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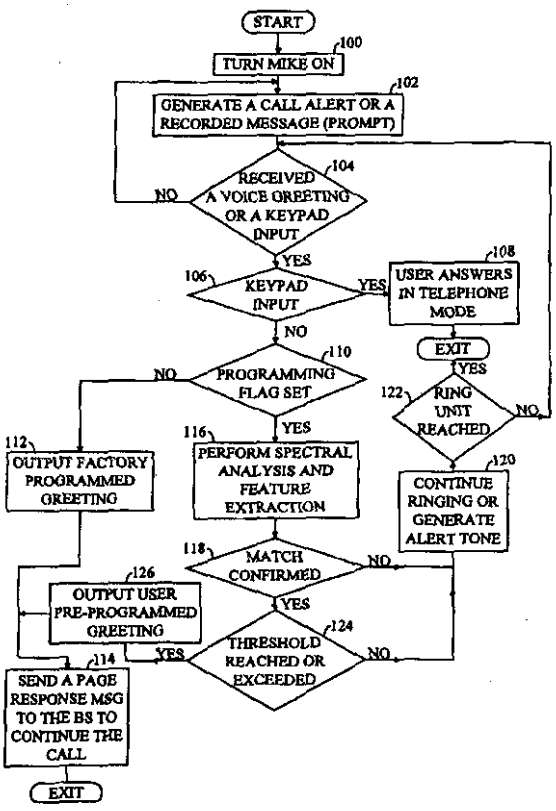
(54) Title: VOICE ACTIVATED MOBILE TELEPHONE CALL ANSWERER

(57) Abstract

A mobile telephone system and a method for answering a mobile telephone incoming call by a user's verbal command, to allow hands-free voice. The mobile telephone system includes a carkit and a mobile telephone. The mobile telephone has a programming key (22) for pre-programming the user's voice greeting, a keypad (23) for answering the call in telephone mode, a microphone (24) for entering a user's verbal command for answering the call in carkit mode, a digital processor (30) connected to the microphone for performing spectrum analysis (36) and feature extractions (38) of the user's verbal command in carkit mode, and a memory (32) connected to the digital processor, having a database (46) for storing the user's pre-programmed voice greeting digitized speech pattern. The pre-programmed voice greeting may be a factory-programmed voice greeting or the user's pre-programmed voice greeting, if previously initialized after pressing the programming key. The digital processor (30) performs spectrum analysis and feature extractions of the user's verbal command for determining if a match exists between the user's verbal command and the stored user pre-programmed voice greetings. The digital processor (30) also checks whether the user's verbal command reaches a pre-programmed pass/fail voice threshold level, if a match is confirmed.



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# VOICE ACTIVATED MOBILE TELEPHONE CALL ANSWERER

## BACKGROUND OF THE INVENTION

### I. Field of the Invention

This invention relates generally to the field of mobile telephones, and more specifically pertains to a voice activated call answerer and a method for hands-free voice activation of a mobile telephone by verbal command.

### II. Description of Related Art

When a mobile telephone is turned on in a cellular PCS radiotelephone environment, it typically must search for and acquire the forward link signal (pilot signal), which is continuously transmitted by a base station. The pilot signal is used by the mobile telephone to obtain initial system synchronization and to provide time, frequency and phase tracking of the signals from the base station. Since the mobile telephone cannot start transmitting or receiving until the pilot signal is acquired, this signal must be acquired quickly after the turn on, since the user typically does not want to wait to make a telephone call.

Once the mobile telephone is turned on, it may be used in a vehicle to send or receive telephone calls. In order to allow a driver, who wants to use the mobile telephone, to practice careful driving and pay good attention to the road environment, the mobile telephone is preferably placed in a carkit cradle mounted within the vehicle. Presently, however, answering an analog or digital mobile telephone call has to be started by manually pressing a key on a mobile telephone keypad. There does not appear to be a reliable method and architecture for activation of a mobile telephone by verbal command.

Therefore, there is a need for an efficient voice activated call answerer architecture and a method for hands-free voice activation of a mobile telephone by verbal command.

## SUMMARY OF THE INVENTION

The preceding and other shortcomings of currently available mobile phone answering systems are addressed and overcome by the various embodiments of the present invention.

One embodiment of the present invention is a mobile telephone system for answering a mobile telephone incoming call by a user's verbal command, to allow hands-free voice activation. The mobile telephone system includes a carkit and a mobile telephone. The mobile telephone has a programming key for pre-programming the user's voice greeting, a keypad for answering the call in "telephone mode", a microphone for entering a user's verbal command for answering the call in "carkit mode", a digital processor connected to the microphone for performing spectrum analysis and feature extractions of the user's verbal command in carkit mode, and a memory connected to the digital processor, having a database for storing the digitized speech pattern of the user's pre-programmed voice greeting.

The pre-programmed voice greeting may be a factory-programmedvoice greeting or the user's pre-programmed voice greeting, if previously initialized by the user pressing the programming key. The digital processor performs spectrum analysis and feature extractions of the user's verbal command for determining if a match exists between the user's verbal command and the stored user entered pre-programmed voice greetings. If a match is found the digital processor also checks whether the user's verbal command reaches a pre-programmed pass/fail voice threshold level.

Another embodiment of the present invention is a method for allowing a mobile telephone user to answer an incoming call by a verbal command to perform hands-free voice activation. The method may include performing initialization to pre-program a user's voice greeting. If an incoming call is received, the method allows answering the incoming call by a verbal command, to accept or reject the incoming call.

The initialization step prompts and inputs the user's voice greeting, prompts the user and enters a mobile telephone memory database location for

storing the voice greeting, and stores the voice greeting represented as a digitized speech pattern in the specified mobile telephone memory database location. The digitized speech pattern may be in compressed or uncompressed form.

When a mobile device is paged to complete a voice call, it goes through the "call answering" process. The call answering process alerts the user to enter a verbal command, and waits for the user's verbal command. If the user answers by a verbal command and if not previously initialized, the method outputs a factory-programmed voice greeting. If the user answers by the verbal command and if previously initialized, the method determines if a match is found of the user's verbal command and the stored user pre-programmed voice greetings, and if a match is found, outputs the matched user pre-programmed voice greeting. After one of the voice greetings is output, the method sends a page response message to the mobile telephone's base station to continue with the incoming call.

The foregoing and additional features and advantages of the present invention will become further apparent from the following detailed description and accompanying drawing figures that follow. In the figures and written description, numerals indicate the various features of the invention, like numerals referring to like features throughout.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a functional block diagram of a conventional carkit.

Figure 2 illustrates a functional block diagram of a mobile telephone, according to one embodiment of the present invention.

Figure 3 illustrates a flow chart of an initialization mode method used to pre-program a user's voice greeting, according to another embodiment of the present invention.

Figure 4 illustrates a flow chart of a method allowing the user to answer the incoming call by voice activation, without pressing any keys of the keypad, according to yet another embodiment of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

The following description is provided to enable any person skilled in the art to make and use the invention and sets forth the best modes contemplated by the inventors of carrying out their invention. Various modifications, however, will be readily apparent to those skilled in the art, since the general principles of the present invention have been defined herein with specificity.

The present invention pertains to a device and method for call answering an analog or digital mobile telephone by voice activation. This feature enables users of mobile telephones to enjoy hands-free voice activation, in "telephone mode" or "carkit mode", and to answer incoming telephone calls through verbal commands.

A functional block diagram of a carkit is shown in Figure 1. It is a conventional device having a mobile telephone cradle 10 with a speaker 12 and a memory 14. Figure 2 illustrates a functional block diagram of a mobile telephone according to an embodiment of the present invention. It has a display 20, a programming key 22 for initiating programming mode, a standard keypad 23, a microphone 24 and a speaker 26. The microphone 24 and the speaker 26 are connected to a speech coder-decoder (CODEC) 28. The speech CODEC 28 consists of an analog-to-digital converter (ADC) and a digital-to-analog converter (DAC), not shown.

The speech CODEC 28 receives input signal from the microphone 24 and outputs signals to the speaker 26. It may also output signals to the speaker 12, when the mobile telephone is in the cradle 10. The analog-to-digital converter receives an analog audio signal as input and converts it into a digital signal. The digital-to-analog converter performs the opposite conversion. The speech coder-decoder (CODEC) 28 either rebuilds specific human language sounds out of the speech blocks received from a conventional channel CODEC, not shown, and passes the digitized speech to the DAC, or compresses digitized speech coming from the ADC so that the data are represented by blocks of bits before being encoded.

