CS 32 Final Project Specifications: Music Arranger

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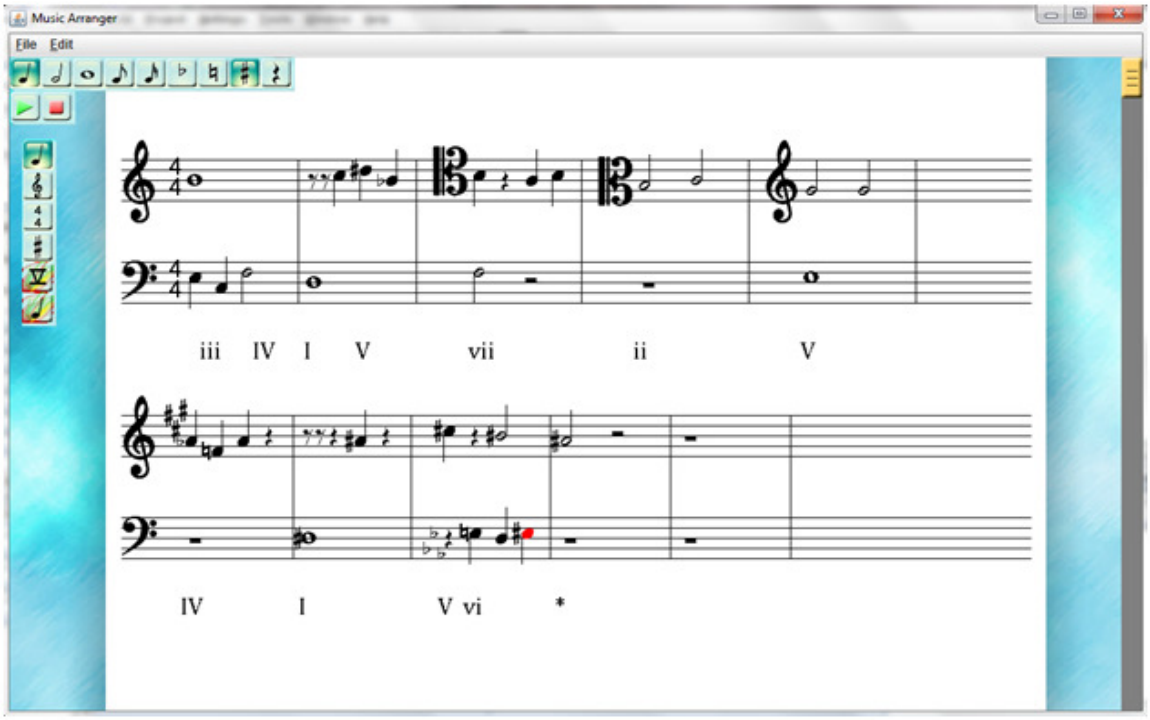
Overview

Music arranger allows for input of musical melodies and harmonies.

User Interface



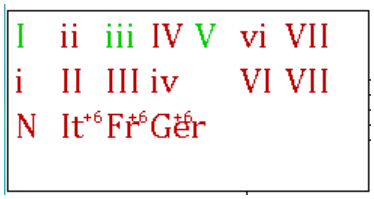
The user interface includes a menu bar, three toolbars, a score sheet, and a slider bar. The slider bar allows scrolling through the score sheet's vertical height. The window can be resized and score sheet will re-center itself.

1. Score Sheet

Music is drawn on a paper-like frame with a white background. Notes are drawn in a traditional musical notation manner. Clefs, key signatures, and time signatures are drawn in that order. If a measure's clef, key signature, or time signature is the same as the previous measure's, it is not drawn. Notes are then drawn, with accidentals drawn according to the current key signature and clef within the measure. Selected notes are drawn in red. If the next drawn measure is calculated to overflow a given system, it is moved to the next system below and illustration continues there.

Holding the mouse button down between two systems will cause a rectangular container of chord symbols to appear. The first row is the chord symbols of a major key in order by degree. The second row is the chord symbols of a minor key ordered similarly. The third row is uncommon chords including the Neapolitan and three augmented sixth chords. Releasing the mouse button on a chord will

select it and change the chord at the initial mouse press to the selected chord. Chords are normally colored in red. If chord analysis has been run, then suggested chords are colored green.



2. Toolbars

Three toolbars present the user with different ways to affect the program and have multiple buttons on them. Toolbars can be dragged around with the mouse and can also be docked to the top or left sides. Docking a toolbar will snap its position to the next stacked position and will also change its orientation. Docking toolbars to the top side will cause the toolbar to acquire a horizontal layout while docking toolbars to the left will cause them to acquire vertical layouts. Most of the buttons are grouped, where only one may be enabled at a time. If a button may be enabled, its graphical image of a button changes when enabled.

a. Mode Toolbar

A Mode Toolbar allow the user to switch between edit modes with 4 buttons (for notes, clefs, time signatures, key signatures) and also allows for generation with 2 buttons (chord and voice generation). Clicking on each of the first four buttons will cause the current mode button to be pressed and will un-press previous buttons. The fifth and sixth buttons do not save press states. Clicking a mode button other than the Note tool will deselect all buttons on the Modifier Toolbar. Clicking on the Note mode button will select the previously selected on the Modifier Toolbar.

The note tool button allows the user to add notes onto the score sheet by clicking at the point at which the note is to be inserted. If notes are being inserted at a selected point, then Inserted notes will add pitches to the current point but will not replace existing ones. If the insertion point is not currently selected, existing notes will be replaced by a note whose duration is determined by the currently selected duration on the Modifier Toolbar, to be detailed later. If the duration of the inserted note is greater than the remaining duration within the measure, then the inserted note's duration will instead be the remaining duration within the measure.

