

## Stage 1 – Basic GUI

This stage will mainly include getting the basic GUI layout ready and setting it up to make sure it is easy to add new sections.

### Design

#### Algorithms

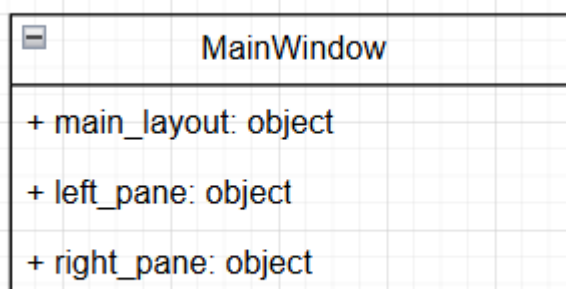
Algorithm	Explanation/Justification
MainWindow Horizontal layout Two panes LeftPane – tabbed layout RightPane – vertical layout	Main logic for the layout. The main window is split into two horizontal panes, where the left one will contain multiple sections that the user can switch between with a tab bar, and the right pane will always show a now playing window with widgets mostly added vertically.

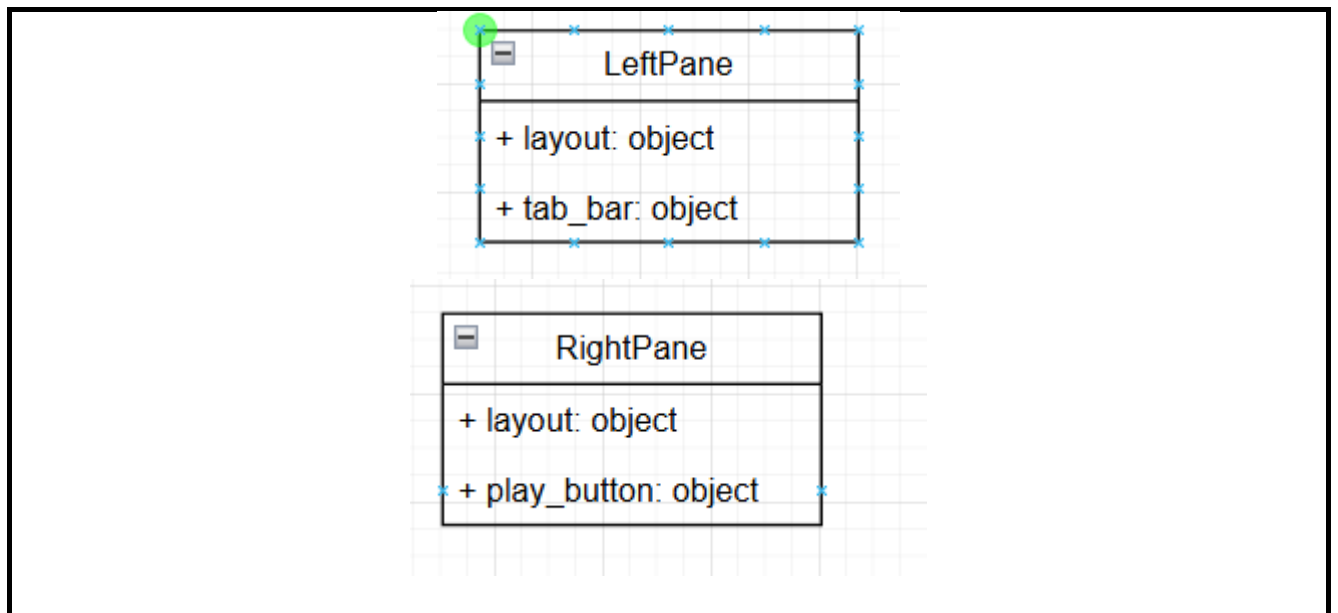
#### Data Dictionary

Variable	Type	Explanation/Justification
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No important variables at this stage as at this point I am mostly only working with objects included in the GUI library, PySide6.

