VXML: AN ALTERNATIVE SOLUTION TO ACCESSING WEBSITE'S CONTENTS

By

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6523

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the requirements for the
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CERTIFICATION OF APPROVAL

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and the original work contains herein have not been undertaken or done by unspecified sources or persons.

MOHD HAFIZ BIN HASHIM

ABSTRACT

Career Center Phone-based Application (CCPA) is a support tool for a career website that is developed using VoiceXML technology which allows users to access the contents of the website via phone call. The use of VoiceXML technology that connects the callers to the application via Public Switched Telephone Network (PSTN) has made the phone-based application accessible by any types of telephone, anywhere around the globe. CCPA work the same as SMS career tool that provides alternative to receive and update the website's content other than using Internet connection. However, this CCPA provides more than just receiving job alerts and applying for a job via SMS. With CCPA, the callers will have a new experience that is like "talking" with the content of the website. Here, callers may retrieve the company's profile, submit voice inquiries, authenticate/validate users for login, retrieve latest 10 job opportunities that is available on the website and apply for a job where all are made via phone call. This is a new environment for career-based application that allows command and output presented in speech format plus, it will be the first VoiceXML-based application in Malaysia. User Centric Design (UCD) approaches has been selected to develop CCPA as it focuses on users' requirements and preferences while the BeVocal café is chosen as an ASP to develop, test and host the voice application. This working CCPA has been tested using Black Box Testing on Vocal Scripter that is a real simulation of telephone. Vocal Scripter is used as it is cost free and effective plus, the application works when it runs perfectly on Vocal Scripter. Some testing using real telephones also have been conducted. As the result of this development, 5 main modules are implemented which are the general section that covers the welcome message, main menu and global help and menu links, voice inquiry section, users authentication section, job post retrieval section and job application section. In near future, the CCPA should be improved with Mixed Initiative Dialog approach that will provide a great call experience, enabled to support Malay Language and personalized to provide different and unique way of entertaining each of callers. In conclusion, this project will definitely initiate and encourage VoiceXML applications' development in Malaysia.

ACKNOWLEDGEMENT

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ABBREVIATIONS

Abbreviations are arranged from A to Z:

ASP	: Active Server Pages
CCAM	: Contact Center Association Malaysia
CCPA	: Career Center Phone-based Application
DTMF	: Dual Tone Multi-Frequency
HTML	: Hyper Text Markup Language
IVR	: Interactive Voice Response
JSP	: Java Server Pages
MDeC	: Multimedia Development Corporation
MSC	: Multimedia Super Corridor
PABX	: Private Automatic Branch eXchange
PHP	: Hypertext Pre-Processor
PSTN	: Public Switched Telephone Network
SMS	: Short Messaging Service
STT	: Speech-to-Text Translator
TTS	: Text-to-Speech Translator
UML	: Unified Modeling Language
UCD	: User Centric Design
URL	: Uniform Resource Locator
URI	: Uniform Resource Identifier
UTP	: Universiti Teknologi PETRONAS
VoiceXML	: Voice-Extensible Markup Language
W3C	: World Wide Web Consortium

CHAPTER 1

INTRODUCTION

1.0 Test Case for the Project

Career web-based application is chosen as the test case for this project to verify whether VoiceXML platform can be used to build alternative solution to access the website's content via telephone. The successfulness of this project will lead to more VoiceXML-based application's developments in Malaysia.

1.1 Today's Trend in Job Hunting

The Internet has revolutionized the job-hunting and recruiting process. Job-seekers previously sent resume or curriculum vitae to companies via snail mail or email but today, they use third parties' service to keep their resume and make them accessible to all registered employers. Job-seekers are continuing the steady migration to searching online since a decade ago. The Conference board of Quintessential Careers Annual Report 2008 reported that the percentage of surveyed job-seekers who were using the Internet increases from 66 percent in 2005 to 73 percent in fall 2007 while the use of newspaper classifieds dropped from 75 percent to 65 percent between 2005 and 2007 [1]. Job-seekers choose a third party, JobStreet.com as an example, as it provides wider coverage to potential recruiters, saves a lot of time and money to send resume to companies, and it is very convenience. On the other hand, employers use the third party service as it is normally free-of charge plus, this helps them to avoid bundles of paper-based applications and to reduce the number of unqualified applicants.

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1.2 Problem Identification

The purpose of this study is not to identify problems related to the functionality of web-based career application but, the *accessibility issue*. It is undeniable that web-based career application provided by third parties such as JobStreet.com, JobsandMore.com and JobsDb.com is a big milestone in recruiting world. However, it cannot be run as a web-based application alone. Other types of application must also be implemented to support the effectiveness of this career service.

When the application is solely based on Internet, it creates limited accessibility for those who are temporarily not connected to the Internet and on the move. Web-based career application should have more options to be accessed by the users.

Mobile technology seems to be the solution. Advanced mobile phone models and Personal Digital Assistants (PDAs) which support GPRS, EDGE or 3G allow users to access the career website via micro browser. However, basic mobile phone, fixed-line telephone and public/prison phone users will have no access to the content due to limited phone functionality. It is also good to mention that not all areas covered by GPRS, EDGE and 3G services.

Besides, some career websites also provide SMS career tool where users can receive job alerts and apply for job via SMS upon subscription. This is very useful while not connected to the Internet. But, this tool offer limited services where nothing can be done except receiving job alert and sending reply to apply for the job. Furthermore, each job alert received and message sent are charged at minimum of RM0.30. Just imagine if the users receive 20 job alerts per day. It is very expensive.

Therefore, an additional access alternative should be provided by third-party career service and this will be highlighted in the next section.

1.3 Objectives and Scope of Study

1.3.1 Objectives of the Project

The project aims to produce two (2) deliverables. The first deliverable is a *Career Center phone-based application* running on VoiceXML platform. It is *not* a replacement to the existing career website or SMS career tool but, it is a **support application** or another alternative that can be used to access the website's content especially when the Internet connection does not permit.

Via this application, users can simply pick up a phone, any type of phone including public phone, and dial a specific number. Once connection is established, the users may access the web contents via the phone call. The users are actually connected to the web content via Public Switched Telephone Network (PSTN) instead of Internet. A detailed explanation is provided in *Chapter 2.*

The second deliverable of this project is a *Career Center web-based simulator* to prove that any contents that can be viewed via Internet browser can also be listened via telephone and to verify that any changes made via phone call really affect the website's content. Besides, this is also to prove that the VoiceXML-based application can be deployed using the existing web infrastructure.

1.3.2 Scope of the Project

The **scope** of this project is to enable main functionalities of career website accessible via phone call such as login/user authentication; latest job posts retrieval and job application. This also includes a simple call center module where callers can submit their voice inquiries over the telephone and will be saved in the data center.

CHAPTER 2

LITERATURE REVIEW

2.0 An Overview of VoiceXML Technology

Voice Extensible Markup Language (VoiceXML) is an open standard markup language for voice applications. It is like Hypertext Markup Language (HTML) but, it is designed for voice browser. The difference is HTML assumes graphical web browser with display, mouse click and keyboard input, while VoiceXML assumes a voice browser with audio input, audio output, and keypad input. The voice browser consists of speech recognizer or Speech-to-Text Translator (STT) to handle audio input and Text-to-Speech Translator (TTS) to handle audio output [2]. In different words, World Wide Web Consortium (W3C) defines VoiceXML as a markup language for creating audio dialogs that feature synthesized speech, digitized audio, recognition of spoken and Dual-Tone Multi Frequency (DTMF) key input, recording of speaking input, and mixed initiative conversations [3].

VoiceXML comes with a major goal which is to bring the advantages of Web-based development and content delivery to interactive voice response applications such as via telephone network [3].

How does VoiceXML work? Technically, based on Figure 2.1 below, once a caller is connected to the voice server, the telephony gateway will collect input from the caller and then transmit it to Speech-to-Text Translator (STT) to translate the speech format into text format. This enables the VoiceXML scripts to process the query such as to

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retrieve information from database. The generated output will be re-transformed into speech by Text-to-Speech Translator (TTS) and returned the result to the caller [4].
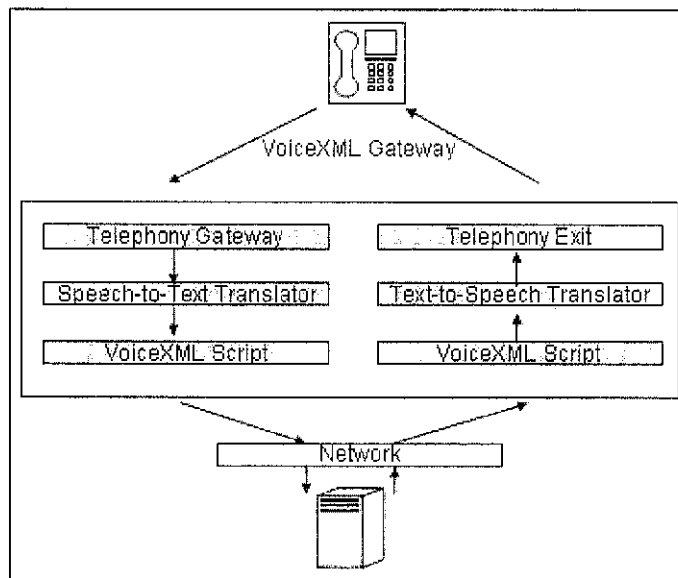
Figure 2.1: VoiceXML Architecture [4]

VoiceXML technology comes with many business advantages especially when it is compared with Interactive Voice Response (IVR) technology. One of the advantages is VoiceXML application can be deployed within the same web infrastructure while IVR needs a separate, silo infrastructure that eventually requires heavy back-end integration [5]. This issue will be further discussed in *Section 2.1*.

In Figure 2.2, a brief explanation on deploying a VoiceXML application in a web infrastructure is provided. The figure also describes the difference between VoiceXML application and HTML application. Based on Figure 2.2, the VoiceXML application can be deployed within an existing web infrastructure where VoiceXML files of the VoiceXML application are put in the web server together with HTML files. Therefore, no hardware purchases are required to handle the VoiceXML files. Organizations also do not have to build in-house voice server. They can purchase an account from any Application Service Providers (ASPs). If Internet Service Providers (ISPs) provide web hosting, ASPs in other hand provide facilities to host the voice application.

