

Design and implementation of an Android-based numbered musical notation editor

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Abstract

Android smartphone is the most widely used terminal equipment for daily contacts by current users, which is portable and whose screen is enough to support many applications, so that your favorite programs can be run at any time and any place as long as there are electricity in the phone; the music player is a necessary program on the phone for users, representing the preference of the majority of users; however, currently there is not a better mobile numbered musical notation editor software allowing a multiple of Chinese music lovers, especially those who wish to make his own creation, to record his work when inspired; based on the above demands, the prototype system design of a numbered musical notation editor that is developed on the basis of the android system and can support virtual keyboard input and screen sliding is primarily introduced in the paper.

Keywords: smartphone, Android system, music editor; virtual keyboard, screen sliding

1 Introduction

The arrival of an epoch is represented by the advent of smartphones since the current smartphones can replace other tools and complete 80% of the existing daily uses, such as web browsing, mutual communications between friends, online shopping, and e-bank transfers, etc. Without particular application background, the idea of opening a computer fails to appear basically through using smartphones. At present, the opening of android system makes the android-based applications [1], spanning from small applications to large mobile games, develop into today's mainstream software development [2]. The numbered musical notation is very prevailing among a large number of Chinese music lovers for creation and entertainment. However, as users have not necessarily received specialized musical training, so they may not and cannot play their favorite instrument to create their own music. The advent of computers can just help music lovers achieve the musical notation saving, editing and organizing through the music software, then convert into music files to play, and help them make music [3]. Nonetheless, inconvenient portability of current computer and the difficult operation of related music software cannot meet everyone's needs well. Due to the emergence of smartphones in recent years, the computer can be replaced in daily use, including document editing, Internet surfing, shopping, and small picture processing, etc. A set of android-based music software that can be edited and composed directly is developed in the paper [4], so as to provide convenient and simple creative conditions of numbered musical notation for a multiple of music lovers.

2 Related work

The existing software of numbered musical notation editor can be broadly divided into the following three kinds according to the different devices.

2.1 MUSIC EDITING SOFTWARE AT COMPUTER

The numerical and software buttons on the keyboard can be combined by computer music software to achieve the input of numbered musical notation files, such as that numbers "1"~"7" can be realized by the keyboard, and the rest of the characters can be achieved through software menus and buttons, but a mouse and keyboard should be coordinated [5]. Concerning users, the use of computer input is simple and convenient though, the menus and buttons learning of the entire software is very complex, and the modification after clicking can only be reached by back way while a particular character cannot be modified, inconvenient for subsequent adjustments.

2.2 MUSIC EDITING SOFTWARE ON MOBILE PHONE

Currently, there is only a software related to mobile music, namely, player, or the existing MP3 and other music can be only edited and synthesized rather than be re-written[6], which cannot meet the purpose of free play and musical creation.

2.3 INPUTTED MUSIC EDITING SOFTWARE OF ELECTRONIC PEN

This class of software is connected to the computer through an electronic pen, write numbered musical notation via WordPad which can identify numbered musical notation automatically, and convert them into electronic documents for recording, meanwhile, the electronic documents are converted to MIDI music through the software for their identification and conversion into electronic music [7].

3 Planning and design of input interface

Similar to the software applications of ordinary mobile

phones, android-based interface requires to be intuitive so as to give users a very comfortable feeling, which allows all notations to be within the visible range of users.

3.1 SIMULATION OF KEYBOARD INPUT

All of the most commonly used input method in Android smartphones support the simulated keyboard. With fast, convenient and multi-character input and other characteristics, simulated keyboard has the highest utilization rate and can realize all interfaces to be inputted. The thought of simulated keyboard is firstly borrowed in the system owing to the above advantages, thus the input of musical notations through the simulated keyboard is presented.

3.2 AUTOMATICALLY INPUT SELECTION BY SLIDING

Single-point amplification and the sliding screen switch can be supported in the current smartphones, giving users a sense of kind and flexible manipulation. Therefore, music creation will possess a freewheeling feeling with the support of single-point amplification and sliding screen switch on music editor, allowing music to be played in free space at will.

3.3 AUDITION SELECTION AND MODIFICATION AT ANY CLIP

As the basic function of music editor, clip audition gives music creators chances to debug his own work in the clip and make his favorite notation thereby. By means of cursor selection from the beginning to the end, the creator may select audition button, and then the clips will be played by the phone; if to delete some clips, the cursor selection first and the delete key clicking then will make sense; if one or a few notations in the clips need to be modified, then the above two input methods can be used.

4 System architecture and implementation

4.1 SYSTEM FRAMEWORK

All of android-based application and development have the open source; so a lot of similar features can be inquired publicly and are available in the android system. Development technologies of interactive interface realized by two different input methods respectively will be described in the paper.

4.2 DEVELOPMENT OF VIRTUAL KEYBOARD TECHNOLOGY

Owing that the virtual keyboard input method is very mature in android system, so the open framework and public classes and functions in android system can be referred to directly in development process; the interface of input method is generally divided into two parts: candidate window (Candidate View) in the above part to display the candidate words, which is used by all input methods now, such as that if you input abc in Sogou and Google input methods, the

associated Chinese will be shown in the input box, namely, candidate view, and virtual keyboard in the lower part, that is, the input of all alphanumeric characters; drawing on the thinking, the input of notations is achieved by two areas of candidate window and virtual keyboard herein.

