A Context Aware Auto Attendant Based on SIP

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Abstract— SIP protocol, with the advantages of been simple and efficient, had become more popular to integrate with context-awareness computing technologies. This paper proposed a SIP based research framework which integrate automatic speech generation to provide more convenient communication between users. Based on the proposed approach, a SIP context server and several SIP agents hosted on PC or PDA were built and tested. If the call party is absent or busy to answer a call, the context-awarded message is automatically replied to the caller via natural speech. The experimental showed an encouraging result of the proposed system, especially on the satisfaction of message transferring rate and service waiting time.

I. INTRODUCTION

At present, Internet phone is getting more popular. But, it still has following questions.

A. Short of unified standards

There are no unified standards for developer and for users. Different products use their own standards and cannot communicate with each other (ex: Skype and MSN); it causes many inconveniences.

B. Connection between heterogeneous network

There are many kinds of network architecture at present. (ex: Wireless, Bluetooth and Ethernet etc.) If they cannot connect with each other, the quality of service will be bad.

C. User’s demand for service

User will not be satisfied with the simple internet phone service. If internet phone does not provide value-added services, it will be not different to the PSTN. They must offer more service than PSTN.

SIP is an application-layer control protocol that can establish, modify and terminate multimedia sessions such as Internet telephony calls. SIP has the following features [4, 5]:

C.1 It is text-based

This allows easy implementation in object-oriented programming languages such as Java and c/c++, allows easy debugging and, most importantly, makes SIP flexible and extensible.

C.2 It involves less signaling

SIP is designed to meet only the basic requirements (create, modify and terminate) of a call-signaling protocol so that the signaling is kept as simple as possible. This means that programmer can be established faster.

C.3 Parallel search is possible.

A stateful SIP server has the ability to split or ‘fork’ an incoming call so that several extensions can be run at once. The first extension to answer takes the call. This feature is handy if a user is working between two locations (a laboratory and an office, for example), or where someone is ringing both a boss and his secretary.

II. SYSTEM FRAMEWORK

In general, SIP server is able to provide three different services, SIP registrator, SIP proxy, or SIP Redirect Server, according its role. A redirect server accepts SIP requests, maps the destination address to a set of one or more addresses, and returns the new routing information to the originator of the request. Thereafter, the originator of the request can send a new request to the address(es) returned by the redirect server. A redirect server does not issue any SIP requests of its own. SIP proxy servers, which are responsible for sending a request to the current host at which the callee is reachable, consult this location service.
A registrar acts as a front end to the location service for a domain, reading and writing mappings based on the contents of the REGISTER messages. Note that the distinction between SIP server types is logical only, not physical. Typically, a registrar is combined with a proxy or redirect server in a real network. A UA (User agent) is a device (ex: PC, PDA) that generates a response to a SIP request and contacts the user. It can send six messages that can be used in requests: INVITE, ACK, OPTIONS, BYE, CANCEL, and REGISTER [4].

According to the definition by Anind [1], three characteristics are included in a context aware system: 1) Presentation, 2) Automatic execution, and 3) Tagging. Presentation offers context information to user. Automatic execution not only provides service automatically, but also able to adapt in different conditions. Tagging combines context information and automatic execution. Generally, a standard context aware system must have three capabilities includes 1) Context Organization, 2) Context Utilization, and 3) Adaptation. Figure 1 shows the concept model of Context-Aware Adaptive Services.

![Figure 1. The Concept Model of Context-Aware Adaptive Services](image)

In Figure 1, context organization focuses on collection, storage, abstraction, and interpretation of context information. It centralizes and manages context information, then offers it to the context utilization. Context utilization sends context information to context-awareness application, and then it could enter next procedure by context information. In this research, we record context information of user by SIP and URL. According to the information, we decide state of user and offer suitable service for the user [2].

The architecture of this research is shown in Figure 2. Users connected to the network via devices equipped with SIP agents. Messages are transmitted to SIP CS via SIP proxy server. SIP CA established the context aware processing module, the context utilization module will search, collect, and store the users’ context information and the context organization module will responds the related command messages based on the judgment of the user’s environment. If the user is busy, SIP CS will reply the busy message and terminate the user’s request.

![Figure 2. The proposed SIP network architecture](image)

Take the message communication between user_A and user_B for example: user_A issues an INVITE message to the proxy server; the message is then passed to SIP CA; CA issues a signal to collect the status of user_B and interprets that status. Once user_B is ready to accept the INVITE request, a confirm message is transmitted to the proxy server of user_A. The control now goes to user_B, user_B finally issues a WAIT message to user_A via the proxy server to indicate that the communication is ready to be established. The detailed message passing is shown in Figure 3 and 4.

![Figure 3. Message redirect mode](image)
The SIP CS is the most essential server in this research; it contains four major modules as shown in Figure 5:

A. Status collection module

The functionality of this component is to collect the status of all users. When the status of a user is changed due to his manual setup or automatic detected location alteration, this component records this change and provide to the Intelligent agent as a cue for status check and judgment[5].

B. Message management module

When the Intelligent agent had successfully judged the status of a user, a command will be passed to this component. The speech message will be automatically generated and transmitted to the user. A message will be issued to the SIP proxy server to provide related service to the user.

C. Automatic speech generation module

This component is built using text-to-speech (TTS) technique. For each plain text message, the TTS module is able to produce the corresponded utterance. The generated utterance can be used to be transmitted to the user via message management module.

D. Intelligent agent

This module is the core module of proposed framework. It comprises three sub-modules: Check & Storage, Interpretation, and Decision making. When the status of a user is collected, it will be conveyed to this module for interpretation. Based on the interpretation result, the intelligent agent will issue a command to message handling component for further communication of other subsystems.

III. CONCLUSIONS

This paper proposed a research framework which combines SIP protocol, context awareness, and automatic TTS replying techniques. Based on the proposed approach, a SIP context server and several SIP agents hosted on PC or PDA were built and tested. Users can communicate with each other via proposed SIP framework. If the call party is absent or busy to answer a call, the context-awarded message is automatically replied to the caller via natural speech.

The further interested tasks include the integration of automatic speech recognition ability and the extension of more heterogeneous network such as PSTN, GSM, and 3G protocols.

REFERENCES
