

A Voice based Technology for the process of learning in Developing Regions

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ABSTRACT

The World Wide Web(WWW) has made the Internet accessible to anyone regardless of their computer background. A large number of people in the world are using Internet facilities for various purposes. Specially, in the education sector most of the universities and other institutions around the world use the Internet for networking, teaching and learning purposes. Therefore a user should have the facilities to access the information through the Internet easily and quickly. In the developing region like Sri Lanka there is a huge number of students who are still unreached with this sophisticated facility, Because of the lack of resources. But mobile phones and wireless phones are being used at a considerably high percentage among the population of Sri Lanka. Low cost, the simple user interfaces, limited menus, Infrastructural issues and voice based access are the main factors for the high usage of mobile and wireless phone.

In this paper, we present a voice-driven site parallel to the existing web site in the University of Colombo School of Computing in Sri Lanka. This concept is known as The World Wide Telecom Web(WWTW). A voice-driven site parallel to the web site allows the underprivileged users to access the information through voice based communication and provide facilities to generate their own voicesites. Voice site enables the telephone (Mobile, Wireless and fixed phones) users to access through a simple voice based interface from telephony devices and do voice browsing further.

1.0 INTRODUCTION

The Internet is the one of sophisticated technologies and fashion that has made differences in world during the last few years. The World Wide Web(WWW) is one of the services that can be accessed via the Internet along with various other such as email, file sharing, online gaming, streaming media, voice telephony, remote access etc. Therefore the Internet and the WWW are very popular in modern society and most of the sectors like educational, industrial, business and government are exposed to the Internet and the World Wide Web.

Usage of the Internet has highly increased during the last 7-8 years around the world. According to the Internet World Stats Today, barely 21% of the World's population are accessing the Internet (Approximately 1407 billion people) [6]. see table 1.1

World Region	Population	% Population (Penetration)	% Usage Growth 2000-2008
Africa	955,206,348	5.3%	1030.2%
Asia	3,776,181,949	14.0%	363.4%
Europe	800,401,065	47.7%	263.5%
North America	337,167,248	73.1%	127.9%
Middle East	197,090,443	21.3%	1176.8%
Latin America/Caribbean	576,091,673	23.8%	659.9%
Oceania/Australia	33,981,562	57.0%	154.0%
World Total	6,676,120,288	21.1%	290.0%

Table 1.1: Internet Usage and World Population Statistics

Referring to the Internet World Stats 79% of the world's population is still unreached with this sophisticated technology. Unfortunately the Internet penetration in developing countries is still below 10%.

Not only this according to the Internet World Stats the Internet penetration in Sri Lanka is 2.2%. When It compares with other developing countries, It is comparatively a low percentage[6]. See table 2.2

Year	User	Population	%penetration
2000	121,500	19,630,230	0.5%
2007	428,000	19,796,874	2.2%

Table1. 2:Internet usage and Population Statistics in Sri Lanka

Many reasons can be pointed out to the low rate of the Internet penetration in Sri Lanka. The most common access mechanism to the Internet is through the PCs or high end web-enabled handling devices. A PC costs about LKR 20,000 (USD200) which is unbearable for the people in Sri Lanka who are spending money for educational purposes as well.(population of Sri Lanka lives below USD1310 per year). In addition, using a PC requires IT skills beyond reading and writing an ordinary language. Cost of the Internet Connection is also very high in Sri Lanka. Common methods of accessing the Internet include dial-up, broadband, Wi-Fi and Satellite. Dial-up connection is comparatively cheap though it has a slow moving traffic(52kbps). In additional to the cost factor infrastructural issues such as non-availability of electricity and non-availability of the Internet connection facility also effect in the Internet penetration. Rural areas of Sri Lanka are still unprovided with the facilities of electricity and telecommunications. A huge amount of money is needed to develop infrastructural facilities but in a developing country like Sri Lanka, It is impossible to do quickly.

Few solutions can be highlighted to access the World Wide Web via Internet to get Information and services. Intermediaries can be used to connect the end users to the web, reducing the requirement of a PC and the Internet connection facility. This can be introduced to the public places including libraries and cyber cafes where computers with the Internet connection facility is available. There are also Internet access points in many public places such as “Public Internet Kiosk”, “Public Access Terminals” and

“web pay phone”. In Sri Lanka some of these solutions are possible while the others are still practically impossible.

Interestingly, Mobile phones and Wireless phones usage in Sri Lanka is a increasing rapidly. Many of the local and foreign Telecom companies invest on the telecommunication sector. Now a days, Most of the rural areas in the Island wide have been covered by telecommunication service providers. Hence cost of Mobile phones and wireless phones are considerably low than a PC and the connections facilities are also cheaper than the Internet connection. Therefore these phones have had a far greater penetration among the Sri Lankan population and have the potential to communicate with the underprivileged users beyond the basic voice communication. In addition, the simple user Interfaces,limited menus are few reasons to the popularity of the mobile and wireless phones.