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```
<html>

       <p>Welcome to Career
       Center!</p>

</html>
```

```
<vxml>
       <form id="welcome">
       <prompt>Welcome to Career
       Center!</prompt>
       </form>
</vxml>
```
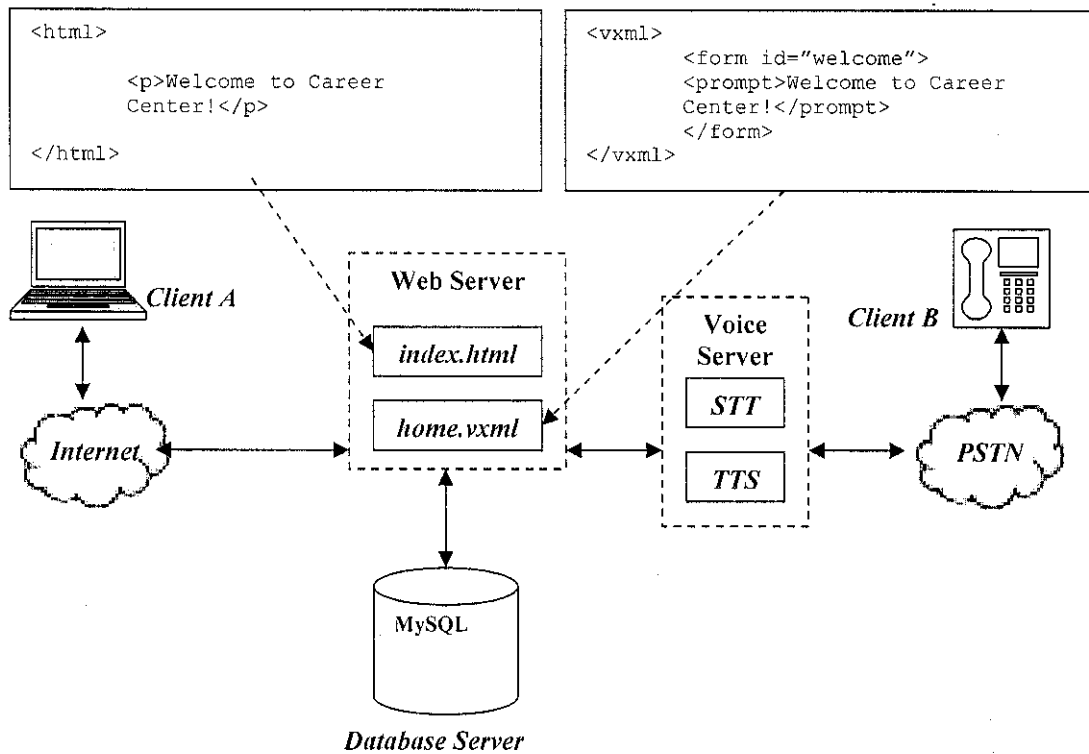
Figure 2.2: Deploying VoiceXML Application on Existing Web Infrastructur

In order to Client A to get the welcome message, Client A must be connected to Internet and open an Internet Browser like Mozilla Firefox and specify the Uniform Resource Locator (URL) of *index.html* file in the address bar. Once connected, the welcome message is displayed in the browser in visual format to Client A. While Client B has to pick up a phone and dial a number to connect to the voice server that contains a voice browser via Public Switched Telephone Network (PSTN). In the voice browser, the Uniform Resource Identifier (URI) of the *home.vxml* has been registered and activated. Once the connection between the voice server and the web server established, the *home.vxml* script is processed and as the result, the welcome message is prompted to Client B in a speech format. It is contradict to the format received by Client A. In Client B environment, we often say the client can *'talk' to* the content of the website.

As mentioned in the previous paragraph, Client A is connected to the web server via Internet while Client B is connected via PSTN. PSTN is actually the network used for telephone services and this is the reason why any types of phones from antique black candlestick phones to the very latest mobiles can be used to access the phone-based application. In number, the voice server, also known as voice gateway, can support hundreds or thousands of simultaneous calls which come from any one of estimated 1, 500, 000, 000 phones in the world [6].

2.1 Choosing VoiceXML over Interactive Voice Response (IVR) Platform

When talking about developing phone-based applications, people might decide to use IVR technology instead of VoiceXML. Same goes to this project. We can actually develop and deploy it on IVR environment but however, the VoiceXML technology which is new in Malaysian market is chosen. The main and always the reasons of switching from IVR to VoiceXML are of high cost to deploy and maintain the IVR-based application [7].

What is IVR? In general, IVR technology is a telephony technology that allows computer to detect voice & touch tone to further callers on how to proceed throughout the 'conversation'. In other words, it is a telephony technology in which someone uses touch-tone telephone to interact with database to acquire information from or enter data into the database. It does not require human over the telephone as user's interaction with the database is predetermined by the IVR system [8].

There are three (3) main technologies for IVR system which are Touch-tone, DTMF and Speech Recognition technologies. However, IVR speech recognition technology is very costly to deploy and to maintain as high as deploying both Touch-Tone and DTMF technologies. The cost comparison is shown in Figure 2.3.
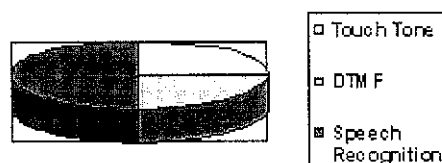

Figure 2.3: Cost Comparison between IVR Technologies

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Table 2.1 below shows some comparison between IVR and VoiceXML Technology where IVR exceeds the VoiceXML technology in every cost aspect.

Table 2.1: Cost Comparison between IVR and VoiceXML Platforms

Issues	IVR	VoiceXML
Hardware purchase	Must purchase	No hardware required
Deployment	14 to 18 months	6 to 9 months
Back-end integration	About USD 250, 000	No integration issue
Maintenance	USD2,500 – 3,500 for professional service/ day	USD1,000 – 1,500 fo professional service/day
Call Center agents	23% increase each yea	Almost not required
Average cost to train a agent	USD3000	-

Source: Call Center Industry Statistics Related to Call/Budget [9]

The main cause that leads to low cost of using VoiceXML technology is that VoiceXML application can be developed and deployed in existing web infrastructure as covered in the previous section. This produces many business advantages such as eliminates the hardware purchases, reduces the deployment time, reduce maintenance cost, and puts aside back-end integration cost and effort to integrate to IVR system with the existing company's resource.

2.2 Related Work of VoiceXML-based Applications

This sub-topic will cover three (3) areas which are:

- Research on VoiceXML applications in international market
- Research on World and Malaysia's top career websites
- Research on VoiceXML applications in Malaysia

2.2.1 Research on VoiceXML Applications in International Market

It is good to start a research from the international market since United States and Europe always lead an invention today. In the international markets, a number of big companies have developed call center software based on VoiceXML platform. The communication industry believes that VoiceXML platform is the best option to replace traditional Interactive Voice Response (IVR) systems, most of which are loosing manufacturer support for the next 18 months [10]. The VoiceXML platform brings advantages by eliminating the gap between legacy IVR system and web service [11]. A company with web application infrastructure needs to have a separate, silo infrastructure if planned to deploy an IVR system but, using VoiceXML-based Call Center; it can be integrated with existing web/application server infrastructure [12].

Four (4) examples of VoiceXML-based Call Center software providers are App-Line (http://www.app-line.com), Envox (http://www.envox.com), and Genesys - an Alcatel-Lucent company (http://www.genesys.com). Examples of companies that are using VoiceXML-based Call Centre under Genesys brand are Vodafone (Egypt and Greece), T-Mobile (Germany), and Telewest (UK) for Europe, Africa and Middle East Asia regions, Axtel (Mexico) and Trinsic (USA) for North and Latin America and StarHub (Singapore), iiNet and Telstra (Australia) for Asia Pacific region.

In foreign countries, other than contact center application, they also develop and deploy VoiceXML-based application in certain industries such as brokerage, public safety and entertainment. For examples, a Spain's leading Internet Bank and brokerage firm,

Bankinter has successfully increased customers satisfaction with its VoiceXML Brokerage Application, the French Regional Direction of Environment of the Region Centre (DIREN) is able to effectively inform and alert residents in areas that experienced flood with its VoiceXML-based Alerting System developed by Eloquent while Virgin Atlantic has replaced its legacy touch-tone telephone information system with VoiceXML-based application developed by Nuance which has successfully improved customer satisfaction [13].

