The Development of GSM Mobile Phone MMI Software

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Abstract

This article discusses the design and implementation of MMI software of GSM mobile phone. In this design, object-oriented programming techniques are used. The way to design the interface between chip and MMI hardware of GSM is introduced too. These skills make the software has clear program structure, high code efficiency and good reusable modules. In this article the development of GSM mobile phone MMI software modules organization, window management techniques, and shortcuts are talked about.

Index Terms: MMI; functional module organization; window managment

1. Introduction

GSM mobile phone is a direct service for mobile users, it is a mobile communication terminal [6]. Fig.1 shows GSM mobile phone's composition, it generally includes four parts: RF unit, Baseband unit, Man Machine Interface (Abbreviated as MMI) and Software.
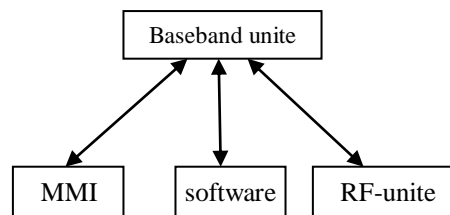

Fig. 1. GSM mobile phone's composition

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2. MMI functions and requirements of the software

MMI is the interface between the user and the mobile phone which provides mobile communication services.Fig.2 shows MMI composition. It includes hardware and software: Hardware are keyboard, monitor, microphone, headset and SIM cards[2]; Software are basic man-machine interface function, users SIM card function, the public mobile network functions, menu and phone book functions.

2.1. MMI's Functions

1) Input the operate information of the user.

2) To display phone and network status by sound, light, vibration and other means and output the operation result.

3) Implement GSM-related protocol s, such as DRAFT pr ETS 300 906 mobile station characteristics.

4) Provide reasonable and convenient operation method.

5) Classify and organize the numerous functions to facilitate the users.

6) Add the calculators and other additional features to improve the phones practicality.

7) Add animation, icons, greeting and other modified functions to make the product interface more beautiful and friendly.
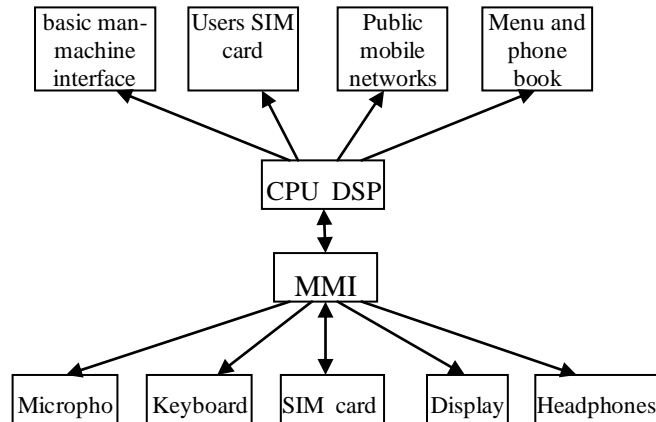

Fig. 2. MMI composition

2.2. Requirements of the software

In order to meet these functions, on the MMI software development put forward the following requirements:

1) Fully understand the GSM protocol to achieve the basic functions completely that the protocol calls for.

2) Ensure that software is stable, reliable and the interface with low-level software is convenient to ensure the machines have good performance.

3) Use the good programming language which has high code efficiency, good presentation skills and good portability, thus to improve product performance and reduce development costs.

4) According to the specific circumstances of GSM mobile phone interface; full use of LED display skills; using the latest software development technology[4]; using of graphics, animation, Chinese interface and Chinese character features, to beautify products and make it easy to be used.

5) Well-organized program structure, make software structure clear, Modules independent of each other, Modules can be scalable and packaged well, to facilitate the development team to share out the work and help one another, to full use of all stages of development results. Thus may shorten the product development cycle and rich product functionality.

6) Development of features and practical functions in a creative way to improve product appeal.

3. MMI structure simulation software features

MMI software of GSM phone has a main program, it main role is to create the message loop and responsible for distributing news[7]. When it receive a message from the bottom of the boot, MMI layer software to initialize and create the basic window.

Window is a term, It can receive messages, May has a corresponding display area in the screen or not. Character display area, edit field, or display both character edit field dialog window all are examples of the window.

Basic window is the "boot" of the all MMI level windows. Other windows are sub-windows of this window. The GSM messages arriving at MMI layer are sent to the basic window for the default processing when other windows are not processed. In the basic window the state is changed under different circumstances and many sub-windows are created such as waiting to shut down, charging, insert the SIM card, waiting for the input PIN, waiting for SIM card to unlock and so on. These sub-windows will handle all the work of boot and shutdown. After the successful completion of the work of the boot, into the standby mode, a standby window will be created. If an incoming call or calling enter the call status, the standby window is canceled and a conversation window is created[5].