The goal of our work is to enable the students who are following external degree program in the University of Colombo School of Computing to access and share existing Information and service for the learning purposes through Mobile,Wireless or fixed line phones. To ensure this, a voicesite which is a set of interconnected voice pages(i.e Vxml files) hosted and located in the telecom infrastructure is developed.

The contributions of the paper are as follows:

- enables the underprivileged students to access and share Information and services through existing telecommunication facility,
- enables the students to access voice pages and generate their own voice pages,
- provides a cost effective ecosystem for users parallel to the WWW.

2.0 A VOICE-DRIVEN SYSTEM PARALLEL TO WEB

A phone subscriber could call into the system by using a general number and access the Information and services by navigating through the custom options offered to the user. Therefore subscriber enables to access the voicesites and get the desired Information and services. In additional to accessing the existing voice-driven applications, users are enable to create their own voicesites as well. This is similar to access the Information and services on WWW. A personal

voicesite is equivalent to a personal homepage on WWW.

2.1 System Architecture and Components

Figure 3.1 depicts the overall system architecture of a voice-driven system parallel to the web.

The core components are as follows

- **Voice Gateway**

A Voice Gateway provides a mechanism to the Voice browser to fetch the voice contents from voicesites which is normally written in VoiceXML. It is situated in between Voice Browser and Web Server to integrate WWTW services and WWW services.

- **Voice Browser**

A Voice Browser is a web-browser that presents an interactive voice interface to the user. A voice browser operates on pages that specify voice dialogues. Typically these pages are written in VoiceXML[7].

2.2 Supportive Technologies and concepts

2.2.1 World Wide Telecom Web(WWTW)

WWTW is a network of interconnected voicesites that are voice driven applications created by the users and hosted in the network[7].

VoiceSites, VoiNumber and VoiLinks form the basic building blocks of the World Wide Telecom Web[1].

A VoiNumber is a virtual phone number that either maps onto a physical phone number or to other uniform resource identifier such as a SIP (Session Initiation Protocol) URI[1].

A VoiceSite is a voice driven application that consists of one or more voice pages(e.g. VoiceXML files) that are hosted in the telecom infrastructure. VoiceSites are accessed by calling up the associated VoiNumber and interacting with its underlying application flow through a telephony interface[1].

A VoiLink is a link from one VoiceSite to another through which a caller interacting with the source VoiceSite can be transferred to the target VoiceSite in the context of the VoiceSite application[1].

The WWTW, therefore, could be visualized as a system that operates over the Telecom infrastructure and parallels can be drawn with the World Wide Telecom Web that runs on the Internet infrastructure[1].

The WWTW comprises of a web of interconnected VoiceSites each of which represents a voice driven application. VoiceSites can be created through a simple voice-driven interfaces over a phone call and therefore, provide the ability to individual subscribers to offer their own voice-based applications. This enables the underprivileged users to have an online identity and personification through which others can reach them and interact with them[2].

2.2.2 VoiceXML(VXML)

VoiceXML is the w3c's standard XML format for specifying interactive voice dialogues between a human and a computer. It allows voice application to be developed & deployed in an analogous way to HTML for visual applications. In our system, Voicesites will be completed using VoiceXML[7].

2.2.3 VOIGEN

VOIGEN simplifies the process of creation of voice-based applications. It enables creation of voice-driven application through a voice-driven interaction. It has two intertwined components – a user interface generator and an application composition system. A phone subscriber could call in to VOIGEN and can compose an application by navigating through the custom options offered. This application is then deployed in the form of a VoiceSite, which is a VoiceXML representation of the created application. VOIGEN makes use of existing components (reusable dialogs as well as IT components such as databases, web services etc.) to compose custom applications. A key aspects is that the generated application can be hosted in the network and for the subscriber it virtually resides on the phone[2].

2.2.4 Hyperspeech Transfer Protocol(HSTP)

HSTP is a protocol to seamlessly connect telephony voice applications. HSTP enables the users to browse across voice applications by navigating the Hyperspeech content in a voice applications[4].

2.2.5 Voice Over Internet Protocol(VoIP)

VoIP is a protocol optimized for the transmission of voice through the Internet or packet-switched networks.VoIP is often used abstractly to refer to the actual transmission of voice[7].

2.2.5 Session Initiation Protocol(SIP)

The Session Initiation Protocol (SIP) is a Session-layer control (signaling) protocol for creating, modifying, and terminating sessions with one or more participants, widely used for setting up and tearing down multimedia communication session such as voice and video calls over the Internet[7].

3.0 CONCLUSIONS

3.1 Advantages

- The easy of accessing Information and services for underprivileged students

Underprivileged students can easily access the Information and services through existing infrastructure and with less number of Hardware resources. They need not to have computers, Internet connection or electricity facilities in order to access to the super highway. when we compare with computer literacy mobile and wireless phones can be used to access the Internet easily because of the simple interfaces and limited menus.