2.2.2 Research on VoiceXML Applications in Malaysia

However, the situation in Malaysia is different as compared to the foreign countries. The use of VoiceXML platform in Malaysian market is very narrow. In 2006, Malaysian application provider, NGC Systems used Vision VoiceXML Server purchased from international provider of communications technologies, NMS Communications to enhance its Genico 3G video SMS solution. The use of the VoiceXML here is to enable both subscribers of 2G and 3G handsets to send and receive voice and video-based SMS messages [14].

As VoiceXML platform is widely and mainly used for call center application in the international market, looking at Malaysian market, to date, there is no VoiceXML-based call center application being deployed. It is based on call survey done with three organizations; Jebsen & Jessen Communication Solutions Sdn Bhd (communication technology provider), Contact Center Association Malaysia (CCAM) and Multimedia Development Corporation, MSC Malaysia (MDeC) available at 1800-88-8338 or chic@mdec.com. Figure 2.4 shows one of conversations between the author and CCAM via email.

Enquires on Basic elements and technology of contact centre

Inbox | ×

⊕ mohd hafiz hashim to ccam_secretari.　　　　　　　　　9/20/07　Reply ▾

Dear Mr/Mrs/Ms,

I'm Mohd Hafiz Hashim, a student of Universiti Teknologi Petronas (UTP).
I'm planning to do a dynamic contact centre application using voiceXML for my project (not to be commercialized) where users can call the contact centre using any types of phone to interact with the website. Users can query information from the website
and the website will then reply in voice format instead of computers and human do the reply.

Some questions:

1) Is voiceXML contact centre application already in Malaysian market? or Malaysia' contact centres still using IVR technology or other technologies?

2) What are the basic elements or function a contact centre should provide? As I would like to develop a dynamic application that can be used by any contact centre, I need to know the basic / general functions of a contact centre.

Thank you in advance for your cooperation. I hope I can get a reply from you.

⊕ mohd hafiz hashim　　　　　　　　　　　　　　　　　9/20/07
　　CRM & CCAM to me　　　　　　　　　　　　9/25/07　Reply ▾

Dear Mohd Hafiz

Sorry for this late reply.

Kindly contact the Multimedia Development Corporation (Mdec) for more information. The website is www.mdec.com.my.

⊕ mohd hafiz hashim　　　　　　　　　　　　　　　9/20/07
　　CRM & CCAM　　　　　　　　　　　　　　　　9/25/07
⊕ mohd hafiz hashim to ccam_secretari.　　　　　10/29/07　Reply ▾

Dear Lily,

Could you verify that there is NO organization in Malaysia that keeps track what technology (ex: IVR, VoiceXML, etc) is being used for call center by businesses in Malaysia, even CCAM.

Your cooperation is highly appreciated

⊕ mohd hafiz hashim　　　　　　　　　　　　　　9/20/07
　　CRM & CCAM　　　　　　　　　　　　　　　　9/25/07
⊕ mohd hafiz hashim　　　　　　　　　　　　　10/29/07
　　CRM & CCAM to me　　　　　　　　　11/18/07　Reply ▾

Dear Hafiz

I apologized for this late reply after doing some research for you.

As I understand it voiceXML has not been used anywhere in Malaysia as of yet. Stand alone developments have not been made as far as I know. But that said, yes, no one tracks who uses what technologically in Malaysia.

Figure 2.4: Email Conversation on VoiceXML Application with CCAM

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The result of survey on 104 samples of UTP students also shows that no one has experienced interacting with VoiceXML-based application in Malaysia. Two (2) respondents or 1.92% have experienced calling Microsoft Speech Recognition-based application to register genuine Windows operating system and another 13 or 13.46% have experienced calling Private Automatic Branch eXchange (PABX) system to call someone within an organization by voice out his/her name over the telephone. Some companies that are having such technology are Mimos Berhad and Panasonic R&D Sdn Bhd. In general, PABX is a small switching system installed in a premise to provide internal telephone switching that serves particular business or office [15].

Another survey also has been conducted to identify what technology is being used by major call centers in Malaysia. It is believed that all of them are using IVR-Dual Tone Multi Frequency (DTMF) technology which allows callers to interact with the system using telephone's keypad by pressing 0-9 including * and # buttons. Those call centers are TM (available at 100), Celcom Careline(available at 1111), Maxis Hotline (available at 1-300-82-0120 or 012-3800000), Digi (available at 016-2211800) and Bonuslink. These call centers are incapable to process voice queries from the callers and therefore, call center agents are located to entertain such queries.

However, it is good to stress that this information is not 100% true as there is no organization, even CCAM, controls and monitors what technology is being used by a company in Malaysia.

2.2.3 Research on World and Malaysia's Top Career Websites

To relate the research with the test case of the project, a research was done by the author on 16 career websites; 10 are the top ten career websites in the world and the rest 6 are the most popular career websites in Malaysia. From the research, no one is found has implemented or deployed the VoiceXML phone-based career application. Only a few provides SMS application as an extra career tool and some have other online support tools like job agents and email-based job alerts. The SMS service is limited to

deliver job alerts and to allow job application via SMS only. Table 2.2 below shows the Malaysia's most famous career websites while Table 2.3 represents the list of world's top ten career websites which were evaluated.

Table 2.2: Malaysia's Most Famous Career Websites

Career Websites	Extra Career Tools Provided
JobStreet.com available at http://my.jobstreet.com [21st in Overall Rank]	**Apply jobs by SMS** Send your resume directly to any job vacancy in newspapers with your mobile phone. more . SMS Apply **Job information on the move** Get instant job alerts on your handphone. Be among the first to know about the hottest jobs! more SMS Alerts
Jobsdb.com available at http://www.jobsdb.com [265th in Overall Rank]	What is Job Alert service? Job Alert is a FREE service that notifies you of new job vacancies that match your pre-selected criteria such as Position, Monthly Salary, Qualification, Year of Experience, Job Function, Job Location, etc. Tell us what you are looking for and we'll email you the latest job openings in daily / weekly basis. What's more, you could modify or unsubscribe it anytime by signing in to your account!