#### Class Diagrams





Develop	
Screenshot	Explanation/Justification
<pre> from PySide6.QtWidgets import QApplication, QPushButton, QMainWindow, QWidget, QHBoxLayout, QVBoxLayout, QStackedLayout  # Usage: BHASVIC-willmoore24 class MainWindow(QMainWindow):     # BHASVIC-willmoore24     def __init__(self):         super().__init__()          self.setWindowTitle("Music Player")          layout = QHBoxLayout()          self.play_button = QPushButton("Paused")         self.play_button.setCheckable(True)         self.play_button.clicked.connect(self.play_pause)          layout.addWidget(self.play_button)          widget = QWidget()         widget.setLayout(layout)         self.setCentralWidget(widget)  # Usage: BHASVIC-willmoore24 def play_pause(self, checked):     if checked == True:         self.play_button.setText("Playing")     else:         self.play_button.setText("Paused")  app = QApplication([]) window = MainWindow() window.show() app.exec() </pre>	<p>MainWindow class will have other widgets included in it. Originally planned to include most widgets in the MainWindow class, but this was changed later. Used the PySide6 docs to find the necessary widgets.</p> <p><a href="https://doc.qt.io/qtforpython-6/PySide6/QtWidgets/index.html">https://doc.qt.io/qtforpython-6/PySide6/QtWidgets/index.html</a></p>
	<p>Simple play button. I added this here as I was originally planning on creating the music playing functionality in this stage, but as I was coding this, I realised it would</p>

## Playing

be beneficial to have the library coded first, so the rest of the now playing section will come later.

<https://www.pythonguis.com/pyside6-tutorial/>

```
self.play_button = QPushButton("Paused")
self.play_button.setCheckable(True) # button can be toggled
self.play_button.clicked.connect(self.play_pause)

def play_pause(self, checked):
    if checked:
        self.play_button.setText("Playing")
    else:
        self.play_button.setText("Paused")
```

```
main.py
12 class LeftPane(QMainWindow):
13     def __init__(self):
14         super().__init__()
15         layout = QVBoxLayout()
16
17         self.tab_bar = QTabWidget()
18         self.tab_bar.addTab(Library(), "Library")
19         self.tab_bar.addTab(NowPlaying(), "Now Playing")
20
21         layout.addWidget(self.tab_bar)
22
23         widget = QWidget()
24         widget.setLayout(layout)
25         self.setCentralWidget(widget)
26
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30
31 class Library(QMainWindow):
32     def __init__(self):
33         super().__init__()
34
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39 class NowPlaying(QMainWindow):
40     def __init__(self):
41         super().__init__()
42         layout = QVBoxLayout()
43
44         self.play_button = QPushButton("Paused")
45         self.play_button.setCheckable(True) # button can be toggled
46         self.play_button.clicked.connect(self.play_pause)
47
48         layout.addWidget(self.play_button)
49
50         widget = QWidget()
51         widget.setLayout(layout)
52         self.setCentralWidget(widget)
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54     def play_pause(self, checked):
55         if checked:
56             self.play_button.setText("Playing")
57         else:
58             self.play_button.setText("Paused")
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64 app = QApplication([])
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```
class MainWindow(QMainWindow):
    def __init__(self):
        super().__init__()

        self.setWindowTitle("Music Player")

        main_layout = QHBoxLayout() # main layout w
        left_pane = LeftPane()
        right_pane = NowPlaying()

        main_layout.addWidget(left_pane)
        main_layout.addWidget(right_pane)

        widget = QWidget()
        widget.setLayout(main_layout)
        self.setCentralWidget(widget)
```

Using a horizontal layout (QHBoxLayout) allows for the two panes, where each individual pane will contain nested widgets.

<https://www.pythonguis.com/tutorials/pyside6-layouts/>

```
class RightPane(QMainWindow):
    """BHASVIC-willmoore24 +1"""
    def __init__(self):
        super().__init__()
        layout = QVBoxLayout()

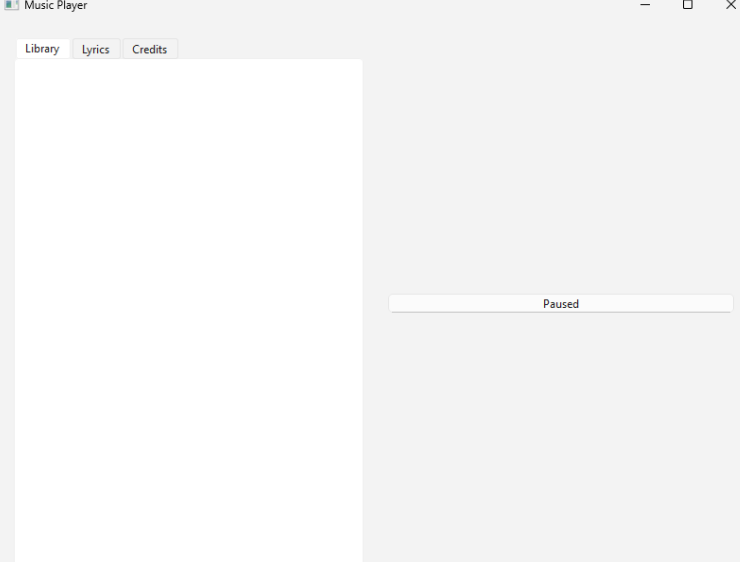
        self.play_button = QPushButton("Paused")
        self.play_button.setCheckable(True) # button can be toggled
        self.play_button.clicked.connect(self.play_pause)

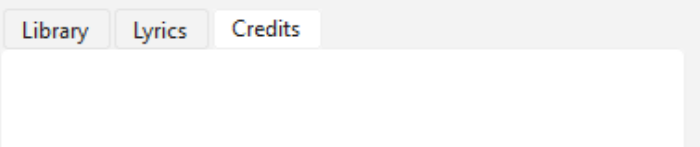
        layout.addWidget(self.play_button)

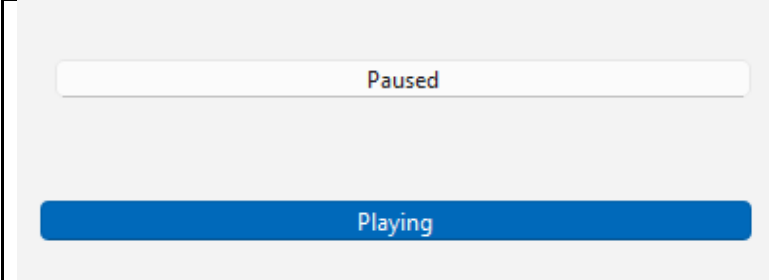
        widget = QWidget()
        widget.setLayout(layout)
        self.setCentralWidget(widget)

1 usage """BHASVIC-willmoore24 +1"""
def play_pause(self, checked):
    if checked:
        self.play_button.setText("Playing")
    else:
        self.play_button.setText("Paused")
```

RightPane class for showing currently playing. At the moment, this section will not contain too many different widgets so should be easy to fit all into this class, but in the future I may move widgets such as 'play\_button' into their own class.

<pre> class LeftPane(QMainWindow):     """Will +1"""     def __init__(self):         super().__init__()         layout = QVBoxLayout()          self.tab_bar = QTabWidget()         self.tab_bar.addTab(Library(), "Library")         self.tab_bar.addTab(Lyrics(), "Lyrics")         self.tab_bar.addTab(Credits(), "Credits")          layout.addWidget(self.tab_bar)          widget = QWidget()         widget.setLayout(layout)         self.setCentralWidget(widget) </pre>	<p>For the left pane I have used the tab bar included in Qt which allows the user to switch between widgets using tabs at the top of the window. This is easy to add new widgets, as I just write the section as a new class and add the tab with <code>self.tab_bar.addTab(&lt;object&gt;, name)</code>.</p>
	<p>This is what the program looks like at the end of stage one.</p> <p>On the left, a simple area that each section can be added to easily and switched between with the tab bar.</p> <p>On the right, space for showing currently playing, and a play/pause button.</p> <p>This is a basic frame of what the GUI will look like by the end, but the layout is mostly correct, and it will be easy to add to as new features are added.</p>

Testing	
Test Description	Evidence
At the moment, tests are quite simple; ensure the layout is correct visually, and all the buttons do what they are supposed to.	
	<p>Tab buttons work fine, as I add widgets this will allow me to switch between</p>

	<p>Play button text updates correctly when clicked. Toggles on and off</p>
---	--

Review
<p>So far in stage 1, I have created the main layout for the rest of the program. I have used classes to ensure it is easy to add new sections/features without majorly restructuring code, and sections can be reused if needed. In the future, should be easy to add colours/styling but for now the default white is fine. The simple layout should be easy for the user to use.</p>

## Stage 2.1 – Scan folders

Originally, stage 2 was to create the library management system. On starting this, I realised that my original plan for stage 2 was too large as there was a lot of functionality that needed to be coded first, that the library and later stages are based on.

