_resample(X_train, y_train)

model = RandomForestClassifier(random_state=42)
model.fit(X_resampled, y_resampled)

y_pred = model.predict(X_test)
print(classification_report(y_test, y_pred))
```

```
C:\Users\india\AppData\Local\Temp\ipykernel_16172\580758058.py:14: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Age'].fillna(df['Age'].median(), inplace=True)
C:\Users\india\AppData\Local\Temp\ipykernel_16172\580758058.py:15: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
              precision    recall  f1-score   support

           0       0.83      0.80      0.82       105
           1       0.73      0.77      0.75        74

    accuracy                           0.79       179
   macro avg       0.78      0.79      0.78       179
weighted avg       0.79      0.79      0.79       179
```

In [20]:
```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.ensemble import RandomForestClassifier
```

```
from sklearn.metrics import classification_report
from imblearn.over_sampling import SMOTE

df = pd.read_csv('titanic.csv')

df.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'], axis=1, inplace=True)

df['Age'].fillna(df['Age'].median(), inplace=True)
df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)

df = pd.get_dummies(df, columns=['Sex', 'Embarked'], drop_first=True)

X = df.drop('Survived', axis=1)
y = df['Survived']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_

scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

smote = SMOTE(random_state=42)
X_resampled, y_resampled = smote.fit_resample(X_train_scaled, y_train)

model = RandomForestClassifier(random_state=42)
model.fit(X_resampled, y_resampled)

y_pred = model.predict(X_test_scaled)
print(classification_report(y_test, y_pred))
```

```
C:\Users\india\AppData\Local\Temp\ipykernel_16172\1217370577.py:12: FutureWarnin
g: A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Age'].fillna(df['Age'].median(), inplace=True)
C:\Users\india\AppData\Local\Temp\ipykernel_16172\1217370577.py:13: FutureWarnin
g: A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
```

	precision	recall	f1-score	support
0	0.86	0.79	0.82	105
1	0.73	0.81	0.77	74
accuracy			0.80	179
macro avg	0.79	0.80	0.80	179
weighted avg	0.80	0.80	0.80	179

In [21]:
```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from imblearn.over_sampling import SMOTE

df = pd.read_csv('titanic.csv')

df.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'], axis=1, inplace=True)

df['Age'].fillna(df['Age'].median(), inplace=True)
df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)

df = pd.get_dummies(df, columns=['Sex', 'Embarked'], drop_first=True)

X = df.drop('Survived', axis=1)
y = df['Survived']

scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

smote = SMOTE(random_state=42)
X_resampled, y_resampled = smote.fit_resample(X_scaled, y)

pca = PCA(n_components=2)
X_pca = pca.fit_transform(X_resampled)