The clef, time signature, and key signature tool buttons allow for insertion of clefs, time signatures, and key signatures respectively. Each is inserted at the beginning of the measure where the mouse click occurred. Changing the time signature of a measure will remove all notes within the measure, replacing them with rests.

The chord generation tool button causes a chord analysis of currently placed notes on the score sheet. Following a pop-up alerting the user of analysis completion, the user may hold the mouse button down below each system, or set of staffs, to show possible chords. Chords suggested by the chord analysis are given in green while others are given in red. The voice generation tool button causes immediate addition of notes every quarter note duration. These notes are added such that all notes form four voices. They follow existing chords on the score sheet and conventional voice leading rules as well.

b. Modifier Toolbar

Duration of notes to be inserted is chosen with the first five buttons. The first five buttons follow the pattern of a radio button group: only one can be selected at a time and choosing one will switch the selected duration. If the current mode selected on the Mode Toolbar is not the Note mode, then pressing a button on the Modifier Toolbar will switch the mode is instantly switched to Note mode.

The sixth to eighth buttons set the accidental of inserted notes. Only one of these can be chosen at a time as well and choosing one will switch the selection. Clicking on a selection will deselect it and cause nothing to be chosen. If none of the accidentals are chosen on this bar, inserted notes follow the key signature of the measure in which they are inserted.

The final ninth button is a toggle between inserting a note and inserting a rest. It's graphical image changes whether it is enabled or not.

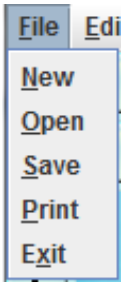
c. Playback Toolbar

"Play" and "Stop" buttons on the toolbar allow the user to listen to the currently loaded piece through any sound device. The Play button will begin playback from the beginning while the Stop button will stop current playback. Neither save pressed states. Pressing the play button while the song is being played will restart playback.

3. Slider and Menu Bars

A slider bar on the right allows the user to scroll along the height of the piece. When the window is resized, the slider is repositioned to be on the right side and to stretch from the top of the window to the bottom. It can be controlled by the mouse wheel as well.

The menu bar on top has two options, File and Edit. This menu bar is a traditional menu bar interaction-wise.



Under File is New, Open, Save, Print, and Exit. Choosing New causes a pop-up to appear, prompting the user for the time signature, key signature aspects (accidentals and whether it is major), as well as the number of staffs and the clef of each staff. The Exit option will close the program immediately.

The Open option will cause a file directory dialog to appear and choosing a file will cause the file to be loaded. The Save option will prompt the user for a save location with a file directory dialog. The currently opened piece will be saved at the selected location in an XML format. Below is an example XML piece with one staff and one measure.

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     </timeSignatures>
     <keySignatures>
      <keySignature duration="1/1" accidentals="0" isMajor="true"/>
     </keySignatures>
     <clefs>
      <clef duration="1/1" type="GCLEF" center_line="-2"/>
     </clefs>
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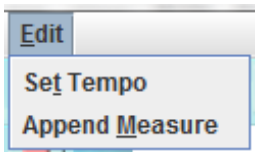
      <chordSymbol duration="1/1" scaleDegreeNumber="0"
scaleDegreeAccidental="NATURAL" chordType="BLANK"/>
     </chordSymbols>
     <voices>
      <voice>
       <multinotes>
        <multinote duration="1/1">
         <pitches/>
        </multinote>
       </multinotes>
      </voice>
     </voices>
    </measure>
   </measures>
  </staff>
```

```
 </staffs>
</piece>
```

Under Edit are “Append Measure” and “Set Tempo.” Choosing Append Measure instantly adds a measure to the end of the current piece. The new measure copies the clef, time and key signatures from the measure directly before it on the same staff. Using the Set Tempo option will pop up an input dialog and set playback tempo to the chosen integer. If an integer is not entered, a default value of 100 is used.



Walkthrough

When the program begins, a default score sheet is loaded with two staffs: one with a treble clef and the other with a bass clef. The default key signature is C major the default time signature is 4, 4.

The user can then input notes on the score sheet with the mouse, modifying edits with the toolbars. Once a voice or melody is on the score sheet, pressing the chord analysis button (fifth on the mode toolbar) will cause the Music Arranger to analyze existing pitches, determining possible chords and a preferred progression. The user can then input chords at any beat with a note or rest above it.

After chords are chosen, pressing the voice generation button (sixth on the mode toolbar) will generate pitches to match the chord symbols. The pitches are added instantly to the score sheet.

Considerations

1. Performance

Many calculations are performed when the score sheet is drawn, so in order to maximize speed, the score sheet is buffered into an image, and the buffer image is redrawn as a whole when the user scrolls. Calculations are only done when the piece is changed. Toolbars are buffered as well and the parts are redrawn only when a button changes states.

Generation is rather fast as well and we did not make optimizing it a priority.

Security

We saw no motivations on the part of a user to crack our program since all interactions are local and with files only. Because the saved files are in XML format with outputs directly from the data structure, it is highly unlikely that they can be transferred and used maliciously.

2. Compatibility

We used Java and the dom4j library for XML reading and writing. Since Java handles playback through the MIDI interface, Music Arranger should work on any system.

3. Accessibility

The hearing impaired will have difficulty listening to their inputs, although if they are like Beethoven (who was deaf), they will be fine. Unfortunately, greatly visibility impaired users will be unable to use the Music Arranger. However, color blinded persons should have no trouble as the main colors are uncommon color blind problem colors: white, black, blue, and red.

Keyboard shortcuts are also available for the toolbar buttons. Numbers 1 to 6 represent the buttons on the mode toolbar. Pressing one is equivalent to pressing the actual button. The top row of a QWERTY keyboard from Q to O represents the buttons on the modifier toolbar.