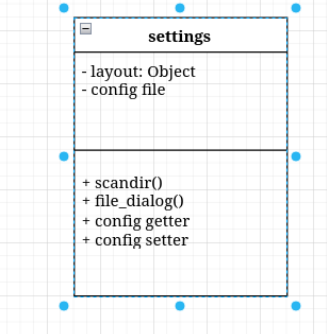
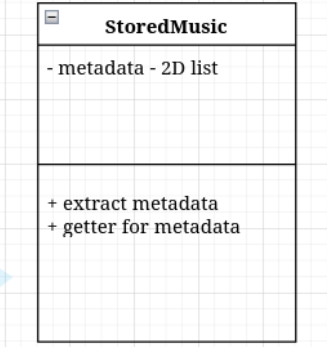
Because of this, I have split stage 2 into two sections, where the first section will be for the necessary algorithms to scan a selected directory and read track metadata, which will be used in most of the other stages later. The second section will be focussed on the library specifically.

## Design

Algorithms	
Algorithm	Explanation

<pre> graph TD     Start([Start]) --&gt; Input[/Input path - as parameter/]     Input --&gt; Decision{Look at next file in path - is it a file, or directory?}     Decision -- "Yes, file" --&gt; Add[/Add file path to list/]     Add --&gt; Decision     Decision -- "No, directory" --&gt; Decision   </pre>	<p><b>Scanning directory algorithm</b></p> <p>Initial path entered</p> <p>Looks at each entry in the directory</p> <p>If it is a file, add the path name to a list – this list can then be analysed later to get the metadata, but for the moment just the path works</p> <p>If it is a folder, run the same algorithm, using the path of this folder</p> <p>End when no more items left</p>
<pre> graph TD     Start([Start]) --&gt; Decision{Is it a music file (mp3, flac)?}     Decision -- No --&gt; NotMusic[Not a music file; do nothing?]     NotMusic --&gt; End([End])     Decision -- Yes --&gt; UseMutagen[Use Mutagen library for the right type of music file]     UseMutagen --&gt; AddData[/Add correct data to list/]     AddData --&gt; End   </pre>	<p>After scanning music directory, need to extract metadata from each file.</p> <p>Need to ensure it is only music files (e.g. an image, video or text file would not work)</p> <p>If it is not a music file – at the moment I will likely just skip over the file, as the program does not need to worry about other files. I could add a warning to the user that the file is not a music file</p>

Data Dictionary & Class Diagrams		
Variable	Type	Explanation
Stored music metadata 2D list structure [ path, artist, album, title, track number, date, genre, length ] ]	2D list	Structure for the 2D list for storing metadata Each individual list contains all the information relating to one music file
Class Diagrams		

		<p>Settings class diagram – main methods include scanning directory, file picker window and editing the config file</p>
		<p>StoredMusic class diagram Unsure of every method that I will include at the moment, but the main purpose of this class is to extract metadata from a file and store it in a 2D list</p>

Develop	
Screenshot	Explanation/Justification
<pre> directory = "Music/"  song_paths = []  1 usage new * def listdir(path):     dir = os.listdir(path)     for i in dir:         if i.is_dir:             listdir(i)         else:             song_paths.append(i)  print(song_paths) </pre> <p>AttributeError: 'str' object has no attribute 'is_dir'</p>	<p>Trying to write an algorithm to retrieve the paths of all music files in a directory, and all subdirectories within.</p> <p>I used the 'os' library.</p> <p>Initially, I was using 'os.listdir(&lt;path&gt;)' which returns a string of each item in the directory. This was causing problems as the 'is_dir' function does not work on strings, which listdir() returns, so I switched to 'os.scandir()', where I can check if the return value is a directory or not.</p>



```
def scandir(path):
    current_dir = os.scandir(path)
    for i in current_dir:
        if i.is_dir():
            scandir(i.path)
        else:
            song_paths.append(f"{i.path}")

directory = "Music/"

song_paths = []

scandir(directory)

print(song_paths[0])
```

‘scandir(path)’ procedure recursively scans every file in a directory, and if it is a file adds a string of the path to the song\_paths list. If it scans a directory, it will then apply itself to all items in that directory. Will continue until all items in main directory scanned.

Music/Elliott Smith\Either\_Or\01 - speed trials.flac

```
from mutagen import (
    flac,
)
test = flac.FLAC(song_paths[0])
print(test["ARTIST"])
['Elliott Smith']
```

Using the ‘Mutagen’ Python library makes it easy to read metadata tags from files.

This will be used for displaying in the program, as part of the library and now playing sections, and will also be helpful for API calls in the future.

<https://www.geeksforgeeks.org/python/extract-and-add-flac-audio-metadata-using-the-mutagen-module-in-python/>

```
def file_dialog(self):
    directory = QFileDialog.getExistingDirectory(self, "Choose directory")
    if directory:
        self.current_dir_text.setText(f"{directory}")
        self.scandir(directory)
        print(self.song_paths)

choose_dir = QPushButton("Select Music Folder")
choose_dir.clicked.connect(self.file_dialog)
self.current_dir_text = QLineEdit()
```

I needed to add a way for the user to select the directory of their stored music. Initially, I planned to just have the user type the path into a text box, but on reading the pyqt docs, I found that PySide6 includes a file picker widget.

<https://doc.qt.io/qtforpython-6/PySide6/QtWidgets/QFileDialog.html>

```

1  settings.py
2  import configparser
3
4  class Settings:
5      def __init__(self):
6          self.config = configparser.ConfigParser()
7
8      def get(self, section, setting):
9          self.config.read("config.ini")
10         value = self.config.get(section, setting)
11         return value
12
13     def set(self, section, setting, value):
14         self.config.set(section, setting, value)
15
16     def add(self, section, setting, value):
17         self.config[section] = {setting: value}
18

```

After adding the file picker, I realised that the user would have to select a directory every time they ran the program, so I thought it would be beneficial to create a way to store this info and any future settings (i.e. light mode vs dark mode). Created a class to handle the config. Decided to use .ini format, as it is built into the configparser standard library, and is very simple.

<https://www.w3schools.io/ini-read-write-python/>

```

1  settings.py  stored_music.py
2  from stored_music import StoredMusic
3
4  class Settings(QMainWindow):
5      def __init__(self):
6          super().__init__()
7          layout = QVBoxLayout()
8          self.stored_music = StoredMusic()
9
10         self.config = configparser.ConfigParser()
11         self.config["Directory"] = {"Folder": ""}
12
13         self.dir = self.get_conf("Directory", "Folder")
14
15         choose_dir = QPushButton("Select Music Folder")
16         choose_dir.clicked.connect(self.file_dialog)
17         self.current_dir_text = QLineEdit()
18
19         if self.dir == "":
20             self.current_dir_text.setText(self.dir)
21             self.scandir(self.dir)
22
23         layout.addWidget(self.current_dir_text)
24         layout.addWidget(choose_dir)
25
26         widget = QWidget()
27         widget.setLayout(layout)
28         self.setCentralWidget(widget)
29
30     def file_dialog(self):
31         directory = QFileDialog.getExistingDirectory(self, "Choose directory")
32         if directory:
33             self.current_dir_text.setText(directory)
34             self.set_conf("Directory", "Folder", directory)
35             self.stored_music.clear_song_paths()
36             self.scandir(directory)
37
38     def scandir(self, path):
39         current_dir = os.scandir(path)
40         for i in current_dir:
41             if i.is_dir():
42                 self.scandir(i.path)
43             else:
44                 filetype = pathlib.Path(i.path).suffix
45                 if filetype == ".file":
46                     self.stored_music.append_song_paths(f"{i.path}")
47

```

I decided to add a GUI for the settings class, which will be shown in the tab bar, and move the file picker, and directory scanning methods to this class. Also created class for storing data.

```

1  settings.py  stored_music.py
2  from mutagen import (
3      flac,
4      mp3,
5  )
6
7  class StoredMusic:
8      def __init__(self):
9          self.song_paths = []
10         self.tracks_full = [[]]
11
12         for i in range(len(self.song_paths)):
13
14
15     def append_song_paths(self, path):
16         self.song_paths.append(path)
17
18     def clear_song_paths(self):
19         self.song_paths = []
20