Standby window can complete dialing and quick start functions, Can further create a phone book, and function menu sub-windows.

Menu window can derive a series of sub-menu window, these windows format a menu tree. The menu tree organizes the many functions of a mobile phone organically. Each menu window is an instance of menu window class, Menu selection, display and other functions is completed in the menu class. Tree structure in Fig3, directly reflects the organizational structure of various functional modules in the MMI software. The end of the menu tree is leaves part, it is the specific features, there is no longer discussed.

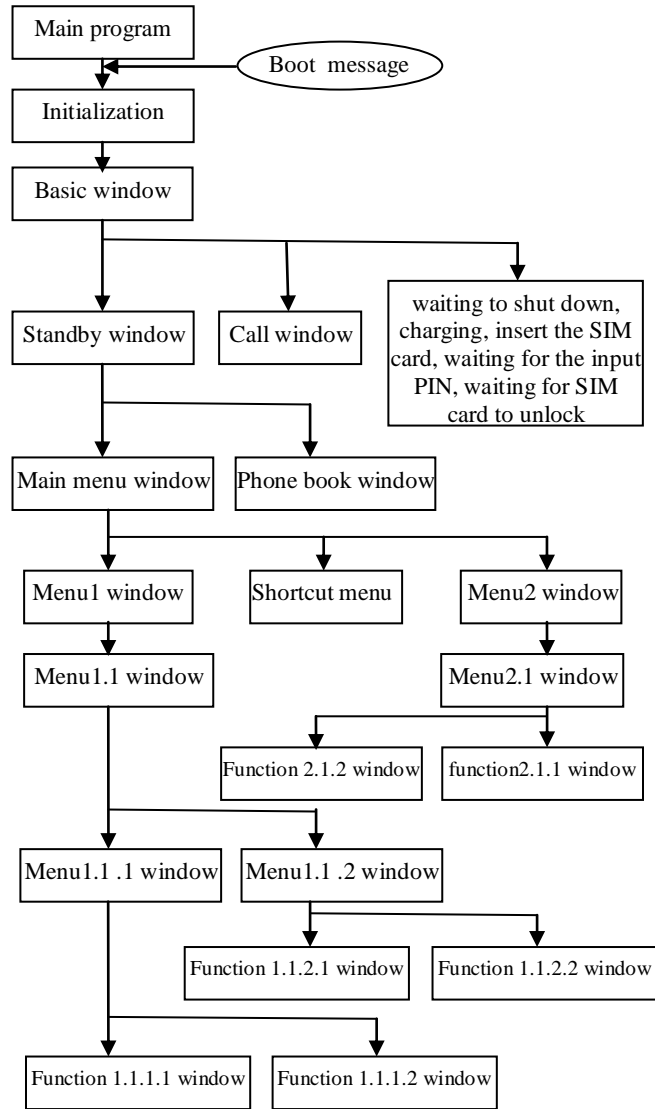Fig.3 shows MMI structure diagram of functional modules.

Fig. 3. MMI function modules structure

4. MMI software, the core structure - the window management

Based on the specific circumstances of GSM mobile phone MMI software development, we use object-oriented programming techniques and C language to organize the software structure by window mode and message-driven mechanism, to meet the all requirements in the MMI software development. In this technical solution, the window management is the core structure of the MMI software.

Window management provides a basic framework for the dialog window, menu, edit, and other user input/output operations, provide the basic means of message processing. Because of using object-oriented

programming method, MMI software adopts message-driven mechanism. Window management collects all the input information, and then sent the information to the appropriate window [3]. Results of the implementation of these messages may generate new message, window management is still responsible for the transmission of new message. Window Management sent the message to the destination window by calling the window function and passing the message parameters to the window function.

Window function is the system function registered by its own window in window management, it is the most important attribute of the window. Window management operates on the window by calling the window function, process all messages window received. The message's processing method of window function determines the window's performance and behavior.

Window management calls the standard window functions, process many features of the window automatically. Application is only responsible for creating windows and handling high-level event generated by window and anomalies of the window. In this environment, users can make GSM message processing, but also allows the system to the GSM messages as the default treatment. Window management sent the message from the keyboard and other entities in the software to the window with the current focus. There is always a focus window in the entire process of the software running. It is responsible for processing the input message or sending the message to a window which can handle the message along the transport chain which direction is from child window to the parent window.