JenJobs.com available at http://jenjobs.com [786th in Overall Rank]	**FREE SMS JOB ALERTS** Extended by popular demand!
Star-Jobs available at http://star-jobs.com	▪ Not available
Kareer available at http://www.kareer.com.my [1702nd in Overall Rank]	▪ Job Alerts via email JOB ALERTS Receive Job Matches
BestJobs.com available at http://www.bestjobs.com [1718th in Overall Rank]	**JOBS BY EMAIL** Subscribe to our job alert service latest vacancies advertised in our s

Ranking Source: *Aleza Traffic Rank available at http://www.alexa.com*

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Table 2.3: World Top 10 Career Websites

Career Websites	Extra Career Tools Provided
Yahoo! hot SEARCH JOBS NOW	▪ Job Plug-in on Yahoo Toolbar ▪ Job Alerts via Email
JOBcentral national employment network	▪ Job Alerts via Email
CollegeRecruiter.com	▪ Not Available
career**builder**"	▪ Job Alerts via Email
(logo)	▪ Not Available
Job.com Gear for your Career	▪ Not Available
Career·com"	▪ Job Alerts via Email by signing up JobSurfer (Agent)
Careers	▪ Not Available
indeed one search. all jobs.	▪ Many job search tools but require Internet connectivity ▪ Email Job Alerts
Net Temps	▪ Job Alerts via Email

Ranking Source: Aleza Traffic Rank available at http://www.alexa.com

CHAPTER 3

METHODOLOGY

3.0 Development Approach

User Centric Design (UCD) is chosen for this system development. UCD is the best methodology to develop any VoiceXML-based applications [16]. Through Farley's experience, he found that users tend to abandon VoiceXML-based applications even if they like the concept. Some of identified causes found by Farley are first; users are confused by their initial contact with the application. Second, they think the application is stop working but in fact, it is processing something, third, they are in difficulties when encountering errors and finally, they do not quickly perceive the application values. Here, Farley recommends implementing human factors wisdom in the context of UCD. Based on Farley's definition, UCD is a methodology that concentrates on product design and development from user; user task and user interface perspectives so that an easy-to-use and desirable application can be developed. This approach involves five phases; Collect Data, Analyze Data, Design and Develop, Test and Deploy, as shown in Figure 3.1.

Figure 3.1: User Centric Design

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3.1 Phase 1 & II: Data Collection and Data Analysis

The author uses several methods to collect data to help in developing the Career Center Phone-based application. **Books** and **online researches** are widely used to discover the VoiceXML technologies. The online research provides a lot of information on the fundamental of VoiceXML while the books provide guides to get started to develop a VoiceXML-based application. Journals on VoiceXML are very difficult to find in the resource center because VoiceXML is not taught in Universiti Teknologi PETRONAS (UTP). Some of good websites are http://www.voicexmlreview.org, http://www.voicexml.org, http://www.contactcenterworld.com and http://www.w3.org. While for books, five reference books are recommended such as VoiceXML 10 Projects to Voice-Enabled Your Web Site by Wiley and VoiceXML 2.0 Developer's Guide, Building Professional Voice-enabled Applications with JSP, ASP and ColdFusion by McGraw-Hill. The second book helps the author a lot in developing a VoiceXML application with scripting language.

A **paper-based survey** also has been conducted, involving 104 samples of Universiti Teknologi PETRONAS (UTP) students to collect some information regarding this project such as to verify, out of 104 samples, no one ever had experience calling a voiceXML-based call center in Malaysia. The survey also covers many aspects such as method to bridge delay during a call, voice personality and services or features highly required on the phone-based application. Refer to *Appendix 1* for the sample of questionnaires.

The survey shows that 57.69% of the respondents agreed that a career website should have phone-based application. As it is only a support tool that aims to serve a portion of a website's users, a majority of almost 58% potential users is a very encouraging figure for this development.

Other than that, the survey also collected two (2) main characteristics of the career center phone-based application. The first is the method to bridge delay and the second

is voice personality. As the system requires database access to process callers' requests, there will be a delay time and therefore, a method to bridge this delay is very crucial to avoid confusion among the callers whether the application is stop working. 96.15% of respondents prefer to listen to an audio instead of silent mode. Figure 3.2 shows the preferred type of audio to bridge the delay.
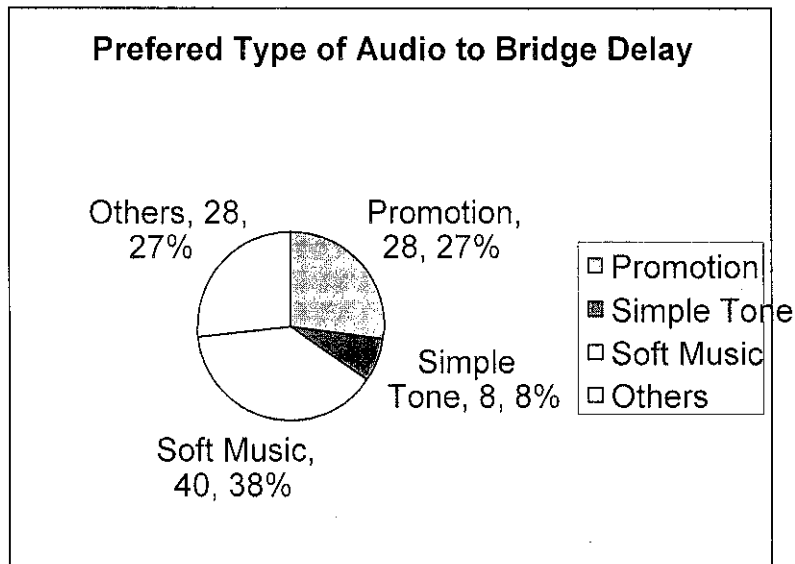
Prefered Type of Audio to Bridge Delay

Others, 28, 27%
Promotion, 28, 27%
Soft Music, 40, 38%
Simple Tone, 8, 8%

- □ Promotion
- ▣ Simple Tone
- □ Soft Music
- □ Others

Figure 3.2: Audio to Bridge Delay

Voice personality is also very crucial in customer service. As businesses prefer to have woman as secretary, so does this application. Most of the respondents with percentage of 65.38% prefer to have adult woman's voice to be used in the pre-recorded audio as shown in Table 3.1 below.

Table 3.1: Preferred Voice for the Application

Type of Voice	Number of Respondents
Teenager (Girl)	28
Woman (Adult)	68
Woman (Aged)	0
Teenager (Boy)	0
Man (Adult)	8
Man (Aged)	0

18

Finally, the survey focuses on desired modules to be implemented in the career center phone based application. Six (6) modules/options are given to the respondents as in Table 3.2.

Table 3.2: Preferred Modules for the Application

Modules	Number of Respondents
Account Registration	76
Account Information	61
Company's Profile	25
FAQ and Voice Inquiry	58
Latest Job Posts Retrieval	92
Job Application	96

Account Registration module is dropped for this project development due to unavailability to submit or deposit resume via telephone. Therefore, in this system environment, all users must be pre-registered to the system via the career website.

In addition, *call survey* and *online survey* are conducted to verify call centers in Malaysia are not running on VoiceXML platform and no VoiceXML-based application developed for career websites. The survey results have been discussed in detailed in *Section 2.2.2* and *2.2.3* of this report.

