Design and implementation of the System Based on the H.323 Protocol of the Beijing 12316 IP call

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Abstract. To improve the network of Beijing 12316 voice call system and access the flexibility, enhance scalability and maintainability of the system, this paper analyzes technical advantages of the IP call system compared with the traditional voice call system, design and implement the voice call system, which is based on H.323 protocol IP on original Beijing 12316 voice call system. The system contains interface layer, traffic flow control layer and encapsulation layer, and the system is based on communication and control functions of H.323 protocol, which is invoked in the form of ActiveX controls, which can be called directly to complete the basic business functions. Users only need a computer with audio equipment or IP telephone of network to use the system, which will improve service quality of the Beijing 12316 IP call system greatly.

Introduction
Since the 2008, the Beijing 12316 agricultural service hotline has accepted 3164 cases about counterfeit agricultural complaints, and provided up to 34 million times about all kinds of agricultural information technology consulting and support services, which has been good for farmers. In order to improve the quality of Beijing 12316 service, accelerate the pace of agricultural informatization of Beijing, it’s necessary to constantly improve the function of the system.

With the development of Internet and communication technology, IP telephone has competitive advantage compared to the traditional PSTN telephone, the IP telephone technology has been greatly developed because it has a simple network, strong scalability and low price. In particularly, the technology of IP telephone which is based on H.323 protocol with its high network utilization has now become the development trend of IP technology[1-2]. This paper has designed and implemented the voice call system which is based on H.323 protocol IP on original Beijing 12316 voice call system.

It greatly improves the system's flexibility and scalability by middleware design, Users just need a IP telephone or a computer to easily handle both voice and data, Which will provides all of a unified, standardized service [3-4].

The Overall Design of System

System Requirements
The main function of Beijing 12316 IP voice call system is network calling, call processing, and can collect and manage customer information. The agents mainly to deal with user consultation, complaints etc, which contains all kinds of business, including complaints, quality traceability of agricultural products, administrative licensing of Agricultural Bureau, market information, agricultural science and technology information and district features information, covering 12316 system's core business, which is the basic part of the whole service hotline, so the quality of agent soft telephone directly affects the quality of the whole system.

The agent system needs good real-time and fluency, business logic, in order to facilitate the management and maintainance. Agent soft telephone has a series of functions, which contains Calling, Hang up, Response, Meetings, Transfer, Retention, Recovery and Evaluation, etc.
Figure 1. Basic Calling Functions of Beijing 12316IP System.

1. Calling: calling is mainly used to establish a voice channel, agent users could input target number and press calling button to achieve call function.
2. Hang up: end a call.
4. Meetings: this function for the operator to initiate the establishment of a conference call.
5. Transfer: when operator input the number, the system will automatically dial numbers, telephone users will be transferred to the destination telephone when the telephone is connected, and then the operator leaves the current session.
6. Retention: the user begin to listen to waiting for the music, the call between agent and user will be disconnected, different from hanging up, the maintained call can be restored.
7. Recover: the system will automatically resume between agents and users.
8. Evaluation: to evaluate the current call.

The Basic Principle of System

IP telephone transmit voice and data packet through the network, the core idea is packet switching, and the system contains the terminal equipment, gateway, gatekeeper, network management server and component composition [5-7].

Figure 2. IP Calling System Based on H.323 Protocol.

In the calling system, IVR can also establish multi-channel voice connection, and provide a full range of self-help voice navigation service. The main function of ACD is will automatically call the assignment of users to specify agent; database server stores all kinds of data, such as audio files, customer information, which can be used to statistical analysis and other application services; the agent terminal parallel process of traffic and business, which can reduce the pressure of server, and improve efficiency of the agents.

The most important application layer protocol of the IP call system is multimedia communication protocol, the current systems are mainly based on the SIP protocol and H.323 protocol. The H.323 protocol is more complex, and is also a protocol framework, which are mainly used for packet network audio and video communication standards, including terminal equipment, data transmission,
communication control, network interface and other aspects[8-9]. H.323 protocol conforms to the design idea of traditional communications, furthermore, it has better compatibility, convenience, little packet loss phenomenon, also has independence of network and platform, and more detailed provisions in the general framework, coding and system control, which can be used conveniently[10]. Therefore, the system of voice communication is designed based on the H.323 protocol, and has real-time storage, display and process of user information through advanced database technology.

**System Structure**

The agent terminal use the oriented object and hierarchical structure of the development method, the system is achieved by three layers: 1, page interaction layer, 2, traffic flow control layer, 3, H.323 protocol and control package. The traffic flow control layer which is in the middle layer call the interface to complete certain functions for interface layer service [11-12]. The structure shown in following figure 3:

![Layered Diagram of Seat Terminal.](image)

**page interface**

User interface is interactive service window between agents and users, the agents can check the relevant information and related operations when successfully land to the system by a browser page, which mainly include basic information, status information and basic operation. By assigning permissions, different landing show the corresponding function, so as to ensure the flexibility of the system and data security.