plt.figure(figsize=(8, 6))
plt.scatter(X_pca[:, 0], X_pca[:, 1], c=y_resampled, cmap='coolwarm', alpha=0.7)
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.title('PCA of Titanic Dataset')
plt.colorbar(label='Survived')
plt.grid(True)
plt.show()
```

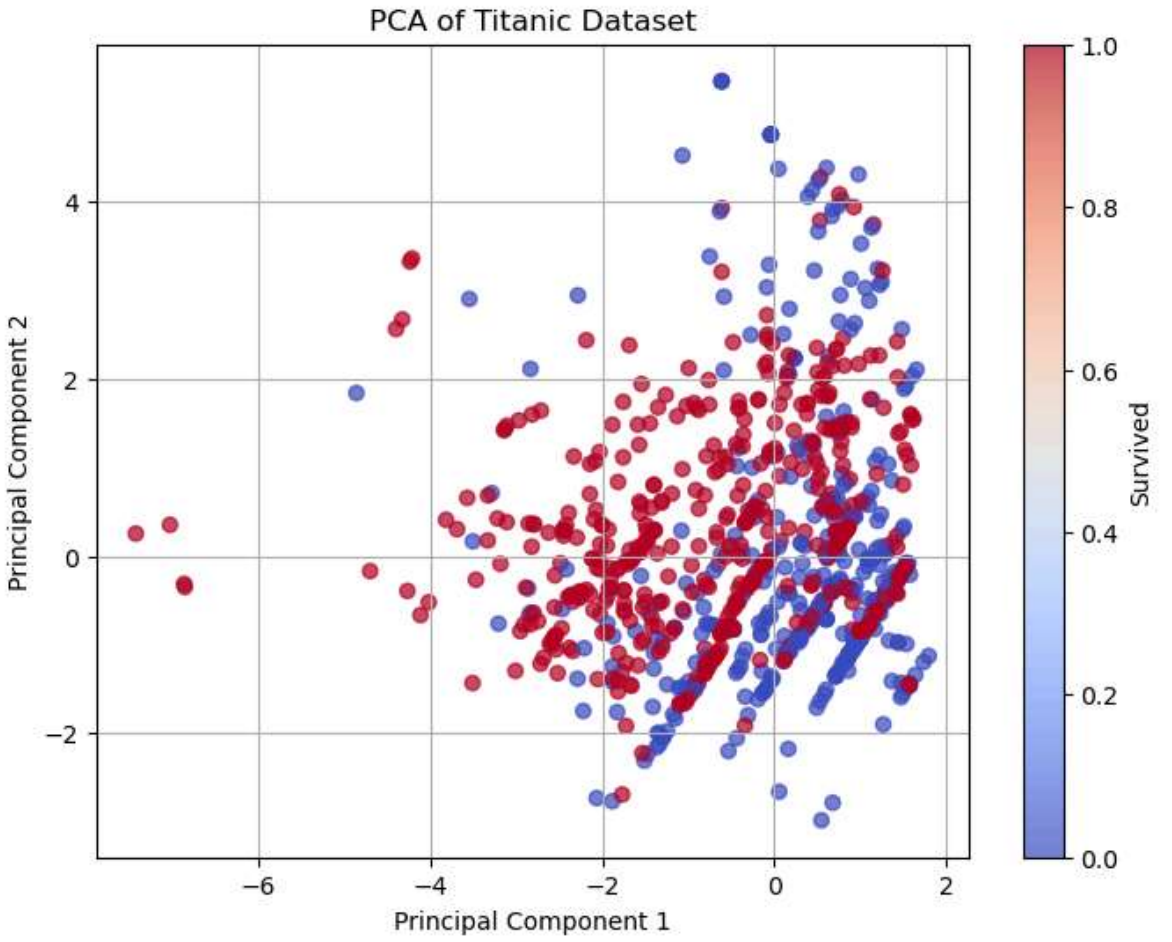
```
C:\Users\india\AppData\Local\Temp\ipykernel_16172\219313292.py:12: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Age'].fillna(df['Age'].median(), inplace=True)
C:\Users\india\AppData\Local\Temp\ipykernel_16172\219313292.py:13: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
```



In [22]:
```
import pandas as pd
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
```

```
from sklearn.metrics import accuracy_score
from imblearn.over_sampling import SMOTE
from sklearn.decomposition import PCA

df = pd.read_csv('titanic.csv')
df.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'], axis=1, inplace=True)
df['Age'].fillna(df['Age'].median(), inplace=True)
df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
df = pd.get_dummies(df, columns=['Sex', 'Embarked'], drop_first=True)

X = df.drop('Survived', axis=1)
y = df['Survived']

scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

X_train1, X_test1, y_train1, y_test1 = train_test_split(X_scaled, y, test_size=0
model1 = RandomForestClassifier(random_state=42)
model1.fit(X_train1, y_train1)
y_pred1 = model1.predict(X_test1)
acc_original = accuracy_score(y_test1, y_pred1)

smote = SMOTE(random_state=42)
X_resampled, y_resampled = smote.fit_resample(X_scaled, y)

pca = PCA(n_components=2)
X_pca = pca.fit_transform(X_resampled)

X_train2, X_test2, y_train2, y_test2 = train_test_split(X_pca, y_resampled, test
model2 = RandomForestClassifier(random_state=42)
model2.fit(X_train2, y_train2)
y_pred2 = model2.predict(X_test2)
acc_pca_smote = accuracy_score(y_test2, y_pred2)

print("Accuracy on original data: {:.2f}%".format(acc_original * 100))
print("Accuracy after PCA + SMOTE: {:.2f}%".format(acc_pca_smote * 100))
```

```
C:\Users\india\AppData\Local\Temp\ipykernel_16172\376547248.py:12: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Age'].fillna(df['Age'].median(), inplace=True)
C:\Users\india\AppData\Local\Temp\ipykernel_16172\376547248.py:13: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained as
signment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work becau
se the intermediate object on which we are setting values always behaves as a cop
y.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.meth
od({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to pe
rform the operation inplace on the original object.


  df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
Accuracy on original data: 81.56%
Accuracy after PCA + SMOTE: 72.27%
```

In [ ]: