CSC 4001 Assignment 2

Automatic Melody Generator

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Requirements

Identifier	Priority	Requirement
REQ1	5	The generator could generate music automatically.
REQ2	5	The user can specify the musical style, tonality and duration.
REQ3	1	The program allows trainer to train the generation model, adjust the parameters for generations and adjust the configurations include musical style, tonality and duration.
REQ4	5	The program could export the generated music in the MIDI format.
REQ5	4	The program could export the generated music as audio file.
REQ6	2	The program allows user to create music by using numbered musical notation to generate the melody.
REQ7	3	The generator could generate music according to a piece of music.
REQ8	1	The generator could visualize the generated music.
REQ9	3	The program allows user import MIDI file.
REQ10	2	The program allows user to tag the unsatisfactory part in the generated music and regenerate.

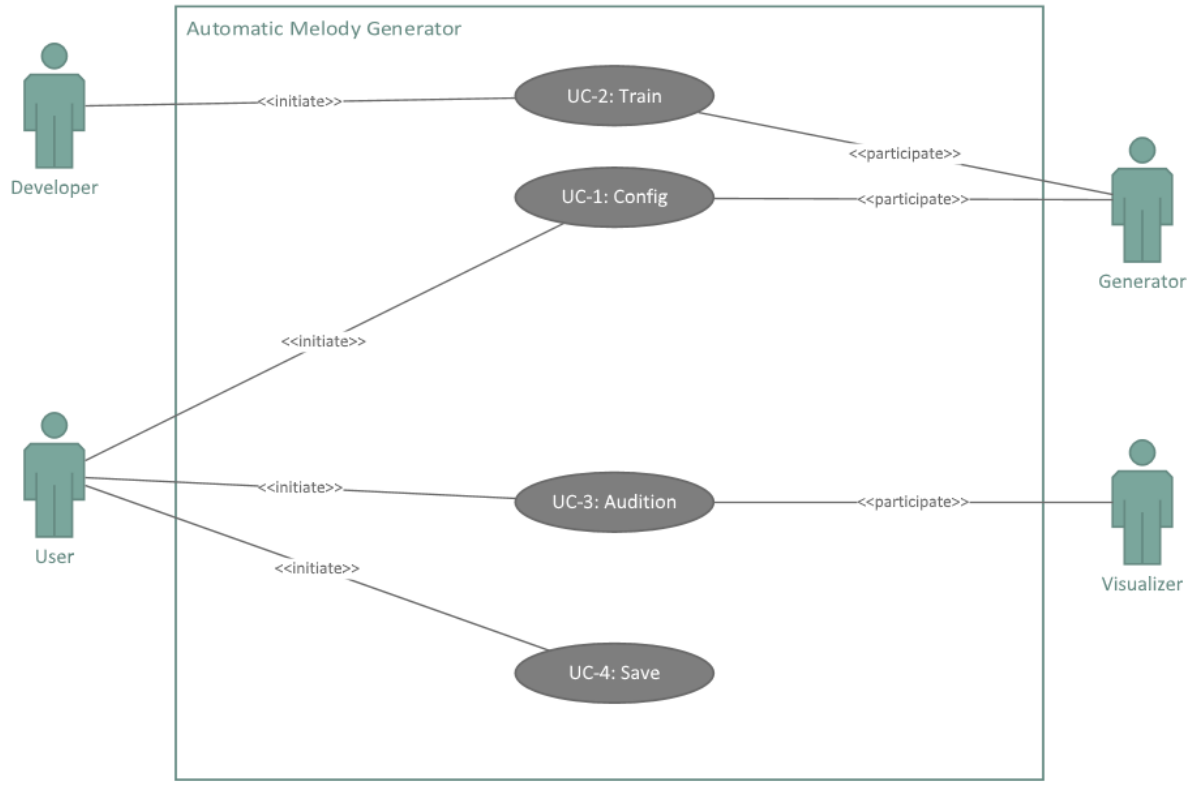
User Stories

Identifier	User Story	Size
ST-1	As a user with no music knowledge, I can generate my music in one-click operation.	4 points
ST-2	As a user with no music knowledge, I can generate music in my favorite style.	6 points
ST-3	As a user with basic music knowledge,I can generate music in my specified tornality.	7 points
ST-4	As a user with rich music knowledge, I can specify the first piece of music, and generate the whole melody with the help of the generator.	9 points
ST-5	As a user with rich music knowledge, I can audition the generated melody, mark the unsatisfactory part and let the program regenerate.	10 points
ST-6	As a trainer, I can train models, adjust the parameters and modify the configuration list.	5 points

Use Cases

Actor	Actor's Goal	Use Case Name
User	To configure the tonality and the style so as to get the generated melody. Or to specify the first piece of music to generate melody.	Config (UC-1)
Developer	To train the model based on collected MIDI files, and adjust the parameters which are used to generate the melody and be added into configuration list.	Develop (UC-2)
Generator	To generate the melody based on the configurations.	UC-1
User	To audition the generated melody and tag the unsatisfactory parts which need to be regenerated.	Audition (UC-3)
Visualizer	To visualize the generated melody, the current playing position and the tagged parts.	UC-3
User	To save the generated melody as MIDI or audio files.	Save (UC-4)
Trainer	To train the model based on collected MIDI files.	UC-2

Use Case Diagram



User Case UC-1 Config

Detailed Formula

Related Requirements: REQ1, RE2, REQ6, REQ7 & REQ9

Initiating Actor: User

Actor's Goal: To configure the tonality and the style so as to get the generated melody. Or to specify the first piece of music to generate melody.

Participating Actor: Visualizer, Generator

Preconditions: None.

Postconditions: The melody is generated according to decision the user made.

Flow of Event for Main Success Scenario:

→ 1. **User** selects the options from the tonality, duration and style lists.

→ 2. **System** (a) saves the choices made by the **User** and (b) sends the data to the **Generator** to generate music.

Flow of Events for Extensions (Alternate Scenarios):

← 1. **User** (a) clicks “Import” button to import the first piece of melody from MIDI file, or (b) notes the melody using numbered musical notations.

← 2. **Visualizer** displays the user’s input.

→ 3. **System** (a) saves the file made by the **User** and (b) sends the data to the **Generator** to generate music.

Responsibilities

Responsibility Description	Concept Name
Rs1. Accept choices that what the tonality, duration and the style to be.	Recorder
Rs2. Send the choice to Generator.	Sender
Rs3. Load the music data from MIDI file.	Loader
Rs4. Translate the MIDI data to become the numbered musical notations.	Translator
Rs5. Graphical interface allowing the user to edit the numbered musical notations.	Editor

Associations

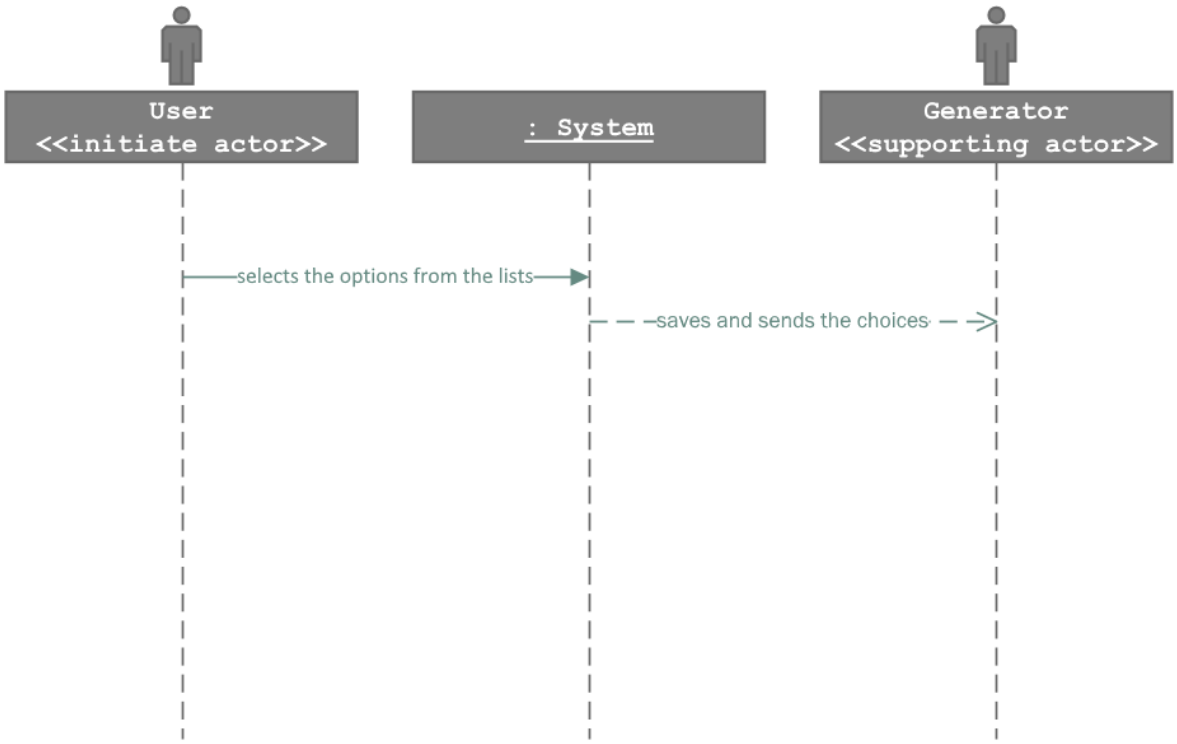
Concept Pair	Association description	Association name
Recorder↔Sender	Recorder passes the user's choice to Sender to store the data.	provides data
Loader↔Translator	Loader passes the MIDI data to Translator.	provides MIDI data
Translator↔Editor	Translator passes the musical notations to Editor.	provides musical notations
Editor↔Sender	Editor passes the final edition MIDI data to Sender.	provides data

Attributes

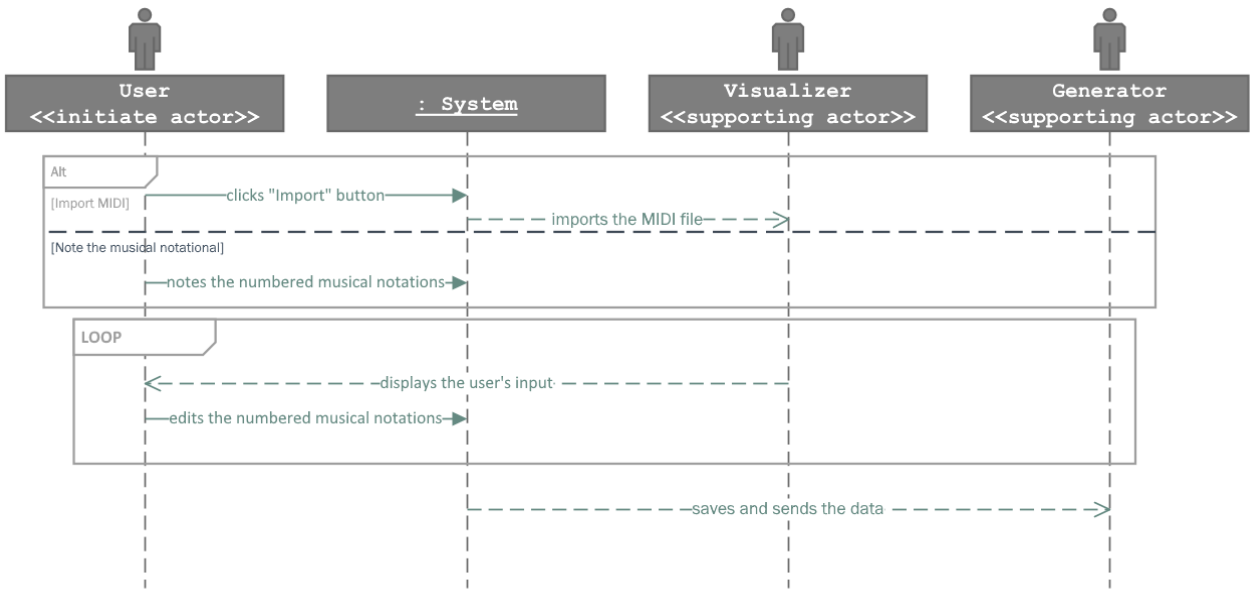
Concept	Attributes	Attribute Description
Recorder	default configuration	The possible tonality, duration and the musical style settings are defaulted.
	archiver	User's choices are archived.
Sender	pass data	The configuration is passed from Recorder to Generator.
Loader	MIDI data	MIDI data which is loaded from files.
Editor	numbered musical notations	User's noted numbered musical notations.

System Sequence Diagram

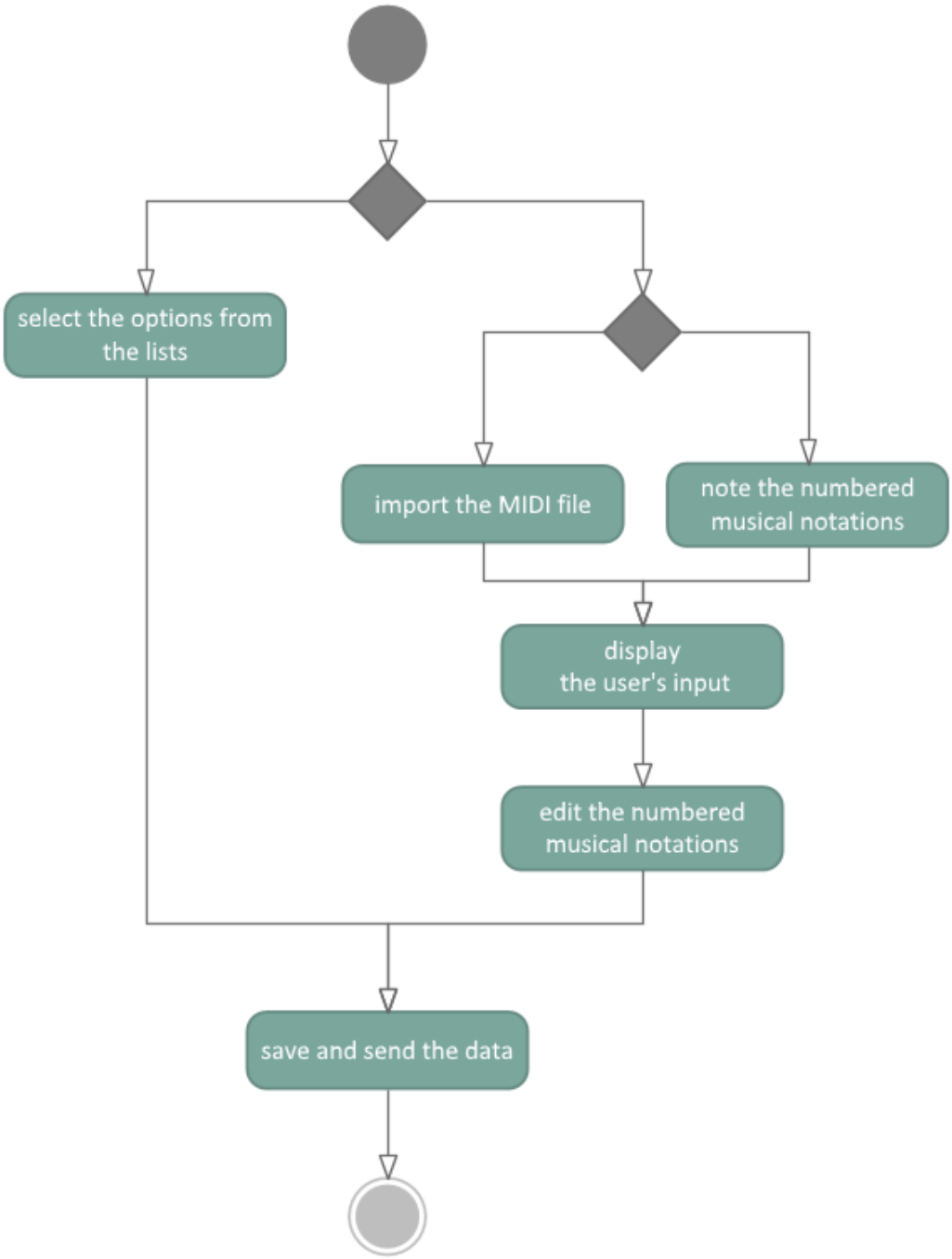
Main Success Scenario:



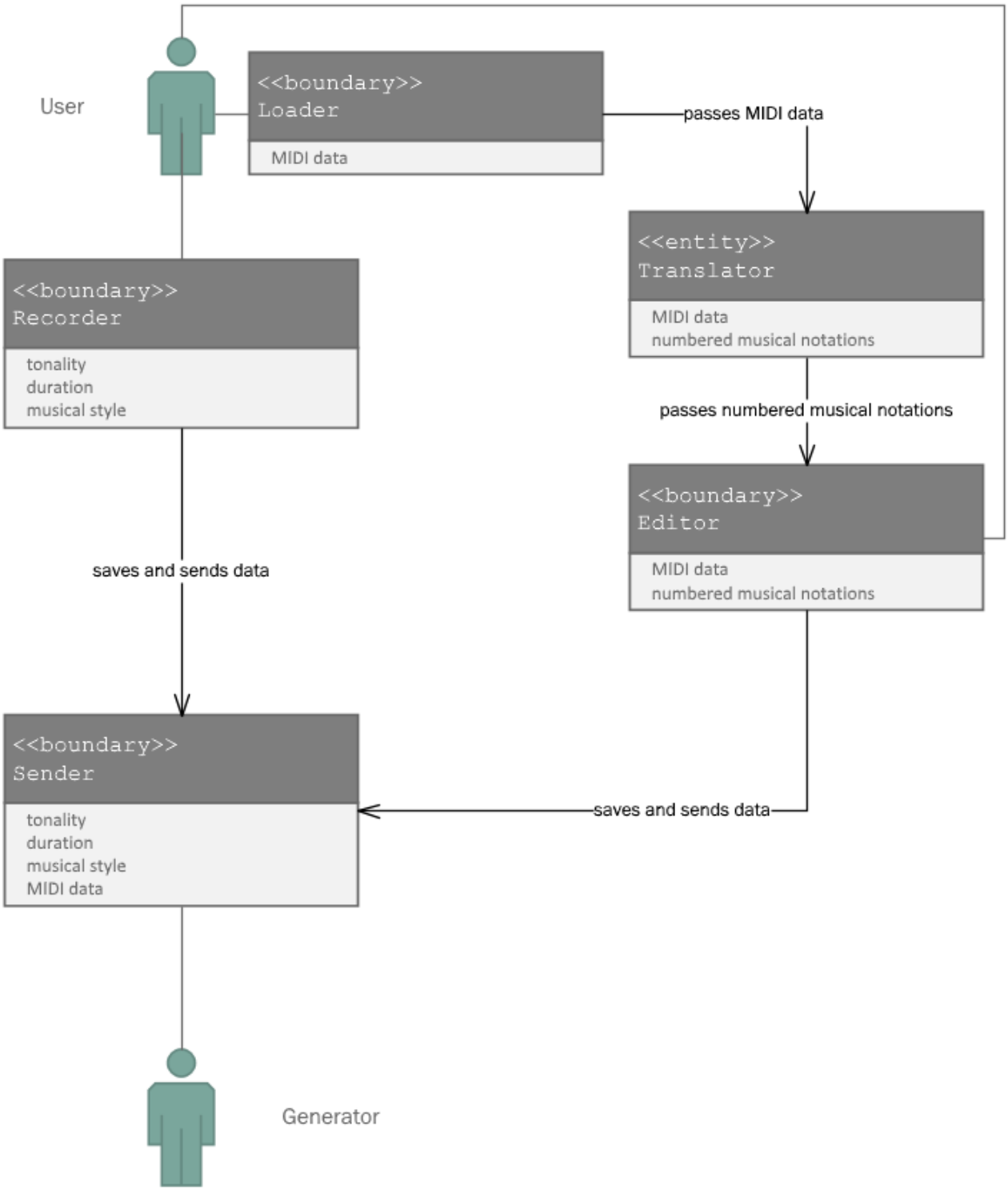
Alternative Scenario:



Activity Diagram

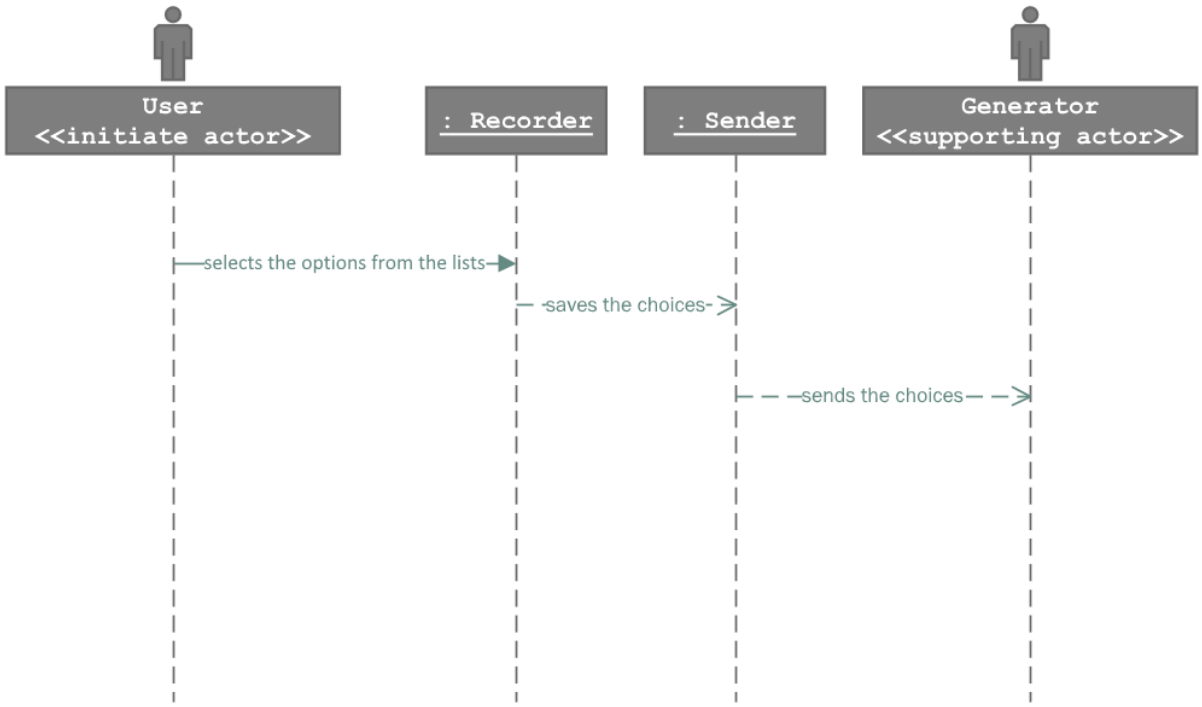


Domain model

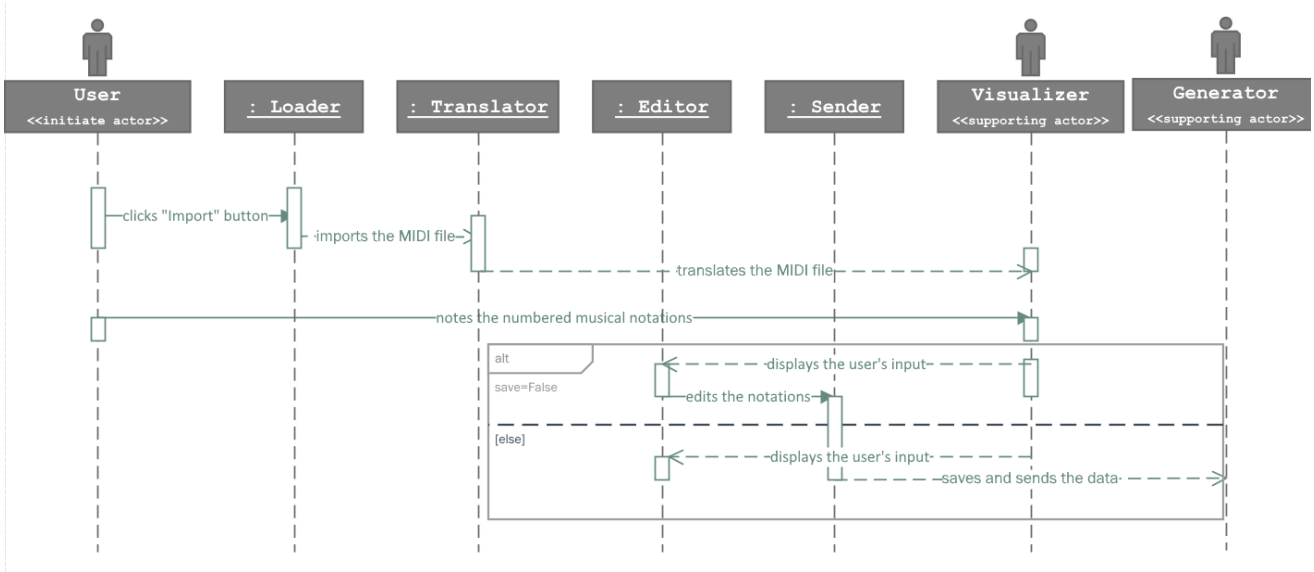


Design Sequence Diagram

Main Success Scenario:



Alternative Scenario:



User Case UC-2 Train

Detailed Formula

Related Requirements: REQ3

Initiating Actor: Developer

Actor's Goal: To train the generation model, adjust the parameters for generation and adjust the configurations including musical style, tonality and duration.

Participating Actor: Generator, Trainer

Preconditions: None.

Postconditions: The configuration list is updated.

Flow of Event for Main Success Scenario:

→ 1. **Developer** puts the MIDI files, which are used to train model, into the train set folder.

→ 2. **Developer** (a) inputs the training settings and (b) adjusts the parameters in the configuration source code.

← 3. **Trainer** (a) prints the training result, (b) generates a piece of melody for testing and (c) saves the trained model.

→ 4. **Developer** updates the configuration lists.

Flow of Events for Extensions (Alternate Scenarios):

2a. Trainer meets error during training.

← 1. **Trainer** prints the errors.

→ 2. **Developer** modifies the training settings.

2b. Generator cannot generate a test case normally.

← 1. **Generator** signals that it cannot generate the melody.

→ 2. **Developer** (a) modifies the training settings or (b) modifies the parameters in the configuration source code.

Responsibilities

Responsibility Description	Concept Name
Rs1. Receive the training settings and parameters.	Receiver
Rs2. Load the training MIDI files.	Loader
Rs3. Process the training data and adjust the model.	Processor
Rs4. Print the logs including training and generation information.	Printer
Rs5. Update the configuration lists.	Updater

Associations

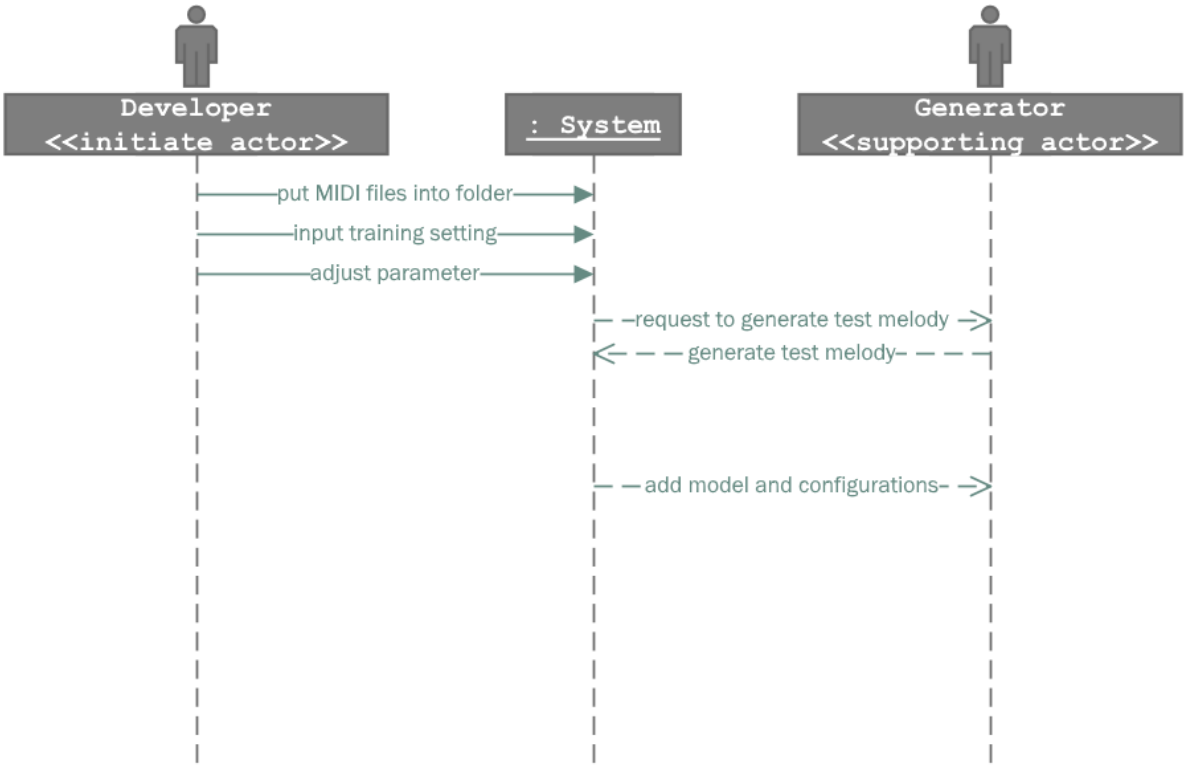
Concept Pair	Association description	Association name
Loader↔Processor	Loader passes the loaded files to Processor to process the training data.	provides training set
Receiver↔Processor	Receiver passes the received parameters and training settings to Processor to control the training process.	provides parameters
Processor↔Printer	Processor passes the information for training regeneration to the Printer.	provides training logs
Generator↔Printer	Generator passes the information for training regeneration to the Printer.	provides generation logs
Receiver↔Updater	Receiver passes the received configurations to Updater to update the configuration lists.	provides configurations

Attributes

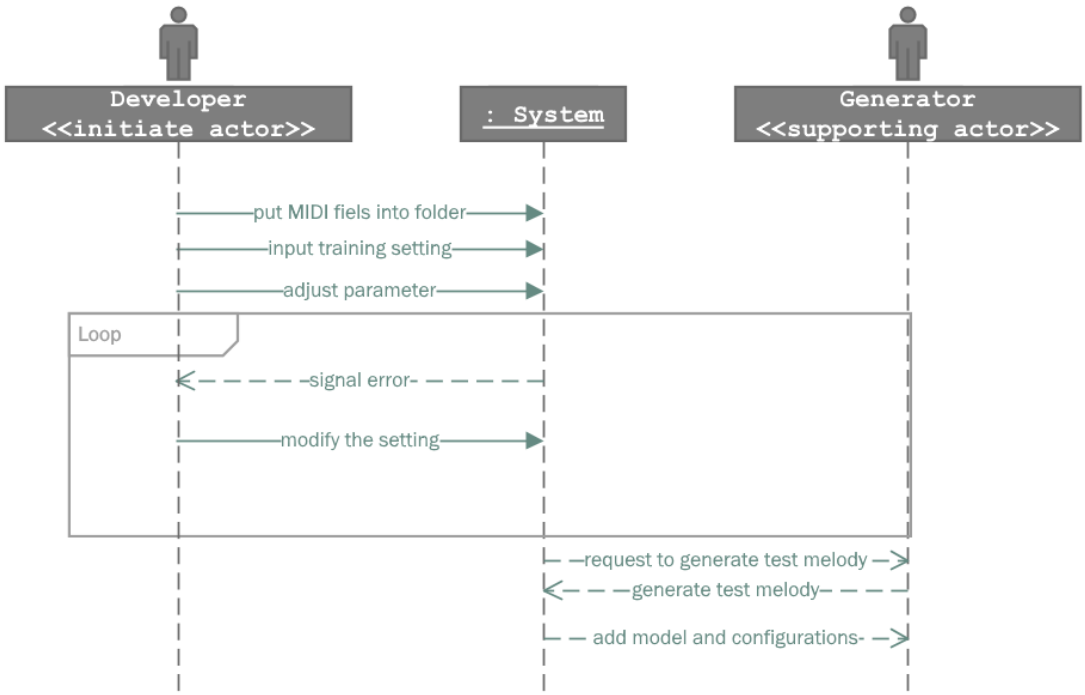
Concept	Attributes	Attribute Description
Processor	settings	The settings for training.
	training set	The training set used to train the model.
	model	The trained model used to generate melody.
Receiver	parameters	The inputted parameters.
	settings	The settings for training.
Loader	dataset	The loaded MIDI dataset.
Printer	logs	Store the logs received from Processor and Generator.
Updater	configurations	Configurations received from Receiver

System Sequence Diagram

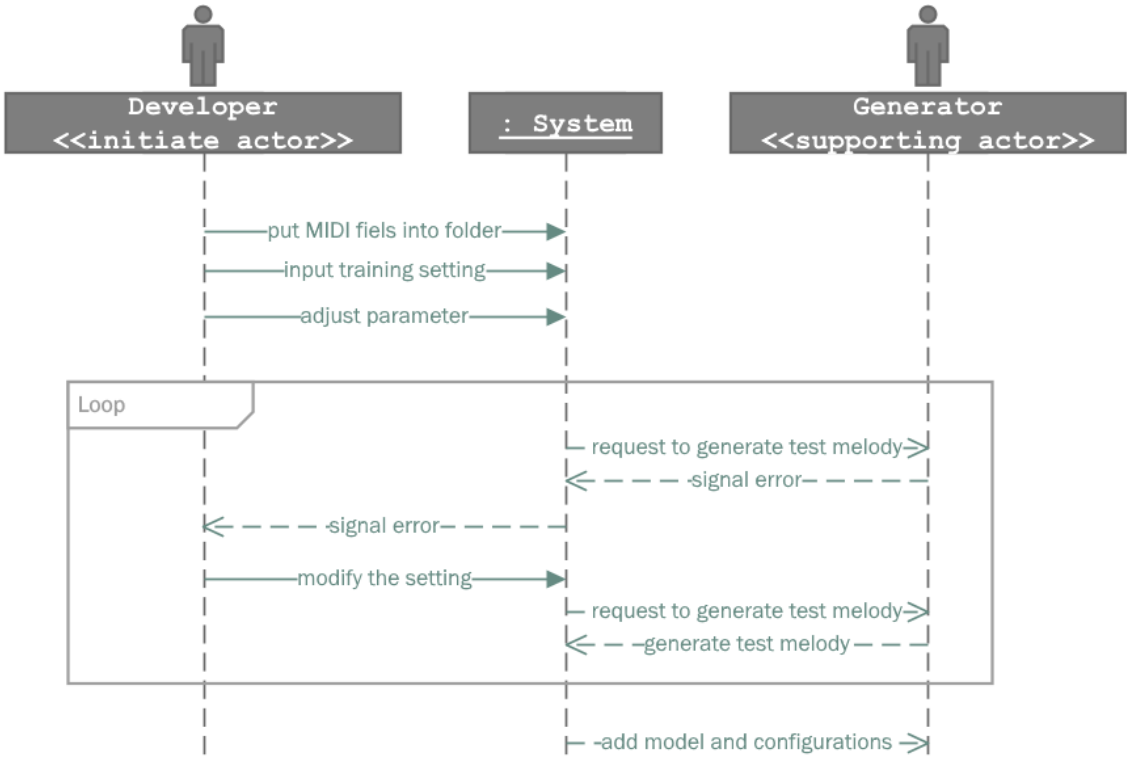
Main success scenario:



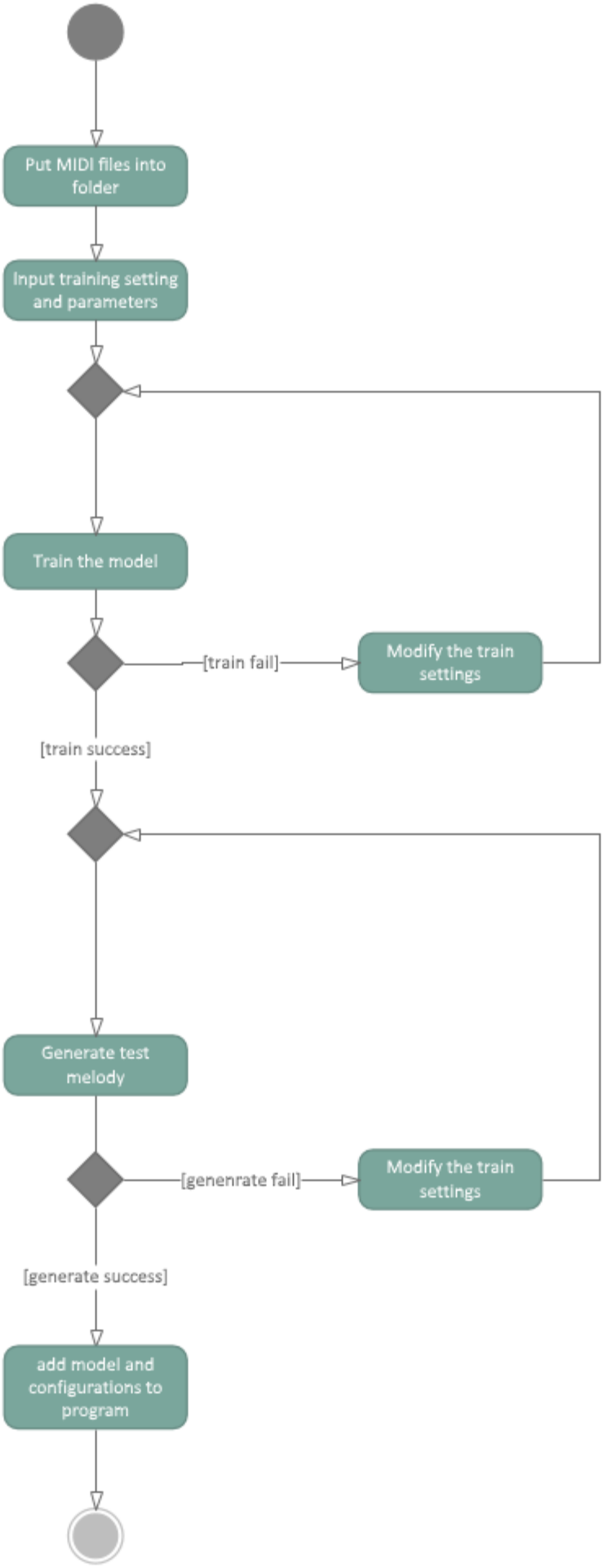
Alternative scenario (trainer meets error during training):