3.2 Phase III: System Design & System Development

In this phase, the author divides the explanation into two (2) major categories:

- System Design
- System Development

3.2.1 System Design

Design is a crucial phase before the system is developed. It guides the author to develop a real functioning system. As highlighted in the project's objectives in *Section 1.2*, this project has two (2) deliverables which are inter-related with each other. A very good and working design is important to ensure both applications to be developed can work as expected. Barnes in his article quoted wise words of his friend, "you can't debug a system; you can only debug a system design. Sure you can fix the syntax things but, it's in design where the bugs are eliminated – or introduced" [17].

Main Unified Modeling Language (UML) Diagrams and other diagrams are used to develop the system design. These include the following:

- System Architecture
- Use Case Diagram
- Activity Diagram
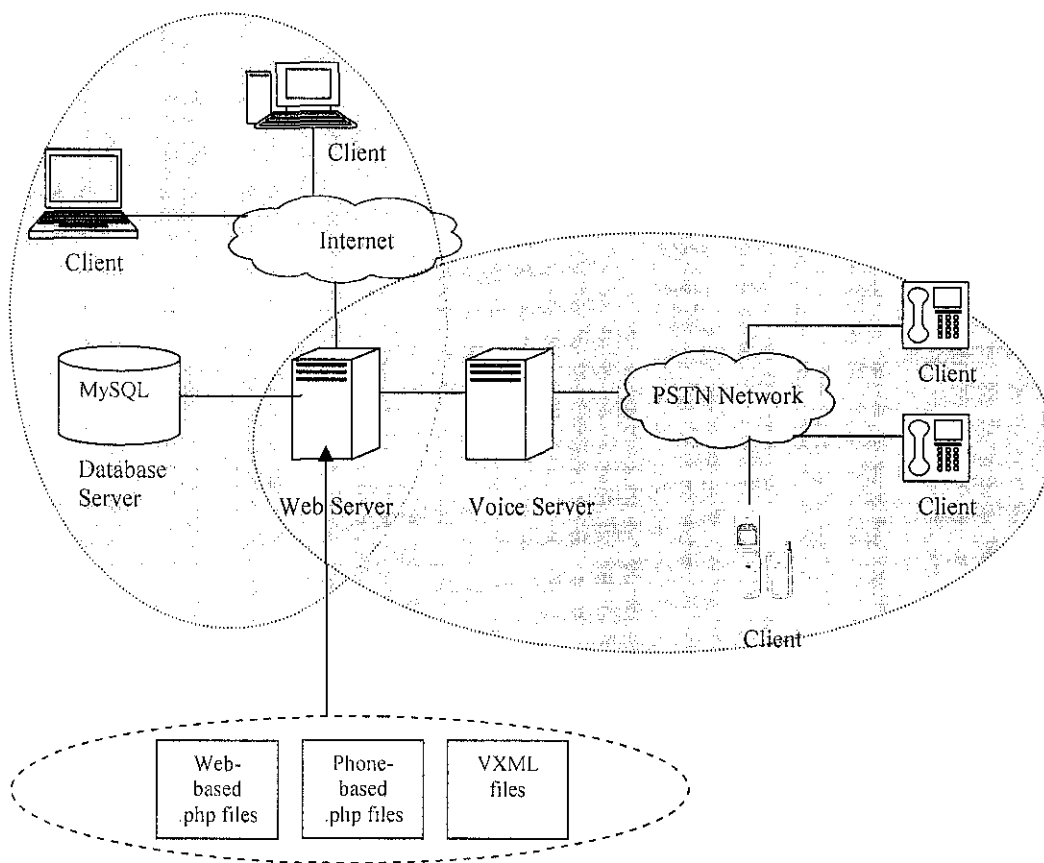- Application Flow Diagram
- Class Diagram

Figure 3.3: System Architecture

Figure 3.3 is the system architecture of web-based and phone-based career applications. It is basically a combination of two architectures; web architecture and VoiceXML architecture. Both are connecting to the same web server and this is the beautifulness of the VoiceXML-based application. It does not require separate, silo technology infrastructure like IVR systems. For the web application, it can be accessed via Internet connection while Public Switched Telephone Network (PSTN) and Voice Server are used to connect phone users to data available in the web server. Voice Server is needed as it contains voice browser, Speech-to-Text Translator (STT), Text-To-Speech Translator (TTS) and the Uniform Resource Locaters (URLs) of each of related files (.vxml and .php) which are available in the web server. In general, it works primarily as middle man between callers and data available in the web server.
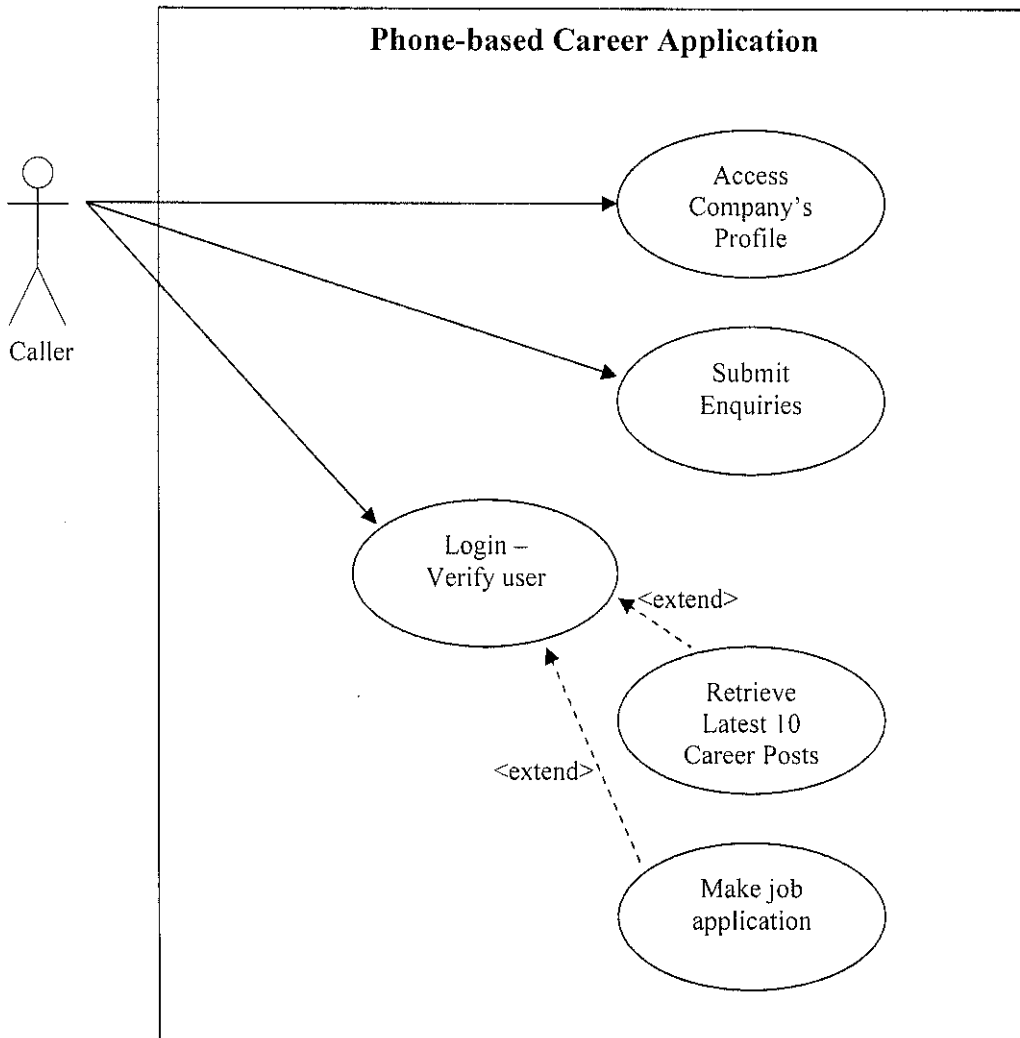
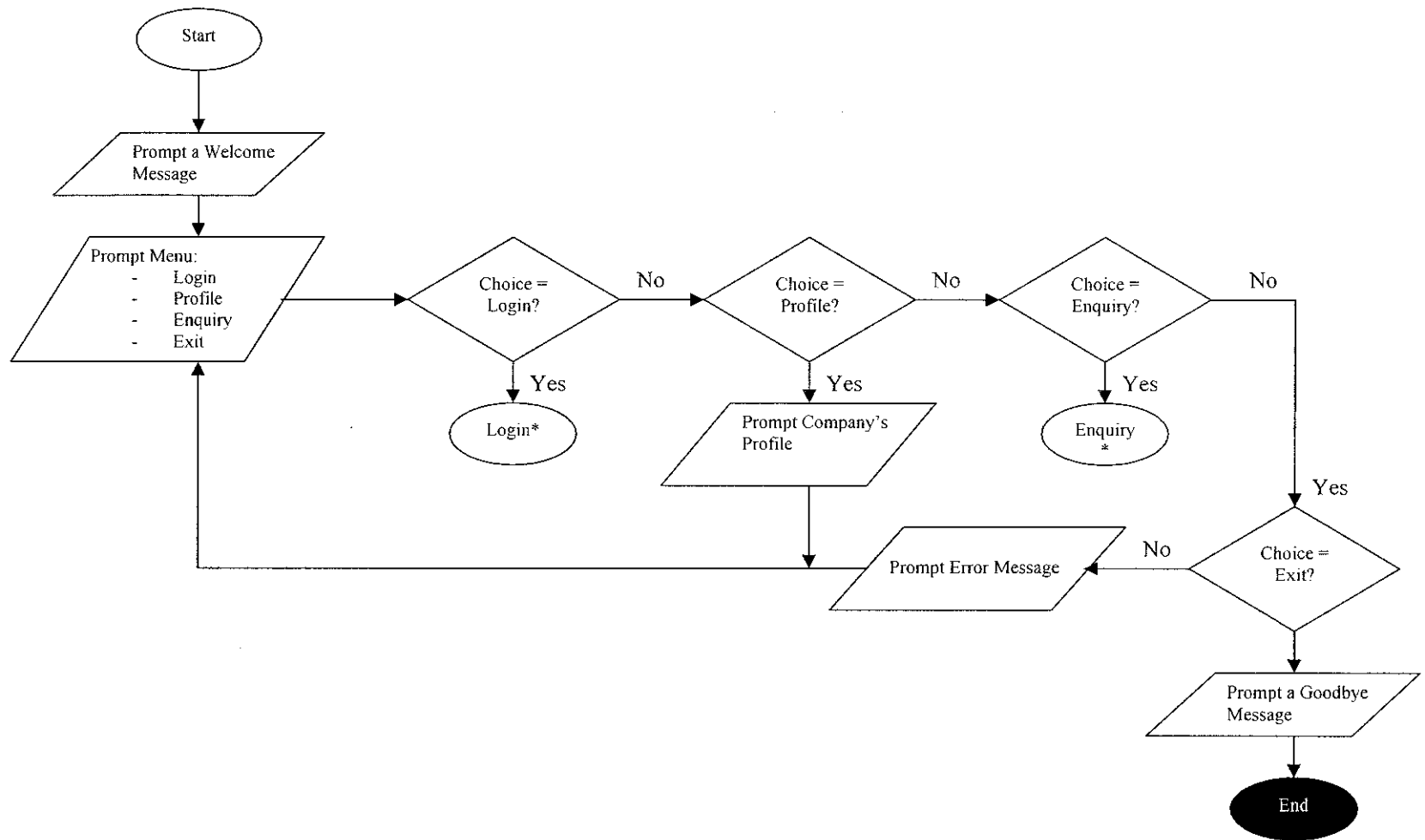**Figure 3.4:** Use Case Diagram of Phone-based Career Application
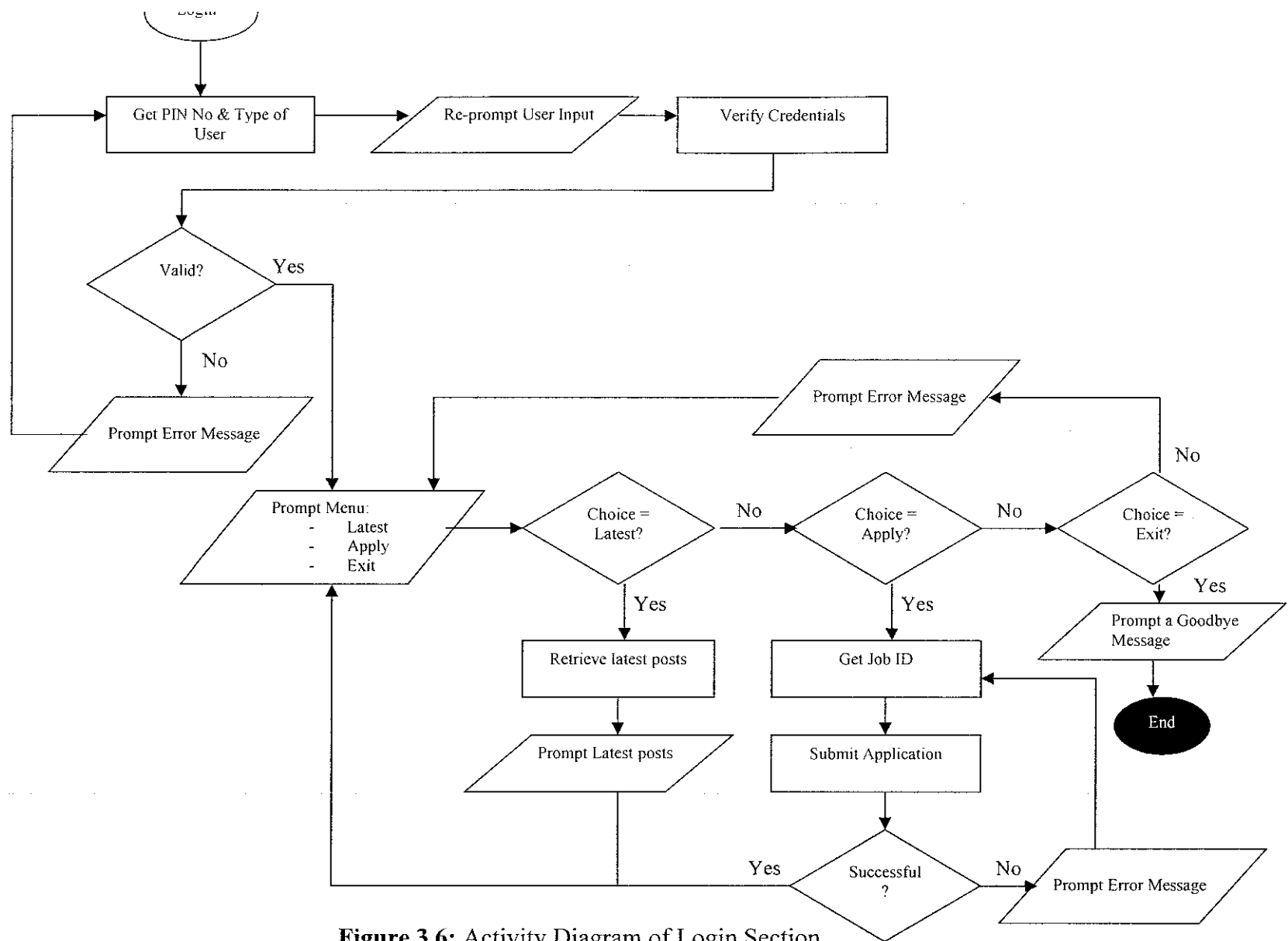
Figure 3.5: Activity Diagram of Main Menu Section
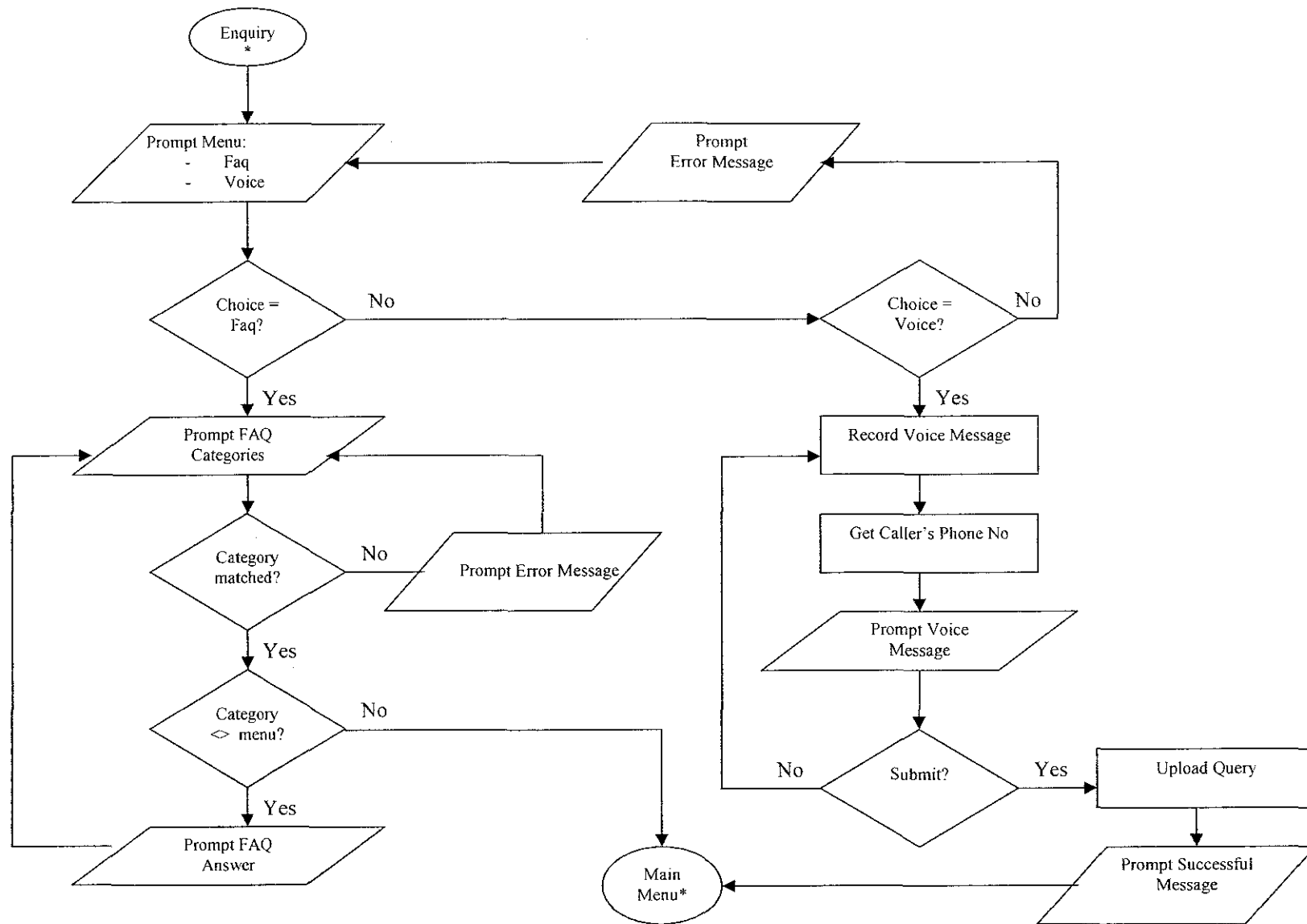
Figure 3.6: Activity Diagram of Login Section

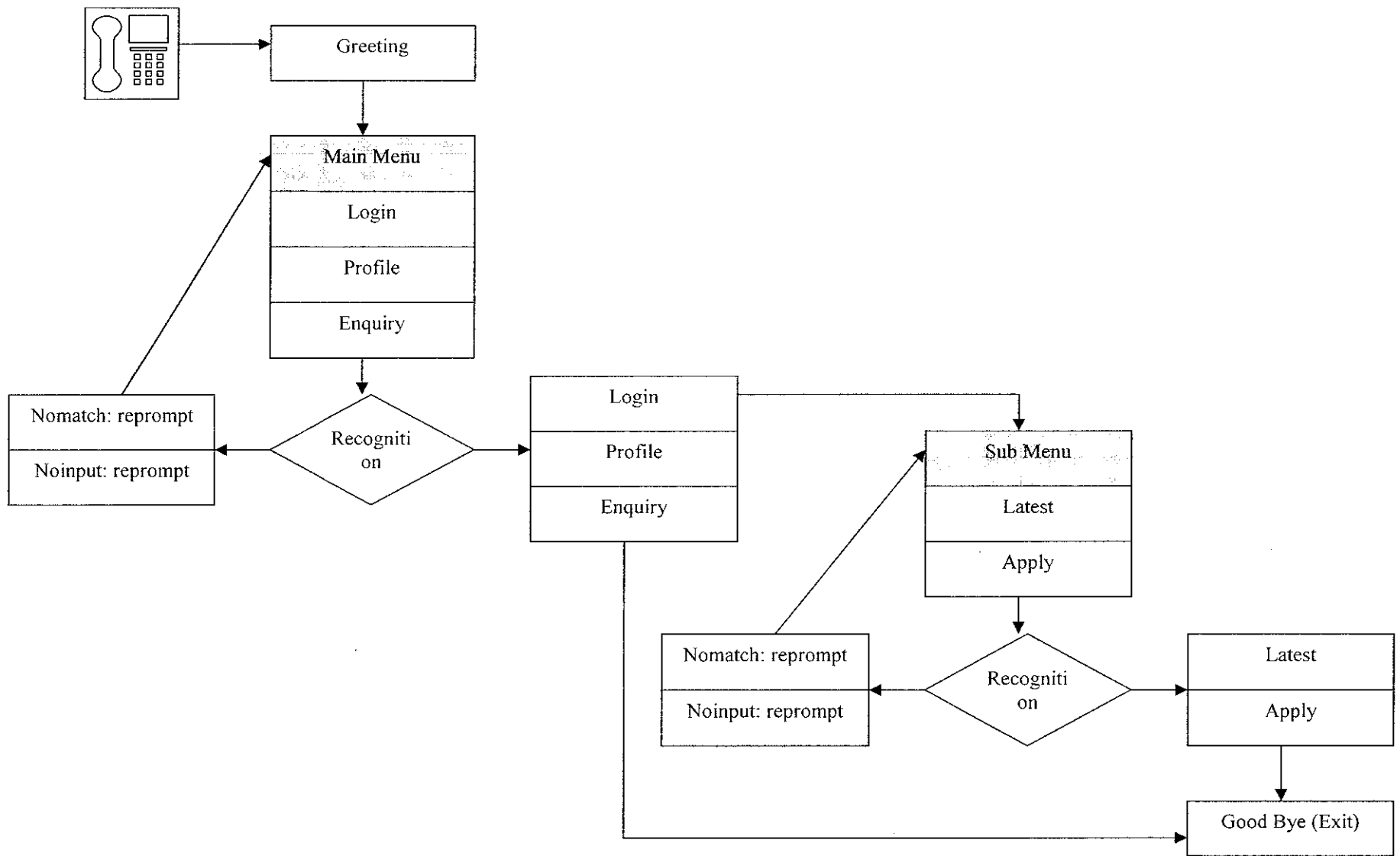**Figure 3.7:** Activity Diagram of Enquiry Section

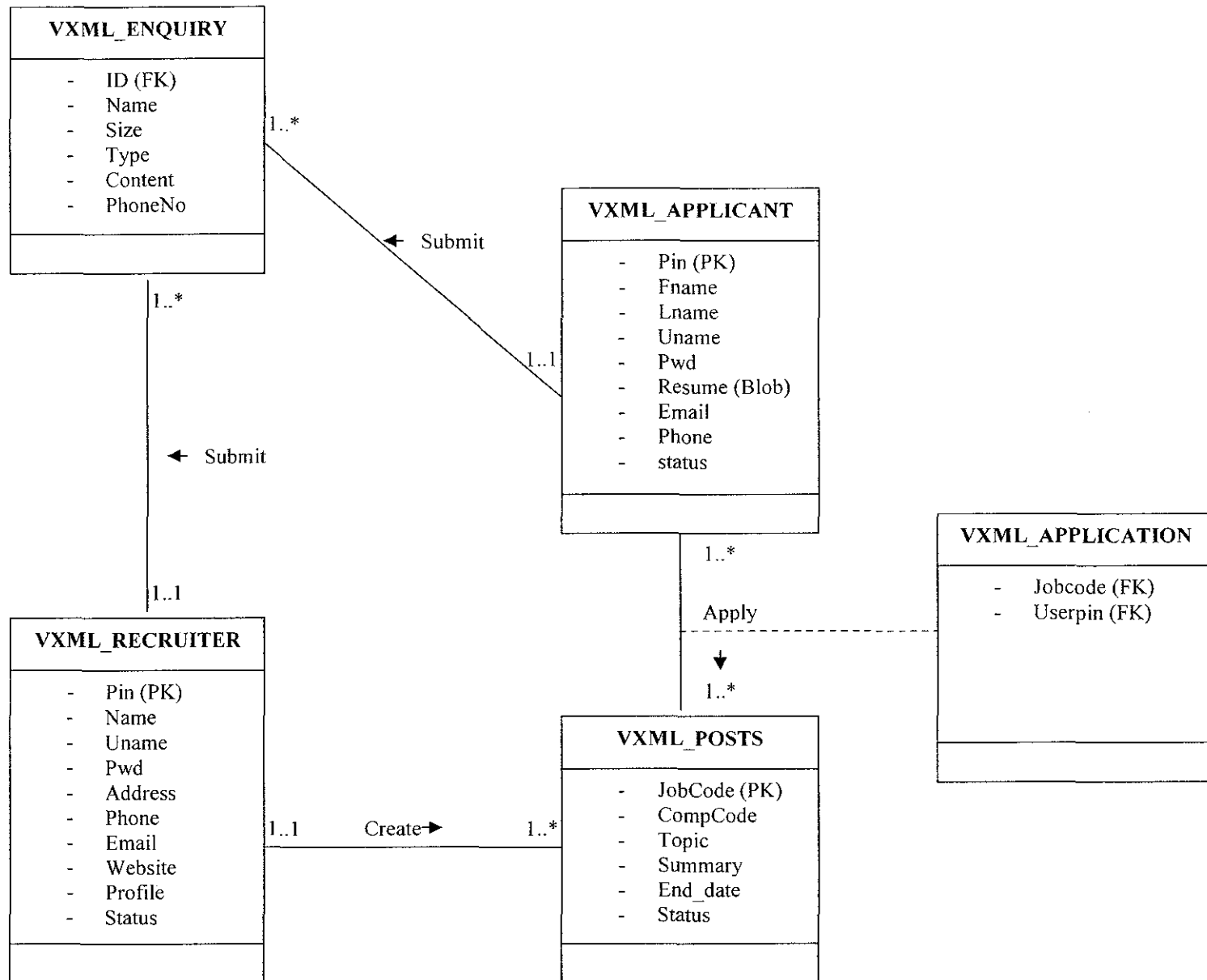**Figure 3.8:** VoiceXML Career Center Application Flow

VXML_ENQUIRY

- ID (FK)
- Name
- Size
- Type
- Content
- PhoneNo

1..*

← Submit

VXML_APPLICANT

- Pin (PK)
- Fname
- Lname
- Uname
- Pwd
- Resume (Blob)
- Email
- Phone
- status

1..1

1..*

← Submit

1..1

VXML_APPLICATION

- Jobcode (FK)
- Userpin (FK)

1..*

Apply

1..*

VXML_RECRUITER

- Pin (PK)
- Name
- Uname
- Pwd
- Address
- Phone
- Email
- Website
- Profile
- Status

1..1   Create►   1..*

VXML_POSTS

- JobCode (PK)
- CompCode
- Topic
- Summary
- End_date
- Status

Figure 3.9: Class Diagram of Career Center Application

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3.2.2 System Development

After designing, the development stage will take place. This part will highlight how the development stage is implemented. This includes major programming/scripting languages and tools used to develop the system as well as brief explanation on process involved in developing phone-based career application. In general, this sub-topic will cover the following three parts:

- Tools and Languages
- Development of Phone-based Career Application
- Major VoiceXML Elements used for the Application

Tools and Languages

Phone-based Career Application

Voice Server : Nuance Café previously known as BeVocal Cafe

Languages : Voice Extensible Markup Language (VoiceXML 2.0)

: Extensible Markup Language (XML 1.0)

: Hypertext Pre-Processor (PHP)

Tools : BeVocal Vocal Scripter

(Web-based Java Applet for testing application)

: BeVocal VoiceXML Checker

(Writing and checking VoiceXML syntax)

: OptimTalk Desktop Suite 1.5 Basic Edition

(Desktop Simulation for Static VoiceXML only)

Web-based Career Application

Languages : Hypertext Markup Language (HTML)

: Hypertext Pre-Processor (PHP)

Tools : Macromedia Dreamweaver 8 Professional Edition

: Textpad

General (Used by both applications)

Web Server : Apache Web Server

Database : MySQL

Hosting : http://www.hafiz.utpian.net

Development of Phone-based Career Application

The development of phone-based career application can be divided into three (3) main processes:

- Setting up working environment
- Developing static application
- Developing dynamic application

Setting up Working Environment

Three options of setting up working environment are first, to install and deploy a full blown of voice environment, second, to use an established vendor to house the applications or third, to use a third party software that basically only for desktop simulation and local application testing.
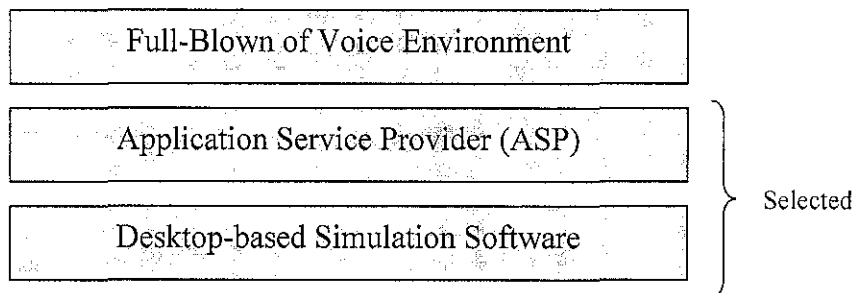
Figure 3.10: VoiceXML Working Environments

The first option which is to install a full-blown of voice environment should not be a choice for new developers. Other than requiring 24-hour, 7-day (24/7) monitoring, very high maintenance cost and high skills and knowledge, it also needs a big money investment for hardware and software purchases. It is reported that the sum of hardware and software costs of setting up in-house voice server is at least USD 15, 000.

Therefore, the second and third options are the best working environment for this project. The author created an account with one of many Application Service Providers (ASPs), BeVocal.com to test and house the VoiceXML application. ASP is similar to Internet Service Provider (ISP) but, providing voice server instead of web server. The account is free only for non-commercial purpose. One of distinct features of BeVocal.com is it offers two ways to test the application 1) by calling the application using *telephone* and 2) by running the application on an applet called *Voice Scripter.* Plus, it provides many development tools such as Voice Player, Voice Browser and Trace Tool.

To test the application during the development stage, the author uses the Voice Scripter because it can accept text input to replace voice input. Besides, it is very expensive to make international call. Since the voice server is located in United States, an international call charge will be imposed. The Voice Scripter simulates the application almost accurately. If the application can be run on Voice Scripter, it also works perfectly over the telephone.