**traffic flow control**

The traffic flow control layer is located at the interface between the application layer and the base design. This part mainly accomplish real-time processing of the agent, the module need to maintain real-time communication with ACD and dynamic ACD to transfer instructions, making ACD to allocate rational road. At the same time, the interactions between this layer and other layers ensure that the whole system can be successfully quit when emergence condition appears[13].

**H.323 protocol and control package**

H.323 protocol stack is a cross layer protocol, mainly covers from the transport layer to the application layer of VoIP technology. H.323 protocol stack provides many communication class object, including the call connection request and response processing, speech collection and playback, voice compression and decompression, telephone signal processing, so through the invocation of these interfaces of objects, you can complete all the basic functions of telephone communication. This system can be used in the form of ActiveX controls, which has encapsulated and expanded the basic function of H.323 protocol and some operating system API function, in the process of developing web applications, users only need to download and install the control, the functions of traffic and control can be completed through the script language.
System Implementation

Development Environment
Agent system use B/S architecture, applications are installed in the server, and the function buttons are embedded directly on the page, it’s unnecessary to install client software on each agent, users only need to complete business operation with a browser. The system mainly adopts three layer architecture: data access layer (DAL), business logic layer (BLL) and presentation layer (UI), the technical architecture is shown in Figure 4 below. So developers just only pay attention to one layer of the whole structure, the new implementation can replace the original level easily, which will contribute to reducing the dependence between layer and layer, and is conducive to the reuse of the standardization and the logic layer. Data access layer mainly complete data resources, such as insert, delete, update, modify, data storage and management work, and also includes defining a variety of stored procedures, constraints, trigger definition. The business logic layer is used to build the bridge between presentation layer and data access layer. The presentation layer is data interface, which is designed for convenient operation. This system uses Microsoft SQL Server 2008 database and H.323 protocol stack to develop.

![Figure 4. Technical Architecture of Seating System.](image)

Implementation
The system includes database, audio I/O, network interface, business processing, audio coding and decoding, system control, traffic flow control and the user application interface, the Fig.5 shows the whole modules of system.

![Figure 5. Logic Structure Diagram of Beijing 12316IP Calling System.](image)

In this chart, the data transfer between business processing module and database is in real time, including data insertion, data query, data update and data deletion etc, the main business is traffic processing, agent state management, log management and so on. Audio encoder first encode the analog audio signal which is acquainted from the audio I/O equipment, and package into IP data packet which can be transmitted on the network, then decoded the data received from the network and restore to the original analog voice signals, in this process, the G series protocol in the framework of H.323 protocol is mainly used, including G.711, G723.1, g722 and g728 etc. System control module
mainly includes media control of H.245, call control of H.225.0, Ras control of H.225.0. In the realization process, H.225.0 Ras protocol is first executed, RAS channel is used to realize the call admission process of gatekeeper as the control channel, then execute H.225.0 call signaling protocol to setup process of calling. Finally, the H.245 protocol is implemented, a bandwidth of one or more logical channel is used to transmit audio data. The network interface is network transmission interface with the use of communication and H.323 protocol stack, and more, end-to-end message is directly transmitted by TCP or UDP [14].

The above basic module and extended function are binded in the form of plug-ins to the page using Microsoft's ActiveX technology in this system, and providing for traffic flow control module by interface, including a series of events, methods and client program definition [15], voice calls and extended function are called by JavaScript language, users do not need to download and install any terminal software, directly implement agents function through a web browser. Users can see their state information when they log in to the system, including seat number, landing time, times of answering, the current time, and traffic operation, the traffic function fails to operate the buttons are gray when in the current state of the corresponding, and the corresponding traffic operation can be executed when activated.

System Test

Users provided with a computer or IP telephone which is access to network are able to call, twist, and connect with other seats. The web has integrated OCX voice call control to download, the users can enter into the existing telephone call center traffic system after downloading and installing the control, when enter the call center system, users are able to realize the traffic channel using the IVR voice navigation system or the seat. Figure 6 is the Beijing 12316 agricultural service hotline network call interface platform which is popped up when click on "online calls" button on the services page, the system automatically enters a voice navigation without any operation, in the process of communication, users can "hang up", "redial" and "break up". After 50 tests, Overall call quality is good, 4 broken in 10 minutes, this may be due to bad network signal.

![Figure 6. Network Calling Platform of Beijing 12316 Agricultural Service Hotline.](image)

Conclusions

This paper has designed and implemented the Beijing 12316 IP call system on the basis of H.323 protocol stack and traditional calling system, users can get access to call system just only need an IP phone or computer with voice peripherals, and complete the traffic function, which will improves the network flexibility and scalability greatly. Since the system is put to each district of Beijing city center and run, there is less situation of sudden broken network, and the system is running in good condition.
References