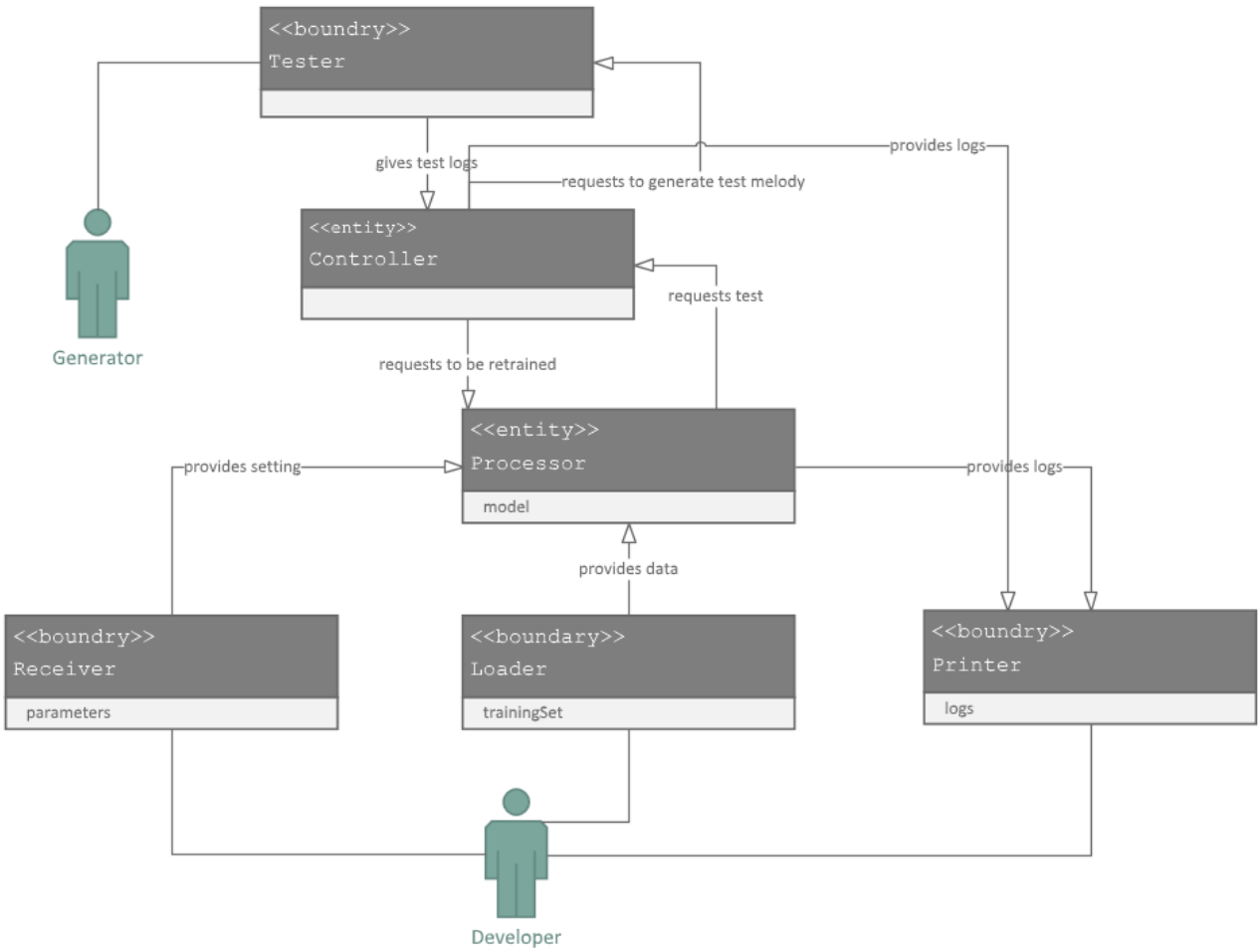
Alternative scenario (Generator cannot generate a test melody normally):