The other working environment to develop the application is desktop-based software, *OptimTalk Desktop Suite Basic Edition 1.5,* which using Microsoft Speech SDK 1.5 to synthesize the voice input. This software allows the author to provide voice input via microphone and receives the voice output via speaker. This is a very good tool for local simulation and testing. However, it comes with disadvantage which primarily supports for static VoiceXML application. This tool is initially used before the Vocal Scripter but, due to unacceptable limitation, the tool is ignored for the rest of development stage.

Developing Static Application

The author uses the phrases of static application to represent Phone-based Career Application that requires no interaction with database which is using a scripting language. The static application only requires interaction between VoiceXML files and within a single VoiceXML file.

The static application includes:
- Greeting/welcome message
- Global Menu Link
- Global Help Link
- General Menu
- Menu for Logged in User
- Company's Profile
- Frequently Asked Questions (FAQs)
- Collect User Credentials
- Record Voice Query
- Good bye message

Developing Dynamic Application

Once the static application finished and fully tested, the dynamic modules are developed where the application is able to interact (submit and retrieve) data from database in the web server.

The dynamic modules are the core of this Phone-based Career Application and this includes:
- Verify user credentials for login
- Save voice query/voice message
- Retrieve latest 10 career opportunities
- Process job application

Major VoiceXML Elements used for the Application

The elements used are conformance with VoiceXML 2.0 Specifications.

Table 3.3: Major VoiceXML Elements Used for the System

Element	Purpose
<?xml>	The VoiceXML file must begin with <?xml> declaration as VoiceXML is a based on XML.
<vxml>	The <vxml> element must be put at the beginning and the ending of VoiceXML codes. Just like <html> tag.
<meta>	The <meta> element is used to specify the details of the application that is actually not used while running the application. Examples are the author and application name.
<var>	The <var> element is to declare a variable either for global variable or local variable.
<link>	Specify a transition common to all dialogs in the link's scope.
<help>	To specify help content that can be accessed globally.
<grammar>	Specify a speech recognition or DTMF grammar.
<form>	A dialog for presenting information and collecting data.
<field>	Declares an input field in a form.
<filled>	To specify an action to be executed once a field is filled.
<block>	A container of (non-interactive) executable code
<prompt>	Queues speech synthesis and audio output to the user.
<goto>	Go to another dialog in the same or different document.
<submit>	Submit values to server – processing document.

<subdialog>	Invoke another dialog as a subdialog of the current one.
<if>	To check whether the execution meet the condition.
<nomatch>	Catch nomatch event when user input does not match the grammar.
<noinput>	Catch noinput event where user being silence/not responding to the system
<catch>	To catch events such as noinput and nomatch events.
<return>	Return from a subdialog. May also return values/parameters together.
<exit>	To terminate the application
<disconnect>	Another way to terminate the application
<record>	To record voice message from the caller.
<script>	To create a string such as for menu etc
<menu>	A dialog for choosing amongst alternative destinations.

3.3 Phase IV: System Testing

System testing is very important to ensure the application delivers right outputs to the users. Black Box testing is the only approach used to test the application. By definition, black box testing is a testing without knowledge of internal working of the item being tested [18]. The tester will provide "legal" inputs and verify whether expected outputs are returned. As long as a right input provides a right output, the test case is considered successful.

The Black Box testing is selected based on its great features such as the tester does not require knowledge on specific programming languages and technologies, very effective to test application with large units of codes and the test is done from the user's point of view.

A complete test case for the black box testing is available in *Appendix II.*

3.4 Phase V: Deployment

There are two ways provided by BeVocal.com to deploy the application and make it accessible by the public:

- Purchase a Hosting Plan
- Activate the Application as a Demo (Chosen for Deployment)

3.5.1 Purchase a Hosting Plan

A hosting plan is not a really good option for this project as this application is based on a test case to find al alternative solution to access website's content. This application is working but, not the real application to deploy for any bodies or organizations. As it

also involves high cost, it is wise to not waste the money while there is an alternative to make it available to *selected* public.

3.5.2 Activate the Application as a Demo

This is the best option for deployment of this project. It is free and we can give the access ID to individuals who want to evaluate the application or to experience the VoiceXML-based application. Only selected public who we give the access ID can call and test the application. This is actually a very good option provided by BeVocal.com where it allows the developer to gain feedbacks from the client before the real deployment.

To activate a demo, the author chooses files which are available in the *Deployment* menu. By clicking it, it means the file is selected for activation. A demo/access ID will be asked and we can distribute the ID to selected individuals. Finally, it is compulsory to agree with the legalese provided by the BeVocal's lawyers.

To call and test the application, pick up any types of telephone and dial an international number 1.408.907.7328 or use Voice Over Internet Protocol (VoIP) software like Skype and call 8773386225@voip.cafe.bevocal.com. Say *"BeVocal Café"* and then the demo ID. Very soon, the demo VoiceXML application will be activated to the caller.

CHAPTER 4

RESULT AND DISCUSSION

4.0 Re-highlighting Objectives

It is important to re-highlight the objectives/deliverables of this project to verify whether they are achieved at the end of the system development life cycle (SDLC). As for the author, the objectives are fully achieved after verifying that all modules were developed and tested successfully. The two (2) objectives set at the beginning of this project are:

- Career Center Phone-based Application to access the website's contents via telephone and
- Career Center Web-based Simulator to verify that changes made via phone call really affect the website's contents.

Vocal Scripter by BeVocal Café, the voice platform, is used as a replacement of telephone for dialing the phone-based application as it is cost-free and very effective for application testing.

In this chapter, the result will be divided into five (5) sections:
- General Section
- Inquiry Section
- Login Section
- Latest Job Post Section
- Job Application Section

4.1 General Section

General Section will present the following output:

- Welcome Page
- Company's Profile
- Global Help and Menu Links
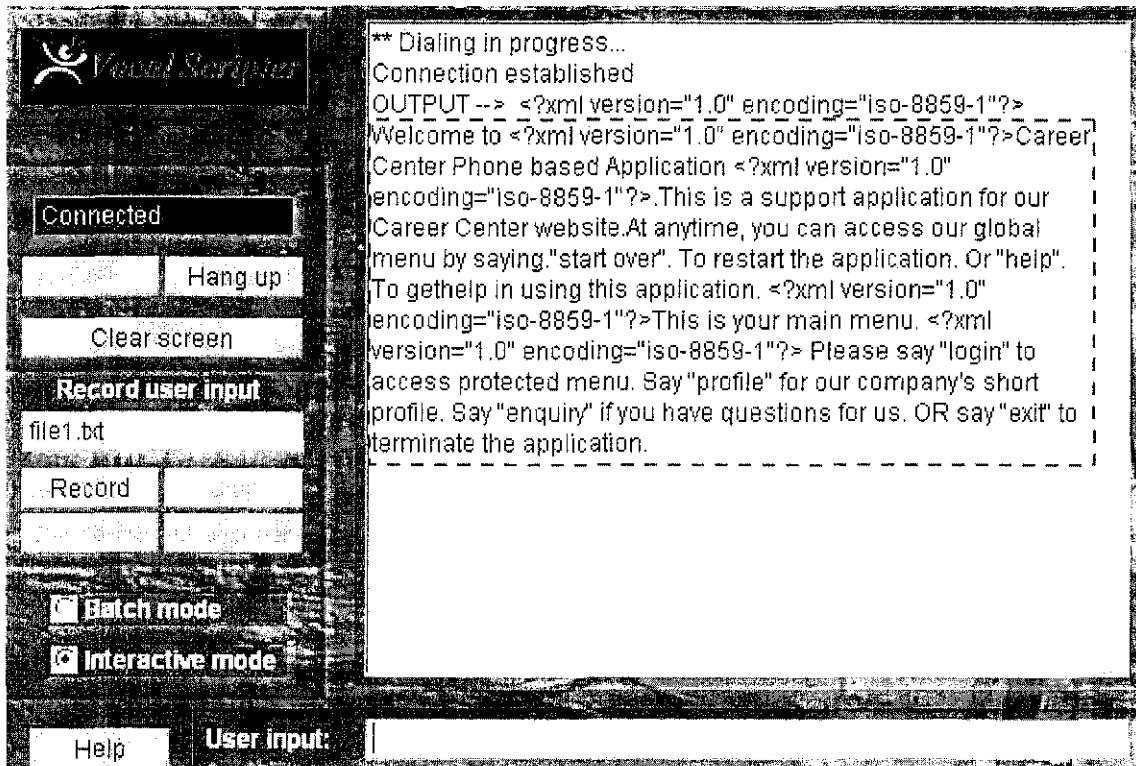
Figure 4.1: Welcome Page

Based on Figure 4.1, once the connection is established to the voice server, the welcome message is prompted. The welcome message includes the description of the application, main menu, and global menu and help links. Callers may proceed to the next section by specifying any one of available options in the prompted menu. If the caller selected *profile*, the company's profile will be prompted as in Figure 4.2.
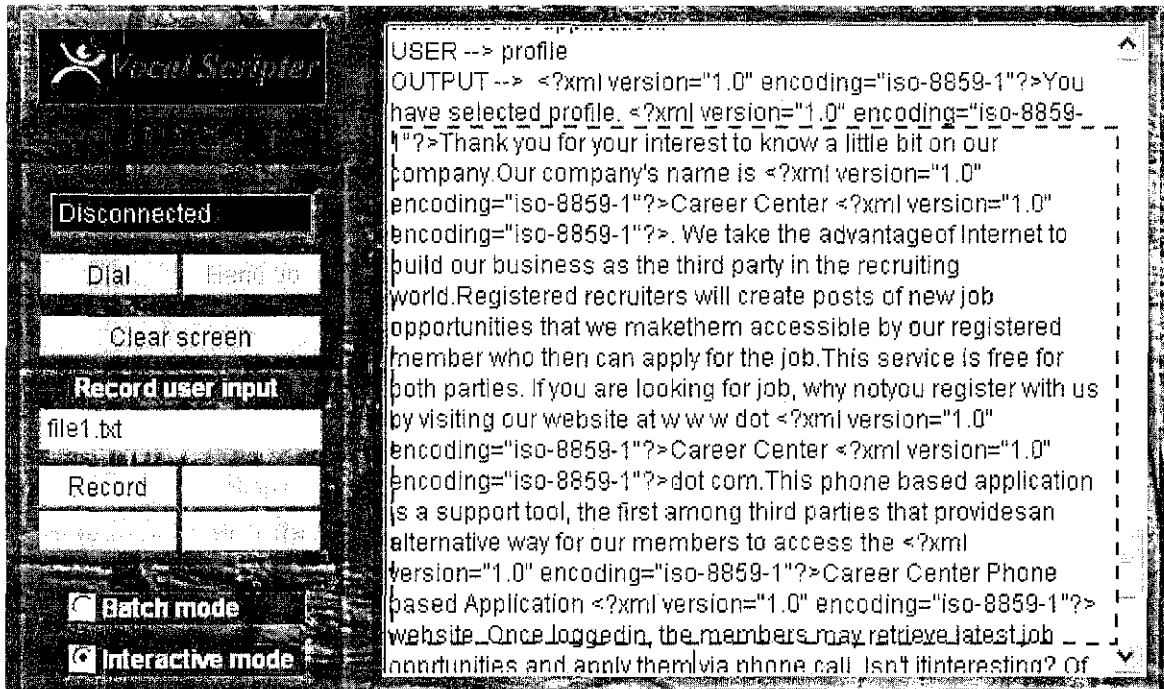
Figure 4.2: Company's Profile

The phone based application also is equipped with global menu and help links where callers may say *help* to get help on how to use the application or *start over* to restart the application by re-directing to the main menu, **anytime** within the application. See Figure 4.3 for samples of global help link.
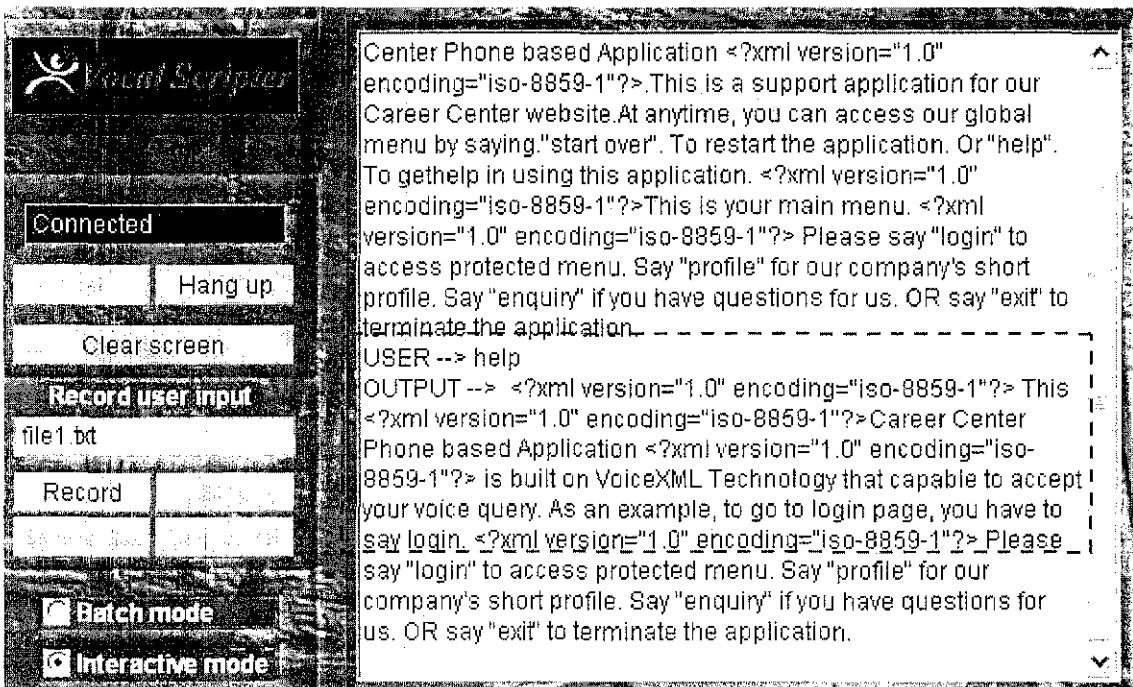
Figure 4.3: Global Help Link

4.2 Inquiry Section

The inquiry section allows callers to record voice queries or to retrieve the frequently asked questions (FAQs). Figure 4.4 shows how to make a voice query which will be saved in the data center with blob data type. The web-based simulator is then used to verify that the voice query is stored in the database correctly.

Figure 4.4: Voice Inquiry

4.3 Login Section

The phone-based application has two-level of menu; main menu and secured menu. Secured menu such as *latest* to retrieve latest 10 job posts and *apply* to make job application can only be accessed by registered members. Figure 4.5 shows a sample of successful login.
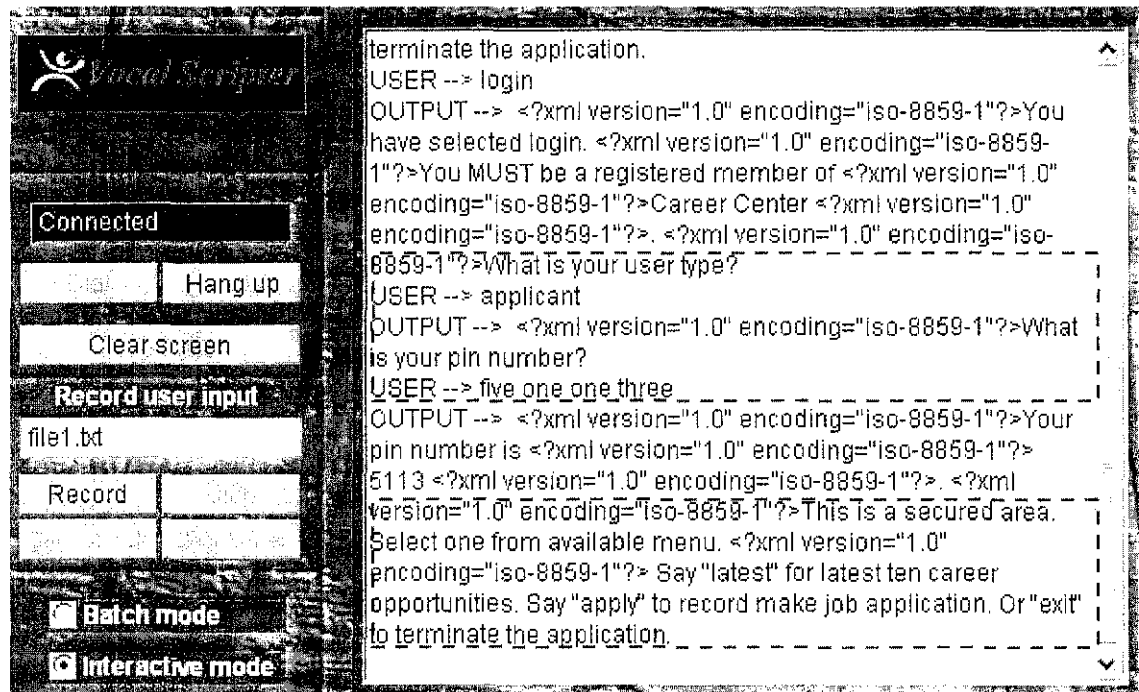

Figure 4.5: Login

To login, callers must produce the user type either applicant or recruiter and the pin number. The credentials then will be compared to records in the data center/database. If the record exists, the secured menu will be prompted. Otherwise, the callers will be asked to re-enter the credentials.

4.4 Latest Job Post Section

The logged-in callers may retrieve latest 10 career opportunities posted by recruiters registered in Career Center. The latest posts retrieved via phone call are the same with which retrieved via web-based simulator. It is shown in Figure 4.6 below:

Figure 4.6: Latest Job Posts

4.5 Job Application Section

In the final section, the logged-in callers also can make job application via phone call by specifying the job code as shown in Figure 4.6. The web-based simulator is again used to verify that the job applied belongs to the right applicant.

Figure 4.7: Job Application

CHAPTER 5

CONCLUSION AND FURTHER WORKS

5.0 Conclusion

This project is done, tested and working perfectly. This will be a great alternative to access the website's content especially the career websites in Malaysia and the World. With VoiceXML technology, now people can 'talk' with the content of a website and make update via a phone call. The development of this project will definitely initiate more VoiceXML-based development in Malaysia and it is hoped, in very soon, the voice server will be hosted by a Malaysian company that surely encourage such application development.

If foreign companies like Virgin Atlantic successfully increases the customer satisfaction using its VoiceXML-based customer service application, it is undeniable same benefits will be enjoyed by local companies. Therefore, this project is very feasible even though, to date, there is no voice server in Malaysia. What to do is to propose applications that eventually will initiate involvements mainly by communication technology providers.

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5.1 Further Works

There are three recommended works for further development and improvement:

- Mixed Initiative Dialog
- Personalization of the Application
- Malay Language Enabled

5.1.1 Mixed Initiative Dialog

Currently, the callers have to say word by word to go from one menu to another menu. For an example, from the main menu, in order to reach the latest job posts retrieval, the callers have to say *login* to access the secured menu and *latest* to command the application to present the result. With mixed initiative dialog, from the main menu, the callers can simply give a number of commands in a regular conversation. As an example, "*I want to login and listen to latest job opportunities.*" This full-sentence command will be processed quickly and will skip some steps to reach the latest job posts retrieval menu. Mixed initiative dialog is an advanced approach with complex grammars to handle such voice command. The use of this approach will definitely provide great experience especially to regular callers of Career Center Phone-based Application.

5.1.2 Personalization of the Application

Personalization is a way to treat each people differently. Personalization may help a company to ensure the users will keep using the application as they feel being treated uniquely. Two areas that can be implemented to develop personalized application are the system voice and the audio to bridge delay.

For the system voice, the callers may decide what type of voice to be heard within the application because some people prefer to be entertained by female voice while another

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group of people much prefer on male voice. Providing options is very good to attract more users for the application.

While audio to bridge delay will help to inform the callers that the application is not stop working. This will normally happen when silence mode is on while the application is retrieving, sending or processing data in data center/database. The delay may provide confuses that the application is stop running where it is actually working. A various types of audio should be provided as options for callers whether they prefer to listen to company's advertisements, soft music, songs and others.

