

### 1. User Module:

- Provides the interface for users to interact with the system.
- Allows users to upload audio recordings and receive real-time predictions.

### 2. Application Module:

- Handles the backend processing of the audio data.
- Integrates the various components of the system, including data preprocessing, feature extraction, and model prediction.

## Detailed Algorithm Descriptions

### 1. Feature Extraction Using Librosa:

#### - MFCC Extraction:

```
```python
import librosa

def extract_mfcc(file_path, n_mfcc=13):
    y, sr = librosa.load(file_path)
    mfcc = librosa.feature.mfcc(y=y, sr=sr, n_mfcc=n_mfcc)
    return mfcc
```
```

#### - Chroma Feature Extraction:

```
```python
def extract_chroma(file_path):
    y, sr = librosa.load(file_path)
    chroma = librosa.feature.chroma_stft(y=y, sr=sr)
    return chroma
```
```

#### - Spectral Contrast Extraction:

```
```python
def extract_spectral_contrast(file_path):
    y, sr = librosa.load(file_path)
    spectral_contrast = librosa.feature.spectral_contrast(y=y, sr=sr)
    return spectral_contrast
```
```

### 2. Training and Tuning the SVM Model:

#### - Training the Model:

```
```python
from sklearn.svm import SVC
from sklearn.model_selection import train_test_split

def train_svm(X, y):
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
    model = SVC(kernel='rbf', C=1.0, gamma='scale')
    model.fit(X_train, y_train)
    return model, X_test, y_test
```
```