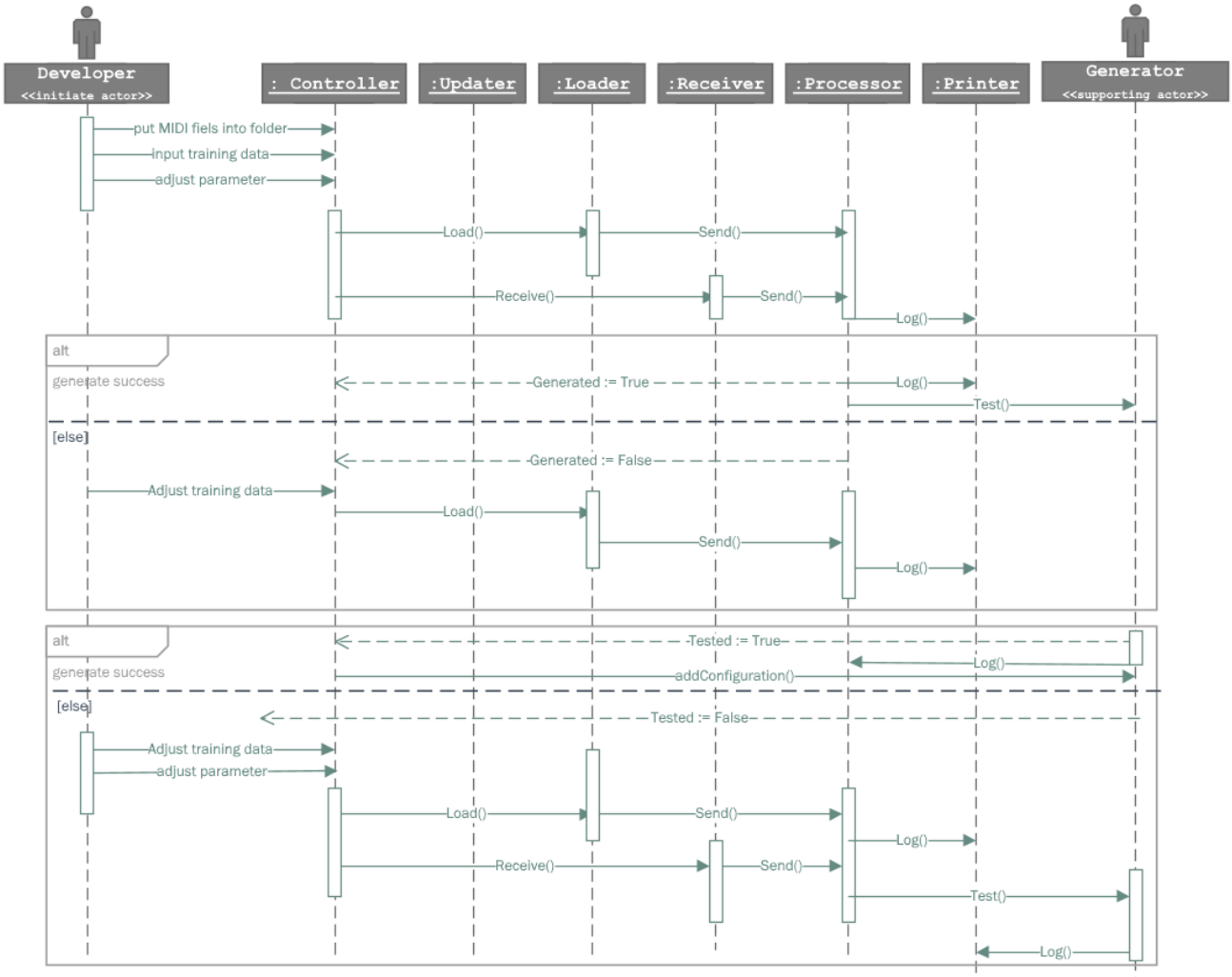
Activity Diagram


Put MIDI files into folder
Input training setting and parameters
Train the model
[train fail]
Modify the train settings
[train success]
Generate test melody
[genenrate fail]
Modify the train settings
[generate success]
add model and configurations to program

Domain Model



Design Sequence Diagram



User Case UC-3 Audition

Detailed Formula

Related Requirements: REQ8 & REQ10

Initiating Actor: User

Actor's Goal: To audition the generated melody and tag the unsatisfactory part.

Participating Actor: Visualizer, Generator

Preconditions: The generator has generated a piece of melody.

Postconditions: The program saves the melody.

Flow of Event for Main Success Scenario:

→ 1. **User** clicks the button "Play/Pause".

← 2. **Visualizer** (a) plays the melody and (b) visualizes the melody in the graphic interface.

Flow of Events for Extensions (Alternate Scenarios):

2a. User finds out some unsatisfactory parts in the melody.

→ 1. **User** tags the unsatisfactory parts.

← 2. **Visualizer** sends the tagged information to the **Generator**.

→ 3. **Generator** regenerates the melody.

← 4. **User** (a) auditions the renegerated melody and (b) visualizes the melody.

Responsibilities

Responsibility Description	Concept Name
Rs1. Receive the generated melody from Generator.	Receiver
Rs2. Visualize the generated melody.	Visualizer
Rs3. Play the melody.	Player
Rs4. Receive the unsatisfactory tags from user.	Tag
Rs5. Request the Generator to regenerate the unsatisfactory part.	Regenerate Request

Associations

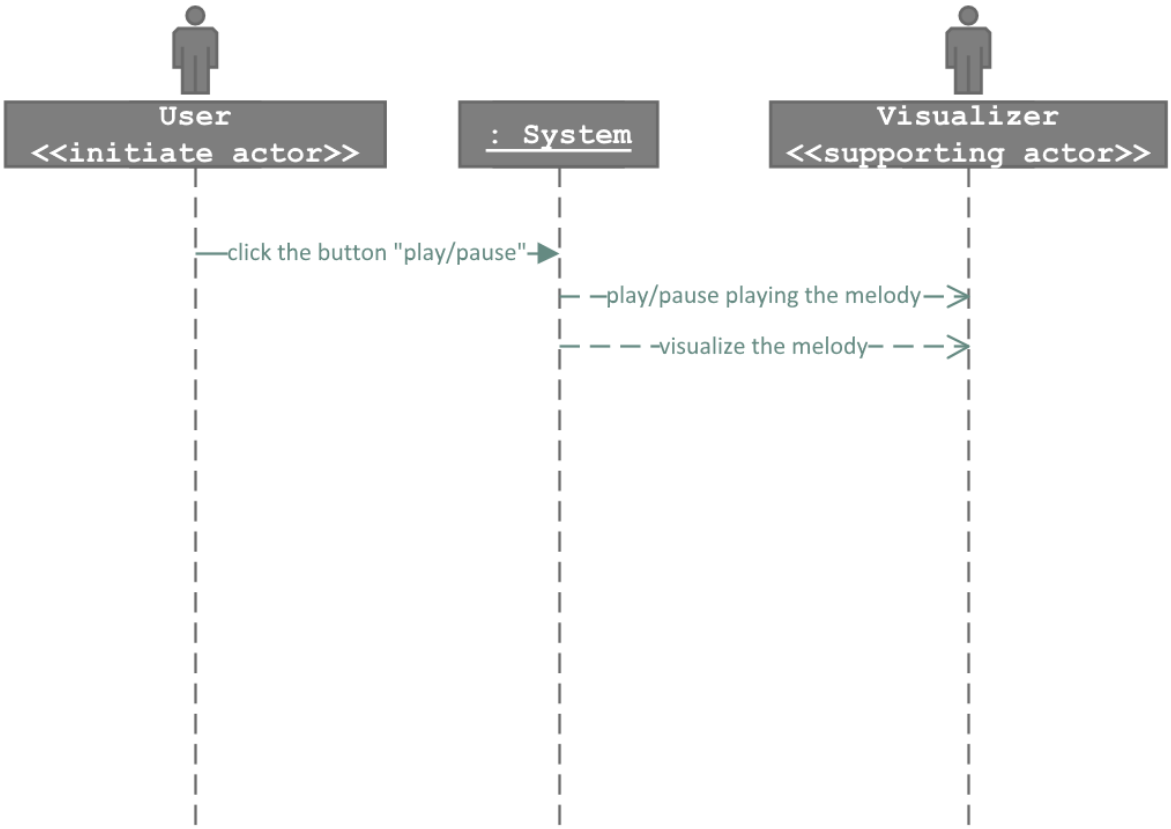
Concept Pair	Association description	Association name
Receiver↔Visualizer	Receiver passes the received melody to Visualizer to visualize the melody.	provides melody
Receiver↔Player	Receiver passes the received melody to Player to play the melody.	provides melody
Tag↔Regeneate Request	Tag passes the information for melody regeneration to Generator.	provides tagged data

Attributes

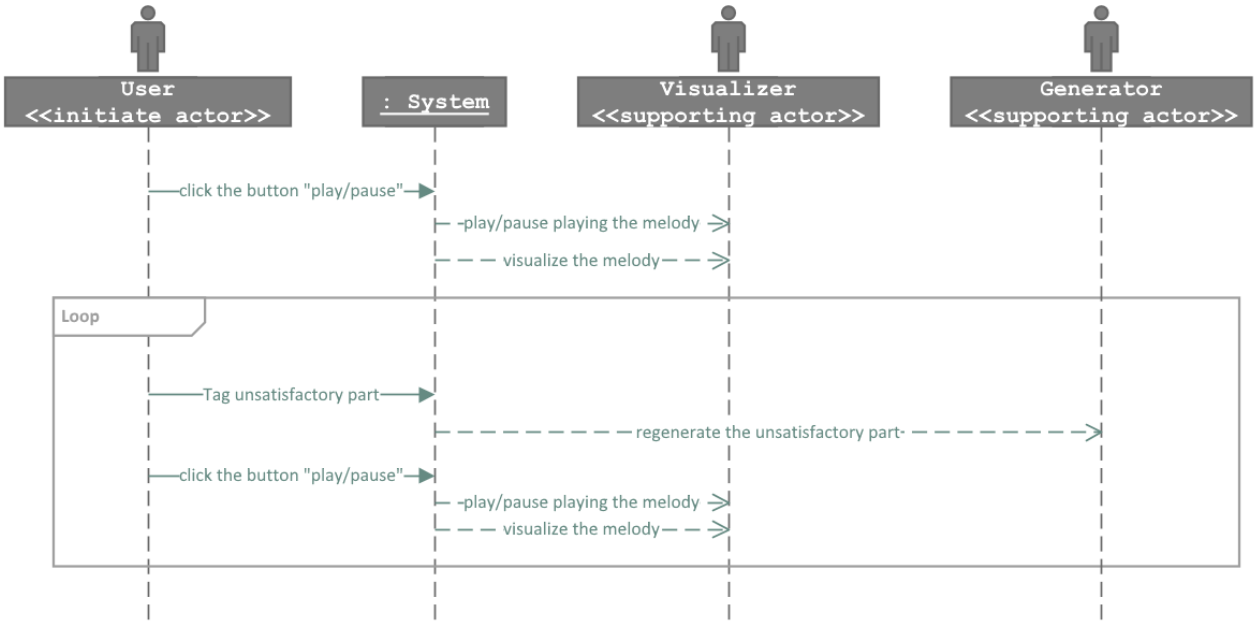
Concept	Attributes	Attribute Description
Receiver	config	Style, tonality and duration.
	melody	The generated melody.
Visualizer	music score	Visualize the melody.
	current moment	Display the current position in the score during playing the music.
Tag	tag information	Store the start and end position of each tagged part.
Regenerate Request	tag information	Copied from tag; send the information to Generator.