```

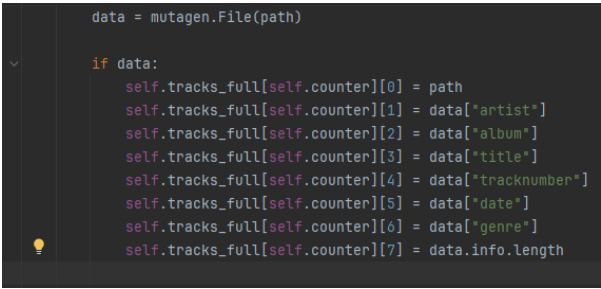
Class for storing metadata. Originally, the file picker was part of the library class, and stored data would be stored there, but when I realised that multiple classes would all require this data, having it part of the library would be inefficient.

```

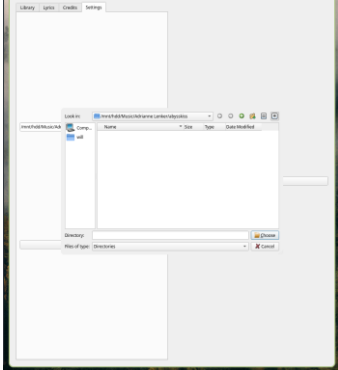

self.tracks_full = [[]]

```

Trying to decide how to store metadata. Some options were:

	<ul style="list-style-type: none"> <li>• Simple 2D Array – simplest, could be inefficient?</li> <li>• Nested dictionaries – still simple, more readable than a 2D array</li> <li>• Separate objects for each track, album or artist – more complex, unclear benefits</li> <li>• Database – most complex but also has the most benefits. A database would be the most efficient, as I would not need to re-run the algorithms over the entire directory every time the program is run. Also allows me to track things that I wouldn't want to be wiped when the program is closed e.g. play count</li> </ul> <p>In the end, I decided to stick with a 2D array and not to use a database as while it had the most benefits, I am aware of scope creep, and it would take too long/be too difficult to implement. Using a 2D list should work perfectly fine and is much easier to implement. However, it could make running the program a lot slower for larger libraries. This is because the algorithms to scan a directory and read metadata will need to be run every time the program is run. This would be fine if the user only has a few albums that need to be read, but if their library contains thousands of albums this will likely be very slow.</p>
 <pre> data = mutagen.File(path)  if data:     self.tracks_full[self.counter][0] = path     self.tracks_full[self.counter][1] = data["artist"]     self.tracks_full[self.counter][2] = data["album"]     self.tracks_full[self.counter][3] = data["title"]     self.tracks_full[self.counter][4] = data["tracknumber"]     self.tracks_full[self.counter][5] = data["date"]     self.tracks_full[self.counter][6] = data["genre"]     self.tracks_full[self.counter][7] = data.info.length </pre>	<p>Using the Mutagen library to extract metadata from file and add it to the 2D list.</p> <p>mutagen.File(path) automatically scans the file to work out the filetype (.flac, .mp3 etc.)</p> <p>If it cannot find type, or not a supported format, returns None.</p> <p>The if statement ensures that only files supported by Mutagen get their metadata read, otherwise it does nothing</p>

<pre> if data:     temp_list = [0] * 8     temp_list[0] = path     temp_list[1] = data["artist"]     temp_list[2] = data["album"]     temp_list[3] = data["title"]     temp_list[4] = data["tracknumber"]     temp_list[5] = data["date"]     temp_list[6] = data["genre"]     temp_list[7] = data.info.length      self.tracks_full.append(temp_list) </pre>	<p>However, there was a problem initially with the 2D list. I thought that the .append function wouldn't work with a 2D list, so I was using a counter variable which introduced errors with the list size. I realised that I could use the .append method, by appending an entire list, and this was a lot easier.</p> <p><a href="https://mutagen.readthedocs.io/en/latest/api/flac.html">https://mutagen.readthedocs.io/en/latest/api/flac.html</a></p>
<pre> def get_metadata(self, index, data):     return self.tracks_full[index][data] </pre>	<p>Simple getter method to return chosen metadata. Parameter 'index' will be used to select track, and 'data' for the specific data (i.e. path, artist etc.)</p>

Test		
Test Description		Evidence
Test file dialog window – Ensure it opens correctly and allows for picking a directory		 <p>Opens correctly</p>
Select folder, ensure metadata is correct and complete		 <p>* printing the contents of tracks_full shows that metadata is correct and complete</p>

Review
<p>Completed the necessary functions for scanning library and extracting metadata. Everything works correctly, with the only major issues being wanting to add more features/more complex features (e.g. a database instead of a simple list), that I decided against due to time constraints. For a large library, this could make running the program extremely slow, especially as Python is a high-level interpreted language so it will naturally run slower.</p>