The speech CODEC 28 is connected to a digital signal processor (DSP) 30. The DSP 30 is preferably fabricated on a single semiconductor chip. It is used to

perform spectrum analysis and feature extractions through digital speech processing, preferably in pulse code modulation (PCM) format. The DSP 30 contains a voice recording module 34, a spectrum analyzer 36 and a feature extraction module 38. The DSP 30 is connected to an encoder 40, a decoder 42 and a memory 32.

The encoder 40 and decoder 42 are connected to a microprocessor 44. The memory 32 has a database 46 and a software storage area 48 used by the method embodiments of the present invention. The memory 32 is preferably a re-writable flash memory on a memory chip which allows stored data to be easily retrieved and overwritten. The database 46 may have separate location areas for storing voice greetings of different users of the same mobile telephone.

The output from the speech CODEC 28 is passed to the DSP 30 to perform the spectrum analysis. The sampled values from the speech CODEC 28 ADC are analyzed in the DSP 30 to extract the power spectral density or speech waveform information from the PCM data. The DSP-analyzed data is filtered in the feature extraction module 38 to eliminate redundant data of natural speech such as pauses between words or syllables.

The analysis of a set of data samples produces filter coefficients and an excitation signal for a conventional time-invariant digital filter, not shown, of the feature extraction module 38. This filter can be regarded as a digital imitation of the human vocal tract, where the filter coefficients represent vocal modifiers (e.g., teeth, tongue, pharynx), and the excitation signal represents the sound (e.g., pitch, loudness) or the absence of sound that is passed through the vocal tract (filter). A correct setting of filter coefficients and an appropriate excitation signal yields a sound typical of the human voice.

The data output from the DSP 30 is encoded in the encoder 40 and the data entering the DSP 30 from the microprocessor 44 is decoded in the decoder 42. The microprocessor 44 is used by the software of the present invention to inform the mobile telephone's base station that the call is answered, and keeps the data representative of whether the call is answered in "telephone mode" or "carkit mode".

Another embodiment of the present invention is a method for allowing a mobile telephone user to answer an incoming call by a verbal command to

allow hands-free voice activation. If not previously initialized by the user's voice greeting, the method allows an initialization of the present invention to be performed, to pre-program the user's voice greeting. If an incoming call is received, the method allows a user to answer the incoming call by a verbal command, and allows the user to accept or reject the incoming call. The initialization mode method embodiment of the present invention is performed by a computer program stored in the software storage area 48.

Figure 3 represents a flow chart of the initialization method program, used by the user to pre-program a voice greeting. The voice greeting may be represented in the memory database 46 as a compressed or uncompressed digitized speech pattern. The method of the initialization mode is started at step 58 by pressing the programming key 22 of the mobile telephone. Step 60 includes prompting the user with a beep to enter the voice greeting. The microphone 24 is then turned on in step 62.

Step 64 includes inputting the user's voice greeting. The voice greeting is processed in step 66 in the voice recording module 34 of the DSP 30 and displayed on the mobile telephone display 20. When processing is completed the voice greeting is obtained, and the user is prompted in step 68 to select and enter a memory location and possibly a password for storing the voice greeting. In step 70 the voice greeting and the password are stored in the specified location of memory database 46. A programmed status flag is set in step 72 and a confirmation is displayed on the mobile telephone display 20.

In this mode the user may store any voice greeting, such as "Hello", in male or female voice. The greeting is stored as a compressed or uncompressed digitized speech pattern. Its duration is preferably between 1 and 15 secs. If it is necessary to store a voice greeting of longer duration, it is conceivable that a carkit memory 14, with more storage space, can be used for the database 46.

It is conceivable that the pre-programming in the initialization mode may be attempted several times, to train the phone to store the greeting in a form that can be easily reproduced and accurately recognized. For this purpose, the user can specify a location for the greeting in database 46, so that the user's previous greeting can be overwritten in the same location. Since it is possible that the mobile telephone has restricted access mode capability, the user is

allowed to enter a password, which may be verified before allowing the user to store the voice greeting.

The call answering method of the present invention is performed by a computer program stored in the software storage area 48. Figure 4 is a flow chart of the program for implementing the call answering method, for allowing the user to answer the incoming call by voice activation without pressing any keypad key. The call answering mode has two aspects. In one aspect it provides a choice of answering the incoming call with a factory-programmed greeting. In another aspect the user's own voice greeting can be used, if previously pre-programmed according to the method of Figure 3 and stored in the memory database 46.

Step 100 includes turning on the microphone 24, when the incoming call is received. Step 102 includes generating a call alert tone or a voice prompt to alert the user to enter a voice greeting or press a keypad 23 key. Step 104 includes waiting for the user's voice greeting or an input through the mobile telephone keypad 23, after each alert tone or generated ring. The incoming calls may be answered either in telephone mode, when any keypad 23 key is pressed, or answered/rejected in the voice greeting mode (i.e. the "carkit mode").

In the telephone mode, the stored verbal greeting may be disabled through the mobile telephone keypad 23, to allow the user to answer the telephone by pressing the mobile telephone to the user's ear, in noisy environments such as in the city. Therefore, if it is determined in step 106 that any keypad 23 key is pressed, the stored greeting is disabled and the user answers in telephone mode in step 108.

The voice greeting (or ear kit) mode allows the user to answer or reject an incoming call through voice commands (e.g. "hello", or "answer" etc.) If the user's voice greeting is received in step 104, and if in step 110 it is determined that the programmed status flag is not set by the method of Figure 3, then the factory-programmed greeting is output on the carkit speaker 12. The factory-programmed greeting may be in male or female voice, and in the language of the country where the telephone was sold, but it is limited to only one greeting, such as "hello". Next, in step 114 a page response message is sent to the mobile telephone's base station and the user continues with the call

without using the hands.

If the user's voice greeting is received in step 104, and in step 110 if it is determined that the programmed status flag is set to show that there is at least one existing greeting stored in the memory database 46, then the method continues with step 116. In step 116 the user's greeting is entered in the spectral analyzer 36 and feature extraction module 38, to attempt matching with all stored pre-programmed digitized speech patterns in the database 46. If a match is not confirmed in step 118, the call alert tone or voice prompts are generated in step 120. It is determined in step 122 whether the number of alerts or prompts exceeds a pre-programmed limit. If the limit is not yet reached, the program continues with step 104 to await receipt of another voice greeting or the keypad 23 input. The user can deliberately reject the incoming call by saying a greeting different from all the greetings stored in the database 46.

If a match is confirmed in step 118, step 124 checks whether the input voice greeting reaches a pre-programmed pass/fail voice threshold level. If the voice greeting is below the voice threshold, the telephone continues ringing or generates alert tones in step 120. If the threshold is reached or exceeded, the user pre-programmed greeting is output on the carkit speaker 12 in step 126. Next, step 114 is executed to send the page response message to the base station and the user continues with the call.

In the present invention the mobile telephone is in receiving mode while awaiting the calls. The telephone in receiving mode may be in any of three states: traffic, idle and acquisition state. To originate, terminate or establish a call the base station sends commands to the mobile telephone to enter the traffic state through assigning a traffic channel. In idle state the call is awaited for in a paging channel. In acquisition state the mobile telephone is awaiting to acquire initial system synchronization through frequency and phase tracking in order to establish a link to a base station (such as during a "handoff"). The mobile telephone ringing or alert tone generation can be performed in idle or traffic state. The ringing is enabled in the traffic state so that the mobile telephone user does not miss an incoming call during the handoff.

The preferred embodiments of the present invention may be used in any

type of cellular network, and can provide the user with call answering of analog or digital mobile telephones by hands-free voice activation, in telephone or carkit mode.

While this invention has been described with reference to its presently preferred embodiments, its scope is only limited insofar as defined by the following set of claims and all equivalents thereof. It is quite clear that the above description has been given purely by way of a non-restrictive example. Those skilled in the art will appreciate that various adaptations and modifications of the described preferred embodiments can be configured without departing from the scope and spirit of the invention. Therefore, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed is:

# CLAIMS

1. A method for allowing a mobile telephone user to answer an incoming call by a verbal command to perform hands-free voice activation, comprising the steps of:

if not previously initialized, performing initialization to pre-program a user's voice greeting; and

if an incoming call is received, answering the incoming call by a verbal command

to accept or reject the incoming call.

2. The method of claim 1 wherein the initialization step further comprises the steps of:

prompting the user for, and inputting, the user's voice greeting;

prompting the user for, and entering, a mobile telephone memory database location for storing the voice greeting; and

storing the voice greeting represented as a digitized speech pattern in the specified mobile telephone memory database location.

3. The method of claim 2 wherein the digitized speech pattern may be in compressed or uncompressed form.

4. The method of claim 2 wherein the initialization step further comprises the steps of:

entering a password; and

verifying the password before allowing the user to store the voice greeting.

5. The method of claim 1 wherein the answering the incoming call step further comprises the steps of:

alerting the user to enter a verbal command;

waiting for the user's verbal command; and

if the user answered by the verbal command and if not previously initialized, outputting a factory-programmed voice greeting; or

if the user answered by the verbal command and if previously initialized, determining if a match found of the user's verbal command and the stored user pre-programmed voice greetings, and if a match is found, outputting the matched user pre-programmed voice greeting.

6. The method of claim 5 including the further step of, sending a page response message to the mobile telephone's base station to continue with the incoming call.

7. A method for answering a mobile telephone incoming call by a verbal command, to allow hands-free voice activation of the mobile telephone placed on a carkit, comprising the steps of:

waiting until an incoming call is received;

alerting the user to enter a voice greeting or press the mobile telephone keypad key, after receipt of the incoming call;

waiting for the user's voice greeting or an input through the mobile telephone keypad;

if any keypad key is pressed, answering the call in telephone mode;

if the user answered by a voice greeting, answering the call in carkit mode; and

sending a page response message to the mobile telephone's base station to continue with the incoming call.

8. The method of claim 7 wherein the step of answering the call in carkit mode comprises outputting the pre-programmed voice greeting on the mobile telephone carkit speaker.

9. The method of claim 8 wherein the step of answering the call in carkit mode further comprises a step of choosing a factory-programmed voice greeting or the user's pre-programmed voice greeting, if previously initialized.

10. The method of claim 9 wherein the step of choosing the user's pre-programmed voice greeting further comprises a step of determining if a match is found between the user's voice greeting and the stored user pre-programmed voice greetings, and if a match is found, outputting the matched user pre-programmed voice greeting.

11. The method of claim 9 wherein the voice greeting is represented as a digitized speech pattern, in compressed or uncompressed form.

12. The method of claim 7 wherein the step of waiting for an incoming call further comprises the step of:

if an incoming call is not received and not previously initialized, performing initialization to pre-program the user's voice greeting.

13. The method of claim 12 wherein the initialization step comprises the steps of:

prompting the user and inputting the user's voice greeting;

prompting the user and entering a mobile telephone memory database location for storing the voice greeting; and

storing the voice greeting represented as a digitized speech pattern in the specified mobile telephone memory database location.

14. The method of claim 13 wherein the initialization step further comprises the steps of:

entering a password; and

verifying the password before allowing the user to store the voice greeting.

15. A mobile telephone system for answering a mobile telephone incoming call by a user's verbal command, to allow hands-free voice activation, comprising:

a mobile telephone having:

a programming key for pre-programming the user's voice

greeting,

a keypad means for answering the call in telephone mode,

a microphone means for receiving and entering a user's verbal command when answering the call in carkit mode,

a digital processing means connected to the microphone means for performing spectrum analysis and feature extractions of the user's verbal command in carkit mode, and

a memory means connected to the digital processing means and having a database for storing the user's pre-programmed voice greeting digitized speech pattern; and

a carkit having a cradle for holding the mobile telephone and a speaker for outputting the pre-programmed voice greeting.

16. The system of claim 15 wherein the pre-programmed voice greeting comprises

a factory-programmed voice greeting and the user's pre-programmed voice greeting, if previously initialized after pressing the programming key.

17. The system of claim 15 wherein the voice greeting digitized speech pattern is stored in compressed or uncompressed form.

18. The system of claim 15 wherein the digital processing means comprises a spectrum analyzer means for performing spectrum analysis and a feature extraction means for feature extractions of the user's verbal command for determining if a match exists between the user's verbal command and the stored user pre-programmed voice greetings.

19. The system of claim 18 wherein the digital processing means comprises means for checking whether the user's verbal command reaches a pre-programmed pass/fail voice threshold level, If the match is confirmed.

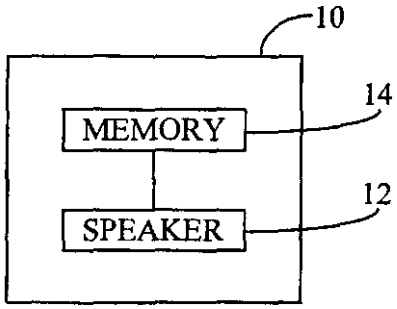


FIG. 1
(PRIOR ART)

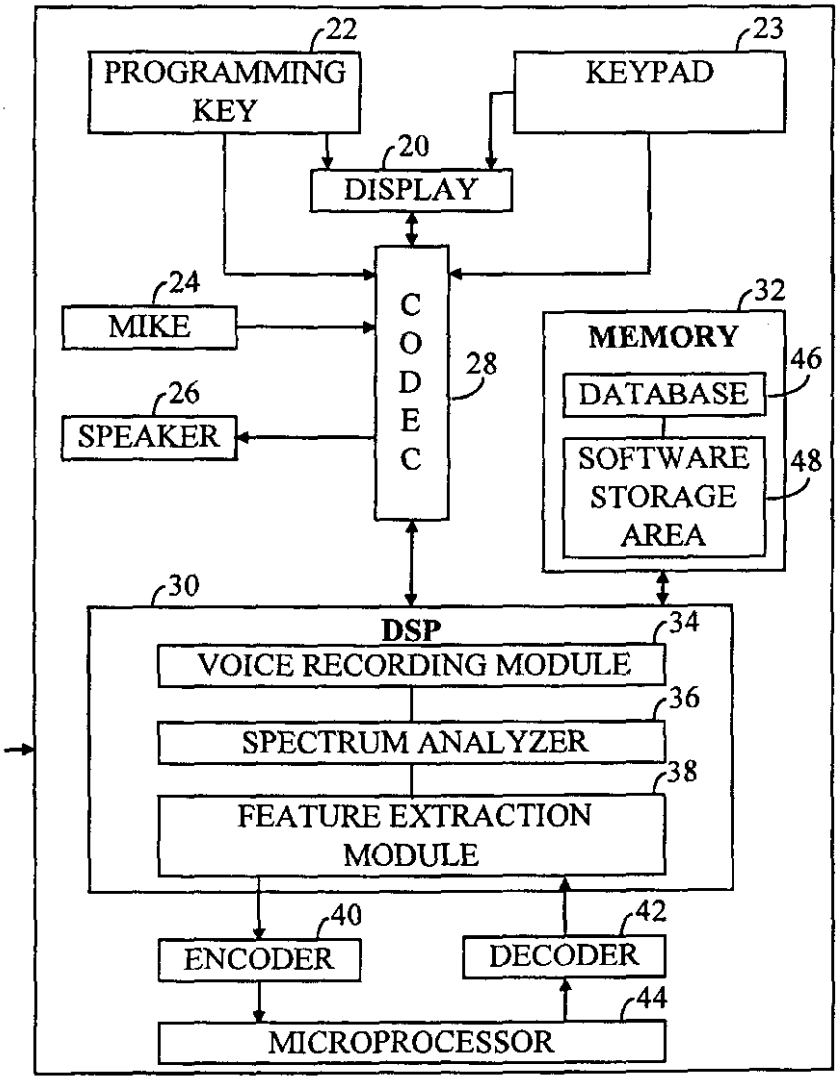


FIG. 2

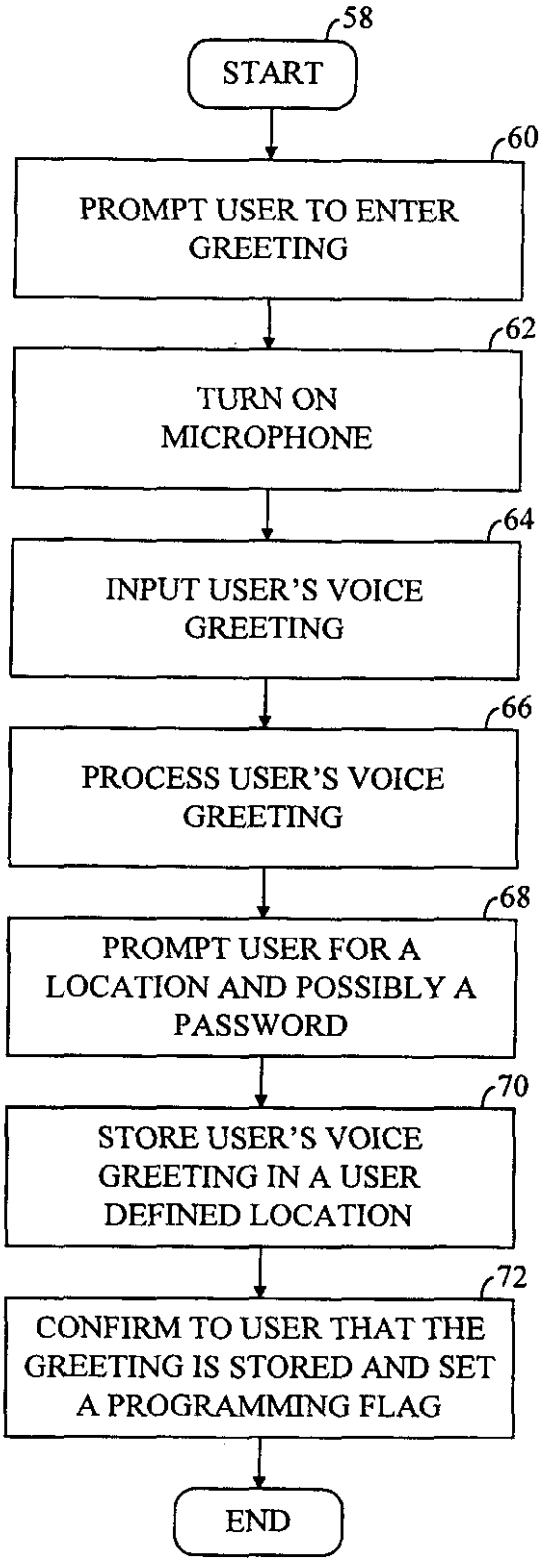
58
START
60
PROMPT USER TO ENTER GREETING
62
TURN ON MICROPHONE
64
INPUT USER'S VOICE GREETING
66
PROCESS USER'S VOICE GREETING
68
PROMPT USER FOR A LOCATION AND POSSIBLY A PASSWORD
70
STORE USER'S VOICE GREETING IN A USER DEFINED LOCATION
72
CONFIRM TO USER THAT THE GREETING IS STORED AND SET A PROGRAMMING FLAG
END

FIG. 3

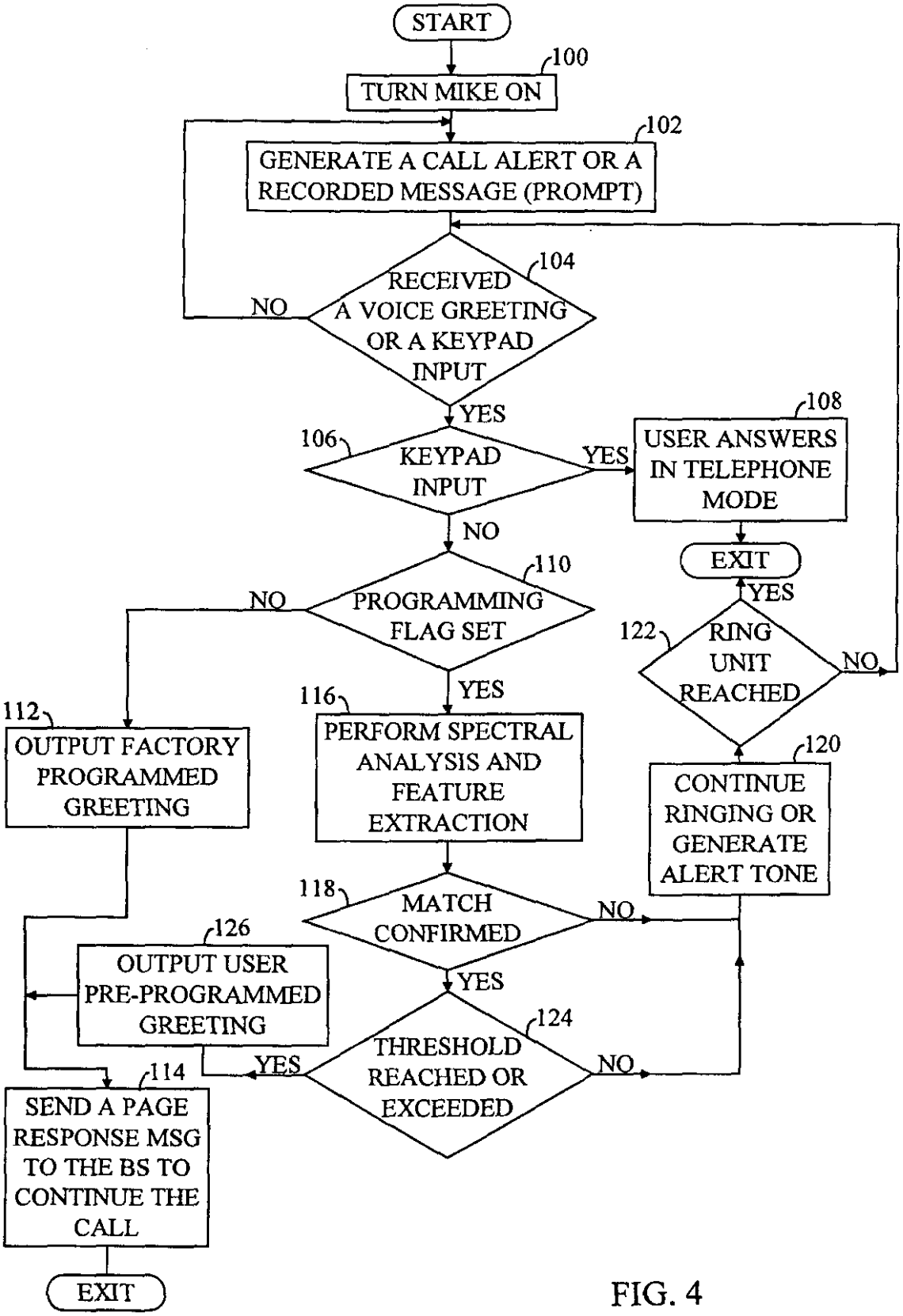
START
100
TURN MIKE ON
102
GENERATE A CALL ALERT OR A RECORDED MESSAGE (PROMPT)
104
RECEIVED A VOICE GREETING OR A KEYPAD INPUT
NO
YES
106
KEYPAD INPUT
YES
108
USER ANSWERS IN TELEPHONE MODE
NO
110
PROGRAMMING FLAG SET
NO
YES
112
OUTPUT FACTORY PROGRAMMED GREETING
116
PERFORM SPECTRAL ANALYSIS AND FEATURE EXTRACTION
118
MATCH CONFIRMED
NO
YES
126
OUTPUT USER PRE-PROGRAMMED GREETING
YES
124
THRESHOLD REACHED OR EXCEEDED
NO
114
SEND A PAGE RESPONSE MSG TO THE BS TO CONTINUE THE CALL
EXIT
EXIT
YES
122
RING UNIT REACHED
NO
120
CONTINUE RINGING OR GENERATE ALERT TONE

FIG. 4

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/02289

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M1/27 H04M1/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | GB 2 317 781 A (MATSUSHITA ELECTRIC IND CO LTD) 1 April 1998 (1998-04-01) page 3, line 6 -page 5, line 14; figures 7-9 | 1,7,15 |
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[X] Further documents are listed in the continuation of box C.

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| 28 June 2000 | 04/07/2000 |

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| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | de Biolley, L |

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# INTERNATIONAL SEARCH REPORT

| In ational Application No |
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| PCT/US 00/02289 |

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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H04M 1/27
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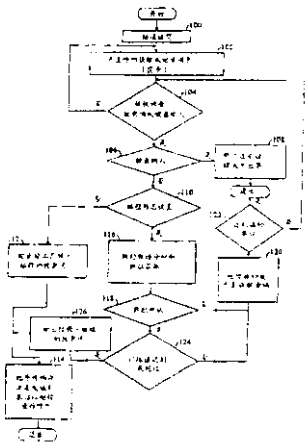
权利要求书3页 说明书6页 附图页数3页

[54]发明名称 激活语音的移动电话呼叫应答器

[57]摘要

一种移动电话和方法,用于通过用户的口述命令应答移动电话输入呼叫,以 允许免提语音。移动电话系统包括汽车附件和移动电话。移动电话具有编程键(22),用于对用户的语音致意词进行预编程;键盘(23),用于应答在电话模 式中的呼叫;话筒(24),用于输入用户的口述命令以应答在汽车附件模式中的 呼叫;连接到话筒的数字处理器(30),用于执行在汽车附件模式中的用户口述 命令的频谱分析(36)和特征获取(38);以及连接到数字处理器的存储器(32), 它具有数据库(46),用于存储用户的经预编程的语音致意词数字化语音图案。经预编程的语音致意词可以是经工厂预编程的语音致意词或如果先前在按编程 键之后经过初始化,则是用户的经预编程的语音致意词。数字处理器(30)执行 用户的口述命令的频谱分析和特征获取,以确定在用户的口述命令和所存储的经 预编程的用户语音致意词之间是否存在匹配。如果确认匹配,则数字处理器(30) 还检查用户的口述命令是否到达经预编程的通过/失败语音门限值电平。



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# 权　利　要　求　书

1．一种方法，用于允许移动电话用户通过口述命令来应答移动输入呼叫以执行免提语音激活，所述方法包括下列步骤：

如果先前未经初始化，则执行初始化以对用户的语音致意词进行预编程；以及

如果接收到输入呼叫，则通过口述命令应答输入呼叫，以接受或拒绝输入呼叫。

2．如权利要求 1 所述的方法，其特征在于，初始化步骤进一步包括下列步骤：

向用户提示，并输入用户的语音致意词；

向用户提示，并输入移动电话存储器数据库存储单元，用于存储语音致意词；以及

在指定的移动电话存储器数据库存储单元中存储表示为数字化语音图案的语音致意词。

3．如权利要求 2 所述的方法，其特征在于，数字化语音图案可以是压缩或非压缩形式。

4．如权利要求 2 所述的方法，其特征在于，初始化步骤进一步包括下列步骤：

输入密码；以及

在允许用户存储语音致意词之前验证密码。

5．如权利要求 1 所述的方法，其特征在于，应答输入呼叫步骤进一步包括下列步骤：

提醒用户输入口述命令；

等待用户的口述命令；以及

如果用户通过口述命令应答和如果先前未经初始化，则输出经工厂编程的语音致意词；或

如果用户通过口述命令应答和如果先前已经初始化，则确定是否发现用户的口述命令和所存储的经预编程的用户语音致意词的匹配。如果发现匹配，则输出匹配的经预编程的用户语音致意词。

6．如权利要求 5 所述的方法，其特征在于，进一步包括下列步骤：把寻呼响应消息发送到移动电话的基站以继续进行输入呼叫。

7．一种方法，用于通过口述命令应答移动电话输入呼叫，以允许放置在汽车附件上的移动电话的免提语音激活，所述方法包括下列步骤：

等待直到接收到输入呼叫；

在接收到输入呼叫之后，提醒用户输入语音致意词或按移动电话键盘键；

如果按下任何键盘键，则在电话模式中应答呼叫；

如果用户通过语音致意词应答，则在汽车附件模式中应答呼叫；以及

把寻呼响应消息发送到移动电话的基站以继续进行输入呼叫。

8．如权利要求 7 所述的方法，其特征在于，在汽车附件模式中应答呼叫的步骤包括在移动电话汽车附件扬声器上输出经预编程的语音致意词。

9．如权利要求 8 所述的方法，其特征在于，在汽车附件模式中应答呼叫的步骤进一步包括选择步骤，用于选择经工厂一预编程的语音致意词或如果先前已经初始化则选择用户的经预编程的语音致意词。

10．如权利要求 9 所述的方法，其特征在于，选择用户的经预编程的语音致意词的步骤进一步包括确定步骤，用于确定在用户的语音致意词和所存储的经预编程的用户语音致意词之间是否发现匹配，如果发现匹配，则输出匹配的经预编程的用户语音致意词。

11．如权利要求 9 所述的方法，其特征在于，以压缩或非压缩形式的数字化语音图案来表示语音致意词。

12．如权利要求 7 所述的方法，其特征在于，等待输入呼叫的步骤进一步包括下列步骤：

如果未接收到输入呼叫和先前未经初始化，则执行初始化以对用户的语音致意词进行预编程。

13．如权利要求 12 所述的方法，其特征在于，初始化步骤包括下列步骤：

提示用户和输入用户的语音致意词；

提示用户和输入移动电话存储器数据库存储单元，用于存储语音致意词；以及

在指定的移动电话存储器数据库存储单元中存储表示为数字化语音图案的语音致意词。

14．如权利要求 13 所述的方法，其特征在于，初始化步骤进一步包括下列步骤：

输入密码；以及

在允许用户存储语音致意词之前验证密码。

15．一种移动电话系统，用于通过用户的口述命令应答移动电话输入呼叫以允许免提语音激活，包括：

移动电话，它具有：

编程键，用于对用户的语音致意词进行预编程；

键盘装置，用于在电话模式中应答呼叫；

话筒装置，用于当在汽车附件模式中应答呼叫时接收和输入用户的口述

命令；

数字处理装置，把它连接到话筒装置，用于在汽车附件模式中执行频谱分析和用户的口述命令分特征获取；以及

存储器装置，把它连接到数字处理装置，并具有数据库，用于存储用户的经预编程的语音致意词数字化语音图案；以及

具有支架的汽车附件，用于保持移动电话和扬声器，用于输出经预编程的语音致意词。

16. 如权利要求 15 所述的系统，其特征在于，经预编程的语音致意词包括：

经工厂预编程的语音致意词和如果先前在按编程键之后经初始化，则包括经预编程的用户语音致意词。

17. 如权利要求 15 所述的系统，其特征在于，以压缩或非压缩形式存储语音致意词数字化语音图案。

18. 如权利要求 15 所述的系统，其特征在于，数字处理装置包括用于执行频谱分析的频谱分析仪装置和用于进行用户的口述命令的特征获取的特征获取装置，用于确定用户的口述命令和所存储的经预编程的用户语音致意词之间是否存在匹配。

19. 如权利要求 18 所述的系统，其特征在于，数字处理装置包括一种装置，用于检查用户的口述命令是否到达经预编程的通过/失败语音门限值电平，如果确认匹配时。

# 说　明　书

## 激活语音的移动电话呼叫应答器

发明领域

本发明通常涉及移动电话领域，尤其涉及语音激活呼叫应答器和方法，用于通过口述命令进行免提语音激活移动电话。

背景技术

当在蜂窝 PCS 无线电电话环境中接通移动电话时，一般必须搜索和捕获通过基站连续地发送的前向链路信号（导频信号）。移动电话使用导频信号来得到初始系统同步和提供对来自基站的信号的时间、频率和相位跟踪。由于要到捕获到导频信号移动电话才能开始发送或接收，所以在接通之后必须快速捕获这个信号，因为用户一般不希望为了进行电话呼叫而等待。

一旦接通移动电话，可能在车辆中应用它来发送或接收电话呼叫。为了允许希望使用移动电话的驾驶员实现小心驾驶并把注意力集中到路况上，最好把移动电话放置在安装在车辆内的汽车附件（carkit）上。然而，最好，应答模拟或数字移动电话呼叫从手工按下移动电话键盘上的一个键开始。对于通过口述命令的移动电话的激活看来没有可靠的方法和结构。

因此，需要一种通过口述命令进行免提语音激活移动电话的呼叫应答器架构和方法。

发明内容

本发明的各实施例致力于和解决当前可得到的移动电话应答系统的上述的和其它缺点。

本发明的一个实施例是一种移动电话系统，用于通过用户的口述命令应答移动电话输入呼叫，以允许免提语音激活。移动电话系统包括一个支架和一个移动电话。移动电话具有编程键，用于对用户的语音致意词进行预编程；键盘，用于应答在“电话模式”中的呼叫；话筒，用于输入用户的口述命令以在“支架模式”中应答呼叫；连接到话筒的数字处理器，用于执行在支架模式中的用户口述命令的频谱分析和特征获取；以及连接到数字处理器的存储器，具有存储经预编程的用户语音致意词的数字语音图案的数据库。

预编程语音致意词可以是经工厂编程的语音致意词，或如果先前用户按编程键进行初始化，则是用户的预编程语音致意词。数字处理器执行用户口述命令的

频谱分析和特征获取，用于确定用户的口述命令和所存储的用户输入的预编程语音致意词之间是否存在匹配。如果发现匹配，则数字处理器还检查用户的口述命令是否达到预编程通过/失败语音门限值电平。

本发明的另一个实施例是一种方法，用于允许移动电话用户通过口述命令来应答输入呼叫，以执行免提语音激活。所述方法可以包括执行初始化以进行用户的语音致意词的预编程。如果接收到输入呼叫，则所述方法允许通过口述命令来应答输入呼叫，以接受或拒绝输入呼叫。

初始化步骤提示并输入用户的语音致意词，提示用户并输入移动电话存储器数据库单元（location），用于在特定移动电话存储器数据库单元中存储语音致意词和存储表示为数字化语音图案的语音致意词。数字化语音图案可以是压缩或非压缩的形式。

当寻呼一个移动装置以完成语音呼叫时，就进行“呼叫应答”过程。呼叫应答过程提醒用户输入口述命令，并等待用户的口述命令。如果用户通过口述命令应答和如果以前未经过初始化，则所述方法输出经工厂编程的语音致意词。如果用户通过口述命令应答和如果以前已经经过初始化，则所述方法确定用户的口述命令和所存储的经用户预编程的语音致意词是否发现匹配，如果发现匹配，则输出匹配的经预编程的用户语音致意词。在输出语音致意词中之一之后，所述方法把寻呼响应消息发送到移动电话的基站以继续进行输入呼叫。

从下面结合附图的详细描述中，对本发明的上述的和附加的特性和优点将更为明了，在所有的附图中，用相同的标号作相应的识别。

附图简述

图 1 示出传统汽车附件的功能方框图；

图 2 示出根据本发明的一个实施例的移动电话的功能方框图；

图 3 示出根据本发明另一个实施例的初始化模式方法的流程图，用于对用户的语音致意词预编程；

图 4 示出根据本发明再另一个实施例的一种方法的流程图，所述方法允许用户通过语音激活来应答输入呼叫而无需按键盘的任何键。

本发明的较佳实施方式

提供下述描述，以使熟悉本领域技术的人员可以制造或使用本发明，并列出进行他们的发明的发明者预期最佳的模式。然而，熟悉本领域技术的人员将不费力地明了这些实施例的各种修改，因为这里已经定义的本发明的一般原理具有特征性。

本发明与一种装置和方法有关，用于通过语音激活对模拟或数字移动电话进行呼叫应答。这个特征使移动电话的用户可以在“电话模式”或“汽车附件”模式中享受免提语音激活，并通过口述命令应答输入电话呼叫。

在图 1 中示出汽车附件的功能方框图。这是传统的装置，具有带扬声器 12 和存储器 14 的移动电话支架 10。图 2 示出根据本发明的一个实施例的移动电话的功能方框图。它具有显示器 20、用于编程模式初始化的编程键 22、标准键盘 23、话筒 24 和扬声器 26。把话筒 24 和扬声器 26 连接到语音编码器－解码器（CODEC）28。语音 CODEC 28 包括模数转换器（ADC）和数模转换器（DAC），未示出。

语音 CODEC 28 接受来自话筒 24 的输入信号并把信号输出到扬声器 26。当移动电话在支架 10 中时，也可以把信号输出到扬声器 12。模数转换器接收作为输入的模拟音频信号，并把它转换成数字信号。数模转换器执行相反的转换。语音编码器－解码器 CODEC 28 或是从语音块重建特定的人类语言声音（所述语音块是从传统信道 CODEC 接收到的，未示出），或是压缩从 ADC 输入的数字化语音，以致在编码之前，位的块表示数据。

把语音 CODEC 28 连接到数字信号处理器（DSP）30。最好，在单个半导体芯片上制造 DSP 30。把它用于通过数字语音处理而执行频谱分析和特征获取，最好，在脉冲编码调制（PCM）格式中。DSP 30 包括语音记录模块 34、频谱分析 36 和特征获取模块 38。把 DSP 30 连接到编码器 40、解码器 42 和存储器 32。

把编码器 40 和解码器 42 连接到微处理器 44。存储器 32 具有数据库 46 和本发明的方法实施例使用的软件存储区 48。存储器 32 最好是在存储器芯片上的可再写入快闪存储器，它允许容易地取得和重写所存储的数据。数据库 46 可以具有分开的存储单元区，用于存储相同移动电话的不同用户的语音致意词。

把来自语音 CODEC 28 的输出传递到 DSP 30 以执行频谱分析。在 DSP 30 中分析来自语音 CODEC 28 ADC 的取样值，从 PCM 数据获取功率谱密度或语音波形信息。在特征获取模块 38 中对经 DSP 分析的数据进行滤波以消除自然语音的冗余数据，诸如在词或音节之间的停顿。

对于特征获取模块 38 的传统的时间－不变数字滤波器（未示出），一组数据取样的分析产生滤波器系数和一个激活信号。可以把这个滤波器认为是人类口述域的模仿，其中，滤波系数表示口述修改器（例如，牙齿、舌头、咽喉），而激活信号表示声音（例如，音高、响度）或不存在通过口述域（滤波器）的声音。滤波器系数和合适激活信号的正确设置产生典型的人类语音的声音。

在编码器 40 中对从 DSP 30 输出的数据进行编码，而在解码器 42 中对从微处理器 44 输入 DSP 30 的数据进行解码。本发明的软件使用微处理器 44 把呼叫

已应答和不管该呼叫是在“电话模式”还是在“汽车附件模式”都要保持数据通知移动电话的基站。

本发明的另一个实施例是一种方法，用于允许移动电话用户通过允许免提语音激活的口述命令来应答输入呼叫。如果先前没有对用户的语音致意词进行初始化，则所述方法允许执行本发明的初始化而对用户的语音致意词预编程。如果接收到输入呼叫，则所述方法允许用户通过口述命令来应答输入呼叫，并允许用户接受或拒绝输入呼叫。通过在软件存储区 48 中存储的计算机程序执行本发明的初始化模式方法实施例。

图 3 表示初始化方法程序的流程图，用户使用所述初始化方法程序进行语音致意词的预编程。在存储器数据库 46 中，可以把语音致意词表示为压缩或非压缩数字化语音图案。通过在步骤 58 按移动电话的编程键 22 而开始初始化模式的方法。步骤 60 包括用嘟嘟声提示用户输入语音致意词。然后在步骤 62 中接通话筒 24。

步骤 64 包括输入用户的语音致意词。在步骤 66 中，在 DSP 30 的语音记录模块 34 中处理语音致意词，并显示在移动电话显示器 20 上。当完成处理时得到语音致意词，并在步骤 68 中提示用户选择和输入存储器存储单元和可能的一个密码，用于存储语音致意词。在步骤 70 中，在存储器数据库 46 的指定存储单元中存储语音致意词和密码。在步骤 72 中设置编程状态标志，并在移动电话显示器 20 上显示一个确认。

用户可以在这个模式中存储男性或女性语音的任何语音致意词，诸如“您好”。以压缩或非压缩数字化语音图案来存储致意词。它的持续期最好在 1 到 15 秒之间。如果需要存储持续期较长的语音致意词，则可想象，数据库 46 可以使用较多存储空间的汽车附件存储器 14。

可想象，在初始化模式中可以对预编程尝试数次，以训练存储致意词的音素具有能够容易地再现和正确地识别的形式。为了这个目的，用户可以指定致意词在数据库 46 中的存储单元，以致可以在相同存储单元重写用户以前的致意词。因为有可能移动电话的接入模式能力是有限的，所以允许用户输入一个密码，在允许用户存储语音致意词之前可以用该密码进行验证。

通过存储在软件存储区 48 中的计算机程序执行本发明的呼叫应答方法。图 4 是执行呼叫应答方法的程序的流程图，允许用户通过语音激活应答输入呼叫而无需按任何键盘的键。呼叫应答模式有两个方面。在一个方面中，它提供选择用经工厂编程的致意词应答输入呼叫。在另一方面中，可以使用用户自己的语音致意词，如果根据图 3 的方法以前已经预编程而且存储在存储器数据库 46 中。

步骤 100 包括当接收输入呼叫时接通话筒 24。步骤 102 包括产生呼叫警告语

调或语音提示，提醒用户输入语音致意词或按键盘 23 键。步骤 104 包括在每个警告语调或所产生的振铃之后等待用户的语音致意词或通过移动电话键盘 23 的输入。当按任何键盘 23 的键时，可以在电话模式中应答输入呼叫，或在语音致意词模式中（即，“汽车附件模式”）应答/拒绝。

在电话模式中，诸如在城市中这样的噪声环境中，可以通过移动电话键盘 23 禁止所存储的口述致意词，以允许用户把移动电话按到他的耳朵上而应答电话。因此，如果在步骤 106 中确定按下任何键盘 23 的键，则禁止所存储的致意词，而用户在步骤 108 中的电话模式中应答。

语音致意词（或耳朵附件）模式允许用户通过语音命令（例如，“您好”或“回答”等）应答或拒绝输入呼叫。如果在步骤 104 中接收到用户的语音致意词，以及如果在步骤 110 中确定图 3 的方法没有设置编程状态标志，则在汽车附件扬声器 12 上输出经工厂编程致意词。经工厂编程致意词可以用男性或女性语音，并用销售电话所在地的国家的语言，但是限于只有一个致意词，诸如“您好”。其次，在步骤 114 中，把寻呼响应消息发送到移动电话的基站，而用户继续进行呼叫而无需使用双手。

如果在步骤 104 中接收到用户的语音致意词，以及在步骤 110 中，如果确定设置编程状态标志而示出至少有一个现有的致意词存储在存储器数据库 46 中，则在步骤 116 中继续进行所述方法。在步骤 116 中把用户的致意词输入频谱分析仪 36 和特征获取模块 38，以尝试和所有存储在数据库 46 中的预编程数字化语音图案中的致意词进行匹配。如果在步骤 118 中没有确认匹配，则在步骤 120 中产生呼叫提醒音调或语音提示。在步骤 122 中确定提醒或提示数目是否超过预编程的极限。如果尚未达到极限，则程序继续进行步骤 104，等待接收另一个语音致意词或键盘 23 输入。通过讲述与所有存储在数据库 46 中不同的致意词，用户可以慎重地拒绝输入呼叫。

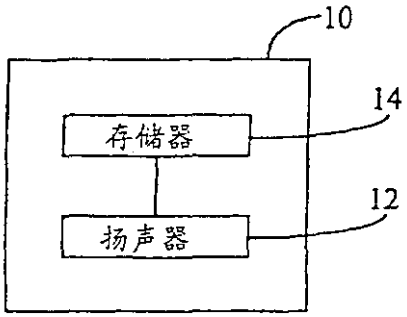
如果在步骤 118 中确认匹配，则步骤 124 检查输入语音致意词是否到达预编程的通过/失败语音门限值电平。如果语音致意词在语音门限值之下，则在步骤 120 中电话继续振铃或产生提醒音调。如果达到或超过门限值，则在步骤 126 中在汽车附件扬声器 12 上输出经预编程的用户致意词。接着，执行步骤 114 把寻呼响应消息发送到基站，而用户继续进行呼叫。

在本发明中，在等待呼叫时，移动电话是在接收模式中。在接收模式中的电话可以处于三种状态中的任意一种状态：话务、空闲和捕获状态。为了开始、终止或建立呼叫，移动站把命令发送到移动电话以通过指定的话务信道输入话务状态。在空闲状态中，等待在一个寻呼信道中的呼叫。在捕获状态中，移动电话通过频率和相位跟踪等待捕获初始系统同步，以便建立到基站的链路（诸如在“越

区切换”期间）。在空闲或话务状态中可以执行移动电话振铃或提醒音调的产生。在话务状态中启动振铃，以致在越区切换期间用户不会丢失一个输入呼叫。

可以在任何类型的蜂窝网络中使用本发明的较佳实施例，并可以为用户配备在电话或汽车附件模式中通过免提语音激活的模拟或数字移动电话的呼叫应答。

当已经参考本发明的当前较佳实施例描述本发明时，它的蜂窝仅受下述权利要求组即其等效的限制。很清楚，已经借助于非一限制性例子给出上述说明。熟悉本领域技术的人员将明了可以组成这些实施例的各种修改而必要偏离本发明的蜂窝和精神。因此，可以理解，在所附的权利要求书的范围内，可以不同于这里所特别描述的实施例来实施本发明。


10
14
存储器
12
扬声器

（现有技术）

图　1

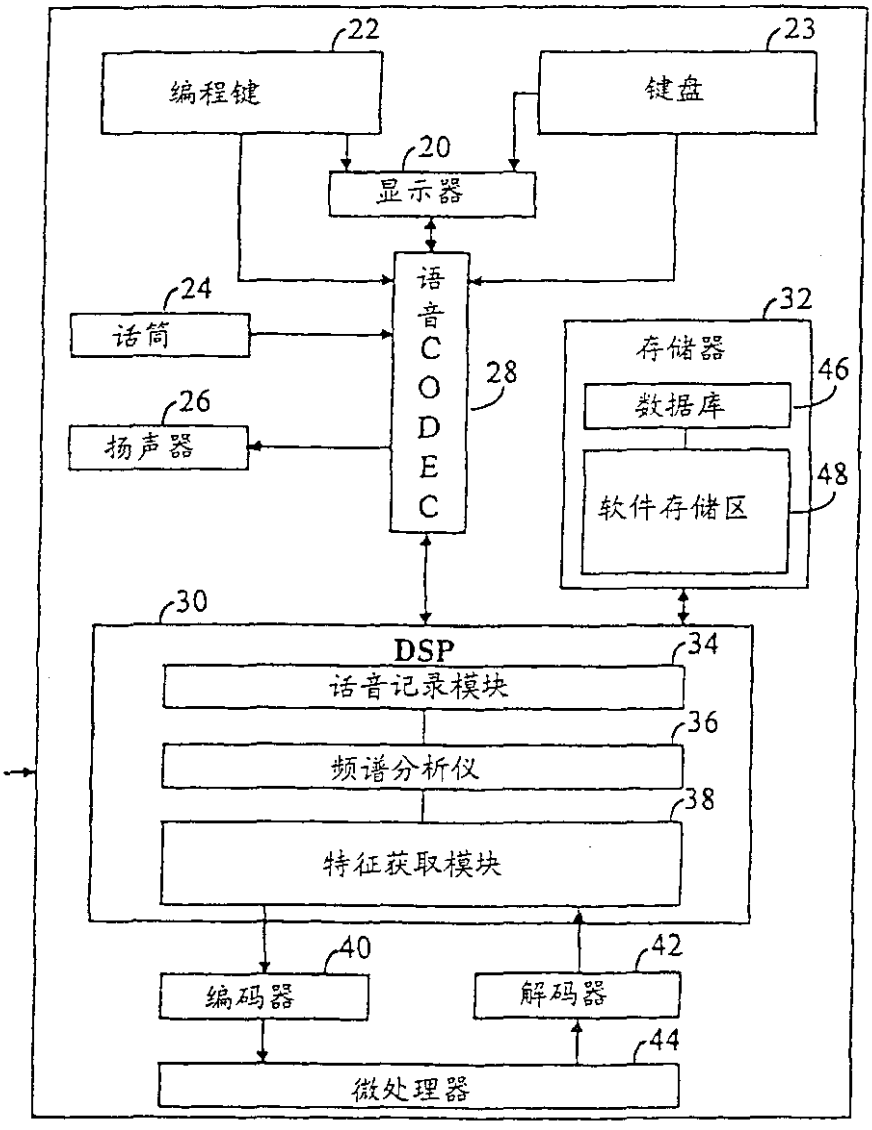

22
编程键
23
键盘
20
显示器
语音CODEC
28
24
话筒
26
扬声器
32
存储器
46
数据库
48
软件存储区
30
DSP
34
话音记录模块
36
频谱分析仪
38
特征获取模块
40
编码器
42
解码器
44
微处理器