5.1.3 Malay Language Enabled

The final important further work is to enable Malay Language for this phone-based application. This is a very hard work and need big money investment. The work must be done on the voice server itself where the Speech-to-Text and Text-to-Speech translators must be Malay Language-enabled. It is possible as many project development in Malaysia focusing on Malay Language Voice Synthesis. What to do is to use the existing syntheses and integrate it within the voice server.

REFERENCES

Main References

- Azrul Abdul Wahab, Voice Authentication using VoiceXML, Thesis, Information Resource Center of Universiti Teknologi Petronas (IRCUTP), 2004
- VoiceXML 2.0 Developer's Guide: Building Proffesional Voice-enabled Applications with JSP, ASP, & ColdFusion, McGraw-Hill/Osborne, 2002
- Larson, James A., VoiceXML: Introductin to Developing Speech Applications, Pearson Education, 2002
- Shaoms, Chetan & Kunis, Jeff, VoiceXML: Strategies & Techniques for Effective Voice Applications Development with VoiceXML 2.0, John Wiley & Sons, 2002
- Abbott, Kenneth R., Voice Enabling Web Application: VoiceXML & Beyond, Apress 2002
- Arehart, Charles, Proffesional WAP: With WML, WMLScript, ASP, JSP, XML, XSLT, WTA, Push and VoiceXML, Wrox Press Ltd, 2000

Additional References

[1] Hansen K, 2008, *Web 2.0 Dominates Trends in Internet Job-Hunting: A Quintessential Careers Annual Report 2008,*
http://www.quintcareers.com/Internet_job-hunting_report.html, February 26, 2008.

[2] Ferrens J. *Introduction of VoiceXML Forum Tutorial,*
http://www.voicexml.org/tutorials/intro2.html, *February 28, 2008*

[3] *Voice Extensible Markup Language (VoiceXML) Version 2.0, W3C Working Draft,*
23 October 2001, http://www.w3.org/TR/2001/WD-voicexml20-20011023/, March 30, 2008

[4] Miller M., *VoiceXML 10 Projects to Voice-Enabled Your Web Site*, Wiley, 2002, pg 16.

[5] Sam Aparicio, Mike Zirngibl, 30 April 2004, *IVR for Web Services Accommodating the Mobile Customer Base,* http://soa.sys-con.com/read/44673.htm, 31 March 2008

[6] *Fundamental of Communications*, http://www-net.cs.umass.edu/cs653-2004/documents/telecomm_fundamentals.pdf, March 12, 2008

[7] Jackson, Eric, August 1, 2003, *Speaking up for Cost Savings in the Call Center, e-CRM, , Customer Interaction Solutions*, The Free Library by Farlex, August 20, 2007.

[8] *Definiton of IVR,* www.expedite-email-marketing.com/internet_marketing_glossary_internetmarketingtermsdefinition.htm, 30 March 2008

[9] Call Center Industry Statistics Related to Call/Budget, http://www.incoming.com/statistics/costsbudget.aspx, August 21, 2007.

[10] Cole C. A., August 03, 2006, *Genesys Leverages VXML to Alleviate Call Center Snafus,* http://news.tmcnet.com/news/2006/08/03/1769066.htm, October 5, 2007.

[11] Lepko M., *Industry News by VoiceGenie Technologies Inc.* http://www.contactcenterworld.com/eventsfp.asp?evid={21E5A788-1364-4954-A723-C6987B16D523}&prev=2, October 5, 2007

[12] John Hibel, February 2001, *Business Advantages of VoiceXML Vol 1, Issue II,* http://www.voicexmlreview.org/Feb2001/features/business_advantages.html, 30 March 2008

[13] Customer Success Stories, http://www.voicexml.org/success_stories/index.html, September 3, 2007

[14] Boston Mass, USA, 11 September 2006, NGC Systems Uses NMS Communication Vision VoiceXML Server to Create Cutting-Edge Voice and Video SMS Solution, http://www.nmscommunications.com/Communications/News/PR/Items/NGC.htm, 14 September 2007

[15] *Definition of PABX,* htpp://www.une.edu.au/it-services/glossary.php, March 30 2008

[16] Farley M., June 2001, User Centric Design for VoiceXML Applications.

[17] Barnes V., 2006, *The Importance of Design,* http://www.htmlgoodies.com/introduction/intro/article.php/3473591, February 29, 2008

[18] Thomas Raishe, June 1999, *Black Box Testing,* http://www.cse.fau.edu/~maria/COURSES/CEN4010-SE/C13/black.html, April 11, 2008

APPENDICES

APPENDIX 1: SURVEY FORM

QUESTIONNAIRES ON CAREER CENTER PHONE-BASED APPLICATION

Purpose of the Survey

This survey aims to collect information from potential users on career center phone-based application that is to be developed on VoiceXML platform as a support tool for career websites.

General Information (#1 - #4)

1. Do you think a career website should have a phone-based application as a support tool so that you can retrieve new job opportunities and apply for a job via phone call?

   ☐ Yes   ☐ No

2. Do you think extra career tools provided by a career website such as SMS and Email Alerts, SMS Job Application and others enough for you as a member?

   ☐ Yes   ☐ No

3. Have you ever called any phone-based applications in Malaysia that require you to speak to go from one menu to another? Example: Say 'login' to login or 'exit' to terminate the call.

   ☐ Yes   ☐ No

4. If your answer for #3 is yes, is the application developed for a career website?

   ☐ Yes   ☐ No

Method to bridge delay (#5 - #6)

5. When you are being put on hold or your request is being processed, would you like the system to remain silent or play an audio? By playing an audio, therefore you will know that the system is still working.

    ☐ Silent   ☐ Play an audio

6. If your answer in #13 is 'play an audio', what type of audio you like?

    ☐ Company's promotion
    ☐ Simple tone. Example: "toot..."
    ☐ Soft, plain music
    ☐ Other kind of sound. Specify: _____

Voice Personality

7. Whose voice you like to hear from the system? Example of conversation: "Say 'order' to use our voice ordering system or 'exit' to terminate your call"

    ☐ Teenager (Girl)   ☐ Adult (Woman)   ☐ Aged (Woman)
    ☐ Teenager (Boy)   ☐ Adult (Man)   ☐ Aged (Man)

Services Required

8. What system modules basically you want the application to provide?

    ☐ Account Information   _____
    ☐ Company's Profile   _____
    ☐ Inquiries   _____
    ☐ Latest Job Offers   _____
    ☐ Job Application   _____
    ☐ Account Registration   _____

    Rank your interest at the blank provided (right). Put 10 for highest priority and 1 for lowest priority.

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SYSTEM TEST PLAN
CAREER CENTER PHONE-BASED APPLICATION

1.0 Introduction

This test plan is prepared for developer only. The objective is to identify any defects and incorrect workflows of career center phone-based application before its real implementation on a career website. Any problems and usability issues identified in this system testing would be taken into considerations and/or actions.

Test plan Part I is divided into Five (5) main divisions and available in Section 3 of this