There is a core class of Input Method Service, and two main classes of Candidate View and Key board View in the input method.

As Candidate View is the candidate window, the objects in Candidate View will be returned to Input Method Service during Input Method Service's boot process through the calling interface of public View on Create Candidates View (), and the inside of Input Method Service will further arrange the returned objects to the appropriate locations. Since no readily available parent class of Candidate View exists in android, so it is necessary to implement a new class as follows: the Service is transferred in by means of public void set Service (Input Method Service listener), and then the candidate list is transferred in by public void set Suggestions (List <String> suggestions ...) and displayed by Candidate View on the screen. After the selection of the user, the Service's method of pick Suggestion Manually (mSelected Index) is taken to transfer the serial number of selected candidate words in the list back to the Input Method Service. Hereto, the framework of Candidate View class thus completes its construction and the diagram is shown as follows:

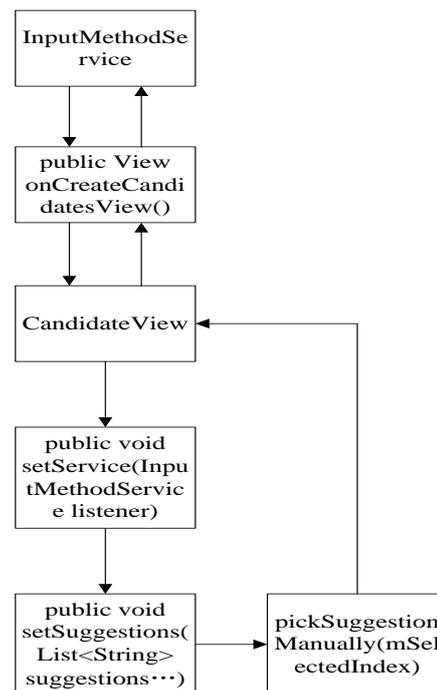


FIGURE 1 Framework diagram of CandidateView

The generic class of Keyboard View in android can display professional virtual keyboard through a simple configuration file after following it, but in addition to the numeric and symbolic parts in the numbered musical notation who can use the phone's soft keyboard, other symbols still need to be further developed and thus cannot be archived by the direct call of generic class. Framework diagram of Keyboard View is shown as follows:

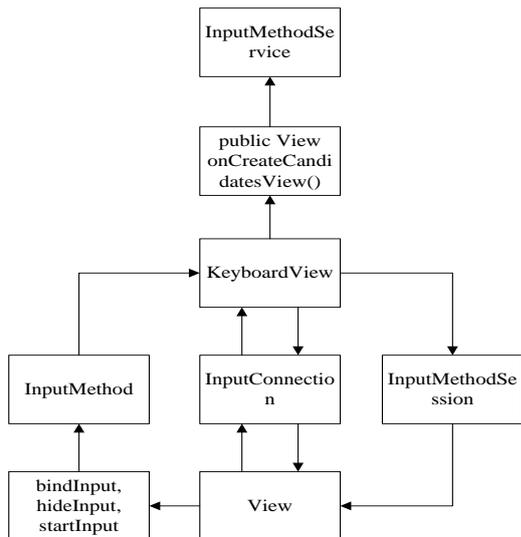


FIGURE 2 Framework diagram of KeyboardView

In the above figures, View is the inputted window of keyboard, which is obtained from Input Method Service by means of public View onCreateCandidatesView(). In the process, Input Method Service conducts the interaction with the system and View through several subclasses of Input Method Impl, Input Method Session Impl and Input Connection. Information is first obtained from View through Input Connection and Input Method Service, and when starting the input method of music keyboard, Input Connection is created by the client controls and passed to the input method application for the call and conducting information feedback; View is connected to Input Method class through bind Input, hide Input, start Input and other interface methods with BIND_INPUT_METHOD permission. Input Method Session is the auxiliary interface class of Input Method, which provides function port that can be called directly for client controls, including the keyboard distribution event of input method applications, cursor position updating, selected information issues updating in the editing area. Unidirectional application interaction of client controls through Input Method Session can only pass information to the input method application rather than get.

Main functions and classes of the soft keyboard basically achieve its development through abovementioned classes and methods.

The screen sliding technology of music editor is slightly different from the common interface and game sliding screen of phones. First of all, users are required to select the music clips to be modified or added, then the clips will be amplified automatically by View with their parameters being displayed, which can be chosen by means of sliding the screen. Therefore, on the basis of following the common sliding screen of android, the functions of screen selection and automatic parameter display of sliding screens need to be increased.

There are primarily four main categories in the development of Android sliding screen: Velocity Tracker, View Configuration, Scroller and View Group.

The class of Velocity Tracker mainly plays the role of tracking the sliding speed of users' fingers on the screen, which gets its instance through obtaining method of (), and

adds to the instances of Velocity Tracker class through receiving Motion Event, so far, the tracking of a touch event has been completed.