图　2

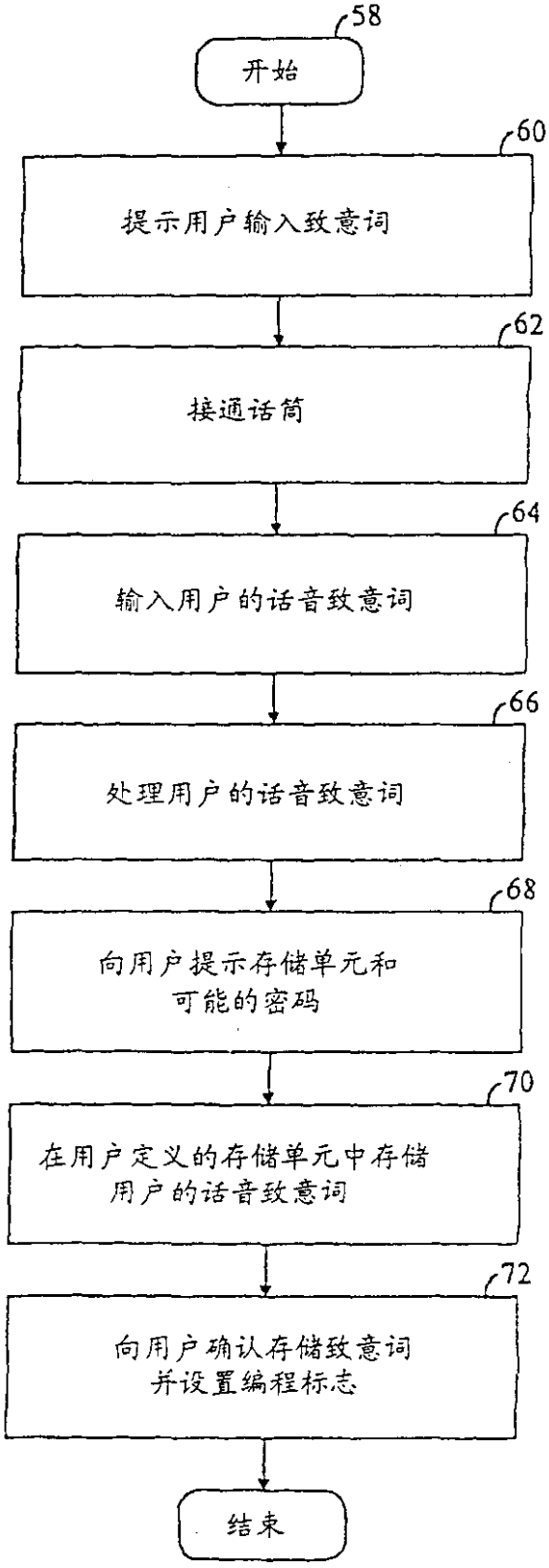

58
开始
60
提示用户输入致意词
62
接通话筒
64
输入用户的话音致意词
66
处理用户的话音致意词
68
向用户提示存储单元和
可能的密码
70
在用户定义的存储单元中存储
用户的话音致意词
72
向用户确认存储致意词
并设置编程标志
结束

图 3

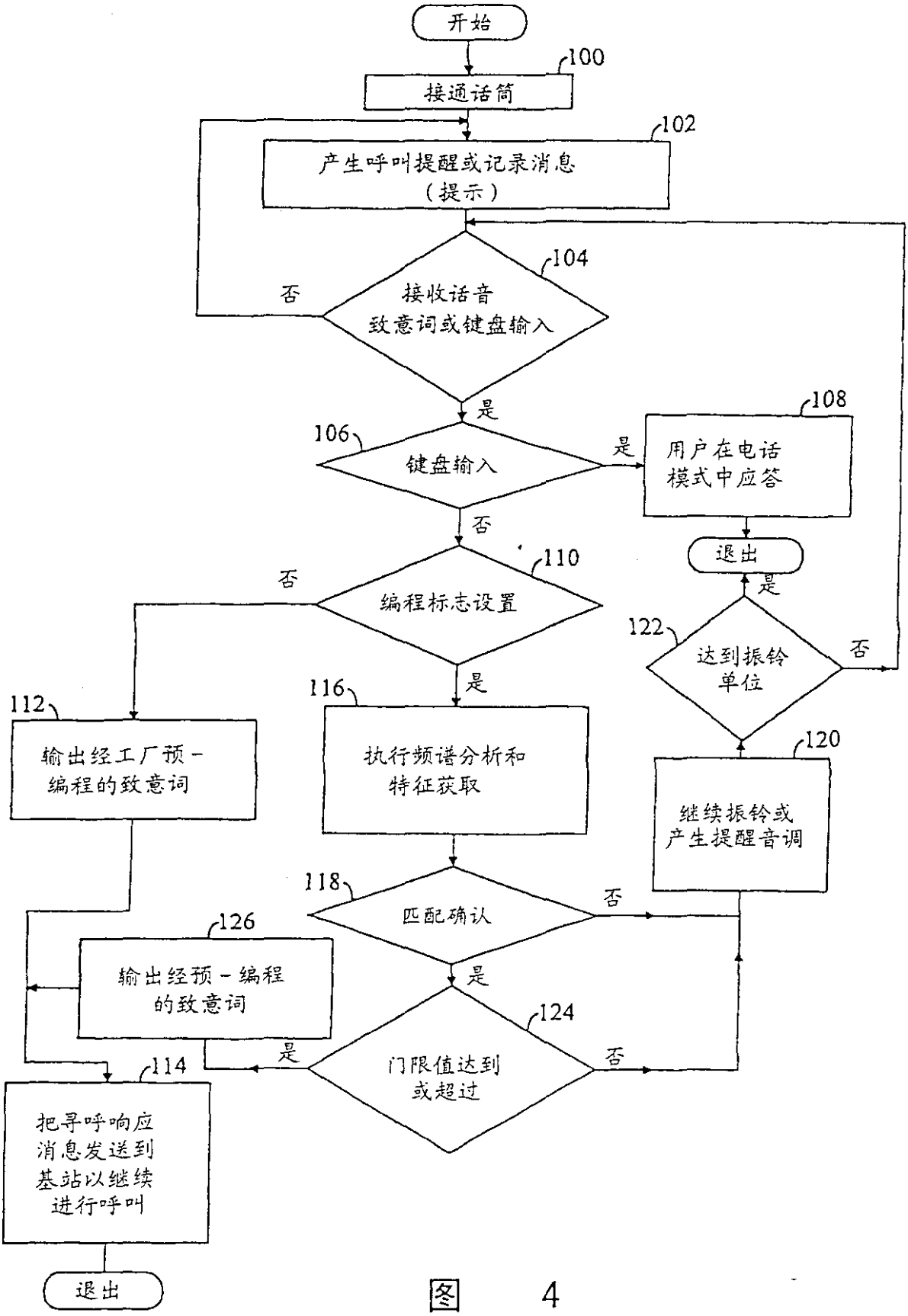

开始
100
接通话筒
102
产生呼叫提醒或记录消息（提示）
104
接收话音致意词或键盘输入
否
是
106
键盘输入
是
108
用户在电话模式中应答
退出
否
110
编程标志设置
否
是
122
达到振铃单位
是
否
112
输出经工厂预－编程的致意词
116
执行频谱分析和特征获取
120
继续振铃或产生提醒音调
118
匹配确认
否
是
126
输出经预－编程的致意词
124
门限值达到或超过
是
否
114
把寻呼响应消息发送到基站以继续进行呼叫
退出

图 4