System Sequence Diagram

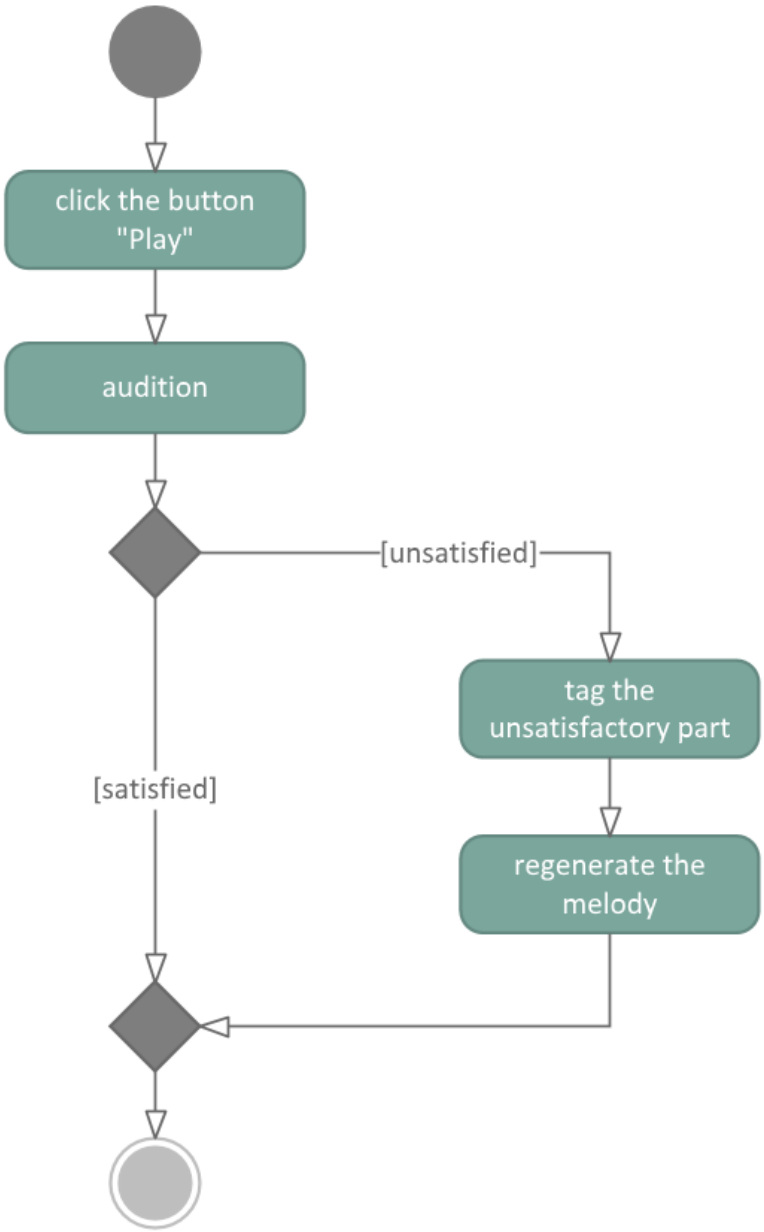
Main success scenario:



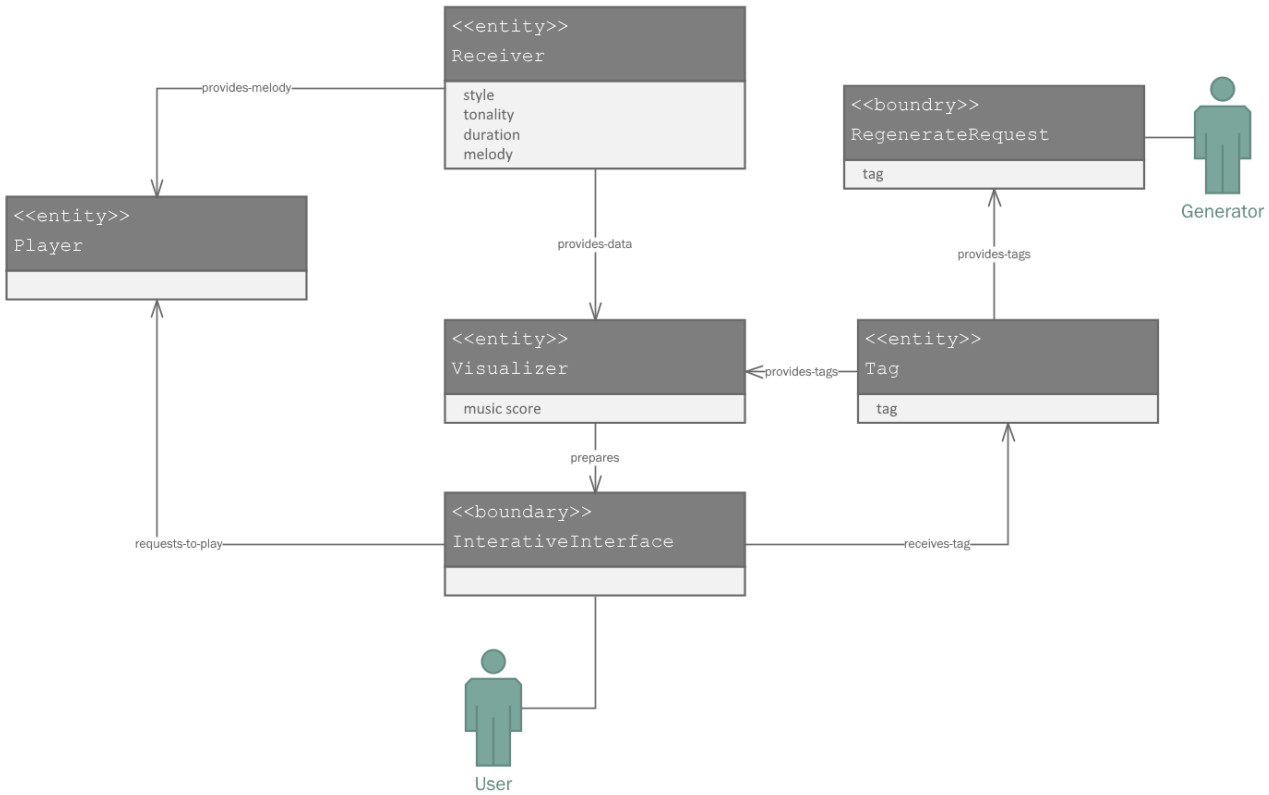
Alternative scenario (find unsatisfactory part):



Activity Diagram



Domain Model



Design Sequence Diagram