There are two types of MMI layer input message: They are the keyboard event messages from the other parts of the system and GSM protocol stack messages. Window message select transmission paths according to certain rules. Keyboard message is generated by pressing and releasing the keys, it is sent to the window has focus. Keyboard message only reached the up to the parent window, it cannot be transmitted upward. GSM protocol stack message can be sent from child window to parent window until a window to accept this message.

Window management has also provided a mechanism that message is sent directly to a window. So that messages can be sent directly to the window requesting the message. This method is very useful in a particular case that only one window interested this message.

The messages generated by MMI internal layer are generally not follow the window hierarchy sent from the parent window to a sub-window. If you want send such a message from sub-window to the parent window, the child window must be responsible for this work. How to send raw messages? The default message handler is responsible for this.

System provides a number of window classes. Such as text type used to display specified character; Menu class used for menu display and processing; Editing class used for character editing. Application can register a new window class to the window management.

Window class implements the common features of many windows. The window class registered to the window management can create a window instance, it is easy to reuse by many windows. For example, the menu windows work the same way, only when a menu item of the menu window is selected, a specific program may needed to deal with this particular choice. Before each instance of the menu class window selected specific menu item the window management can be managed by the same program. Here to emphasize that only the window class which is registered to the window management can create the window instance.

Window instance inherits the characteristics of the window class, it can also add its own features, it can also change the features inherited from the window class features by overloading message processing function. When a window instance is created, the window class name, window name, window ID, window function name, window location data, the parent window, the window style, window state, window keyboard and window parameters such as private data should be sent to the window management.

For convenience, some common dialog window generating function are pre-defined. For example a notification message dialog window can display notification information; On / Off selection dialog window can be used as switch selection similar to the "ON" or "OFF"; PIN input dialog window can be used enter the PIN code and so on.

Window message is processed by the window function. When the window messages are sent to a window, they are actually sent to the window function of this window. Each window class must have a window function.

The messages that not be processed by the instance of the window are automatically sent to the function of the window class by the default message handler. Some messages do not be handled in the window class, such as the GSM event message, they are sent to the parent window automatically to be handled along the transport chain that is from child window to the parent window. Child windows of dialog window may have a child window procedure, Then window message may be sent to the child window which has focus first, for example in the standby window, the number key message is sent to the window function of phone numbers editing child window to be processed first.

5. shortcuts and its implementation

Menu is general classified by its function, sometimes commonly used functions are placed in deeper menu layer, it is often inconvenience for user. In order to facilitate user access to frequently used functions, many mobile phones have shortcuts. There are several different ways to quick access to menu items.

5.1. Number for Function

Each menu item is assigned a function number, Type the number in the main menu, you can enter the menu. For example, the fifth term of main menu - the fourth term of a sub-menu – the first term of sub-sub-menu function number is 5-4-1. Only type 5,4,1 in the main menu can access this feature.

Each menu has a number in its own window. This approach is when you press the number key, the menu item that the number key represents the current window is selected, Step by step, until the required function is recalled. This feature can be implemented in the menu class, thus any menu window have function to select the menu item with the numeric keys. Only handling code of the number keyboard message is added in the window function of the menu class, we can achieve this functionality.

5.2. Shortcut menu

A sub-menu is added to the main menu, collect the common features distributed at all levels sub-menus in this sub-menu, all this format a shortcut menu. These features not only can be found at all levels of sub-menu, but also direct access from the shortcut menu. The way that shortcut menu processing is like ordinary menu.

Shortcut menu itself can be designed into by shortcut keys, The Implementation see shortcut method as following.

5.3. Shortcut

Shortcut general is trying to use certain keys on the keyboard to enter quick function. Because many of the key purposes, certain conditions must be met to enter the shortcut function. For example, in standby mode, hold down a key about 2 seconds to enter shortcuts. Shortcut keys function normally in the standby window to achieve, the basic approach is as follows:

1) In the phone number editing sub-window of the standby window, when it receiving the news of a key pressed, it start the button timer. When it receives the news of the release button, the button timer is stopped.

2) Button timer measures time by using the timer message which reaches the standby window once per second.

3) Once button is pressed longer than 2 seconds, the realization function the keys represent will be called to start quick function.

6. Conclusion

MMI software development of GSM mobile phone is a complex software project. Object-oriented programming techniques are used C language development software window structure of the MMI, program structure is clear, code efficiency, good reusable modules, Easy to increase product functionality, ease of programming development team division of labor.

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