View Configuration window configuration class is a generic class of android, which defines a number of standard constants in android [8], such as the size of the UI, timeout monitoring of touch event, and other parameters.

Scroller, namely sliding category, is mainly to support the view controls and will be hidden in lots of android controls in default. The method of start Scroll () is controlled in Scroller class, but it just starts to pass some parameters before the call of compute Scroll () by the parent class rather than conduct the actual view movement, increasing some animation effects for subsequent view movements. So compute Scroll () needs to be redefined by us and the start Scroll () method should be used cooperatively to achieve animation effects. Five parameters are actually included in start Scroll (): start Scroll (int startX, int startY, int dx, int dy, int duration), and they are defined as follows: startX represents x coordinate value of the current view; startY is the y coordinate value of the current view; dx means the distance of lateral movement x on the basis of x coordinate value of the current view; dy represents the distance of lateral movement y based on y coordinate value of the current view; duration indicates how long would it take to complete the implementation of view movement operation, namely, the duration of the animation.

View Group is special View developed from Android.view.View, with the function of loading and managing View objects or View Group objects in the next layer, that is, this class is a container for other elements to accommodate.

One more class is added on base class, Candidate View, which is consistent with the keyboard input method; reuse of keyboard input method and the class have the same function with the virtual keyboard input method[9], which needs to be embedded into scrolling technology as shown in the figure of the key class relationship in scrolling technology.

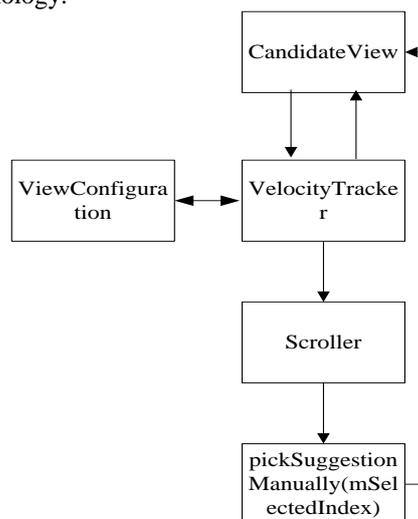


FIGURE 3 Framework diagram of Scroller

The main program and Candidate View of multiplexed keyboard input method display the current selected option through the call of Candidate View, such as the choice of

notation 0-7, monitor the sliding traces and speeds of current users through Velocity Tracker and View Configuration[10], and pass the parameters to pick Suggestion Manually (mSelected Index), pick Suggestion Manually (mSelected Index), then the current index value is calculated according to the Scroller parameters, and is transferred back to Candidate View by index, i.e. displaying the current optional parameter.

5 Conclusion

The prototype system has been tried among many colleagues and friends after the development, and received the generally well feedbacks from users due to that the

convenience and easy use of phones and interactive way of system is consistent with the operating habits of the public. In terms of learning time and editing speed, the system is superior to other types of numbered musical notation editing software, meanwhile, some problems conducive to the system improvement are also found in the trial process, such as that the cursor is easily pulled to the undesirable locations by the fingers owing to the above and low position problems in the keyboard input method; and that in scrolling input method, some notations that need to be inputted cannot be slid accurately due to the excessive alternative notations and so forth. However, the development of the system is still generally better than other PC software due to the android touch screen, easy-to-use and other advantages.

References

- [1] Enck W, Gilbert P, Chun B G 2013 TaintDroid: an information flow tracking system for real-time privacy monitoring on smartphones *Communications of the ACM* **57**(3) 99-106
- [2] Enck W, Ongtang M, McDaniel P D 2009 *IEEE security & privacy* **7**(1) 50-7
- [3] Lammers H B 2003 An oceanside field experiment on background music effects on the restaurant tab *Perceptual and motor skills* **96**(3) 1025-6
- [4] Gandhewar N, Sheikh R 2010 Google Android: An emerging software platform for mobile devices *International Journal on Computer Science and Engineering* **1**(1) 12-7
- [5] Zhang Z, Lin Y 2011 Development of Android-based MediaPlayer *Modern Electronics Technique* 2 003
- [6] Munoz B 1997 The Problem of Our Time: Culture or Industrial Culture? Musical Creation or Industrialized Musical Products? The Spanish Case *Contributions To The Study Of Music And Dance* 41 175-208
- [7] Airy S, Parr J M 2001 MIDI music and me: students' perspectives on composing with MIDI *Music Education Research* **3**(1) 41-9
- [8] Apvrille A, Strazzere T 2012 Reducing the Window of Opportunity for Android Malware Gotta catch'em all *Journal in Computer Virology* **8**(1-2) 61-71
- [9] Scherer R, Muller G R, Neuper C, Graimann, B, Pfuertscheller G 2004 *Biomedical Engineering IEEE Transactions on* **51**(6) 979-84
- [10] Minifie F D, Kelsey C A, Hixon T J 1968 Measurement of vocal fold motion using an ultrasonic Doppler velocity monitor *The Journal of the Acoustical Society of America* **43**(5) 1165-9

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