- The easy of creating voicetimes

Creating a voicetime with VOIGEN is simple. Calling to the system over a phone and navigating through the custom option offered to the students. will fulfill the task. Reusable dialogs, IT components such as Databases, Web Services can be used to compose custom applications as well.

- Browsing facility

Hyperspeech Transfer Protocol (HSTP) enables the users for browsing Voicetimes and navigating hyperspeech contents through voicetimes. It enables to build up VoiLinks to link voicetimes to each others.

- Easily integrate with local and remote applications

Voicetimes provide a gateway to several categories of services in WWW. Voicetimes can be used in existing IP network to share Information and services in WWW.

3.2 Challenges

- Usability

When the users are accessing Information and services. There is no visual interfaces to view the entire application. It is difficult to browse through voicetimes without a proper guide interaction. All the steps should be memorized in order to browse.

- Browsing

The VoiNumber is a virtual phone number that can be used to access voicetime. When the number of voicetimes increase, VoiNumber are needed for each of them. There is a practical problem for keeping track of VoiNumbers and call each individual sites. In VoiceSites, bookmark for the favorite voicetime, view of history of visited voicetimes, view of the source code of voicetimes and simultaneously access two or more voicetimes are key challenges in this application.

- Searching

The key piece of the Information to be searched would be voice. This requires advanced automatic speech recognition techniques. Pronunciation of a key voice phase could be differ from user to user. Therefore it is a key challenge to filter the voice phase. Error recognition is also a big challenge.

- Accessibility

Supporting A multiple language is a huge challenge in underlying speech recognition and synthesis technologies. In additional to that students who have problems in speaking and hearing would be enable to access the access the voicetimes.

- Infrastructure

WWW is very popular in the entire world. New technologies and concepts are developing rapidly and using frequently. The growing rate of the WWW is tremendously high. But Telecom world, It is much more controlled and lack of open standards.

3.3 Summary

Here, our determination is to enable the students who are following the external degree program in the University of Colombo School of Computing(UCSC) to access the Information and services through a voice-driven channel. In another way presenting a voice-driven front-end to the website.

Students can create their own voicetimes or access the Information and service using existing infrastructure. Various user studies show that the motivation to propose voicetime which is parallel to the web site to make difference to the educational life style of underprivileged students.

Here, we use voice as the user-interface channel and provide a low cost mechanism to access Information and services. The network

connections can be quite unreliable and slow in developing country like Sri Lanka.

Finally, our effort is to provide a better and practical solution by integrating WWTW with WWW to minimize the gap between underprivileged and privileged students to achieve their educational prospects.

4.0 ACKNOWLEDGMENTS

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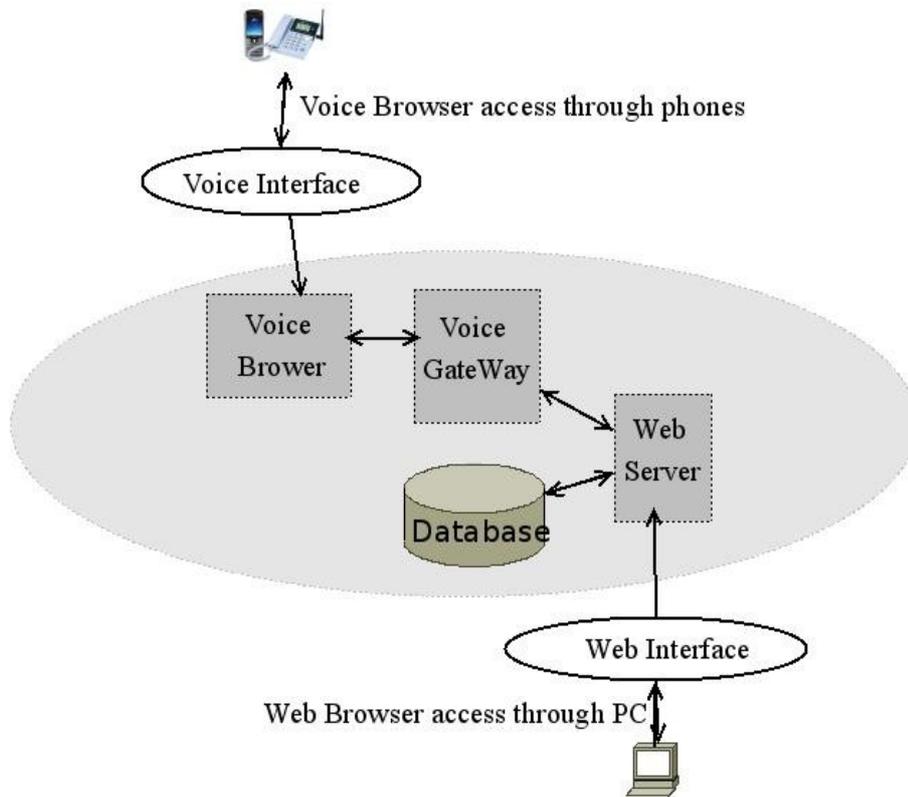


Figure 3.1-Voice-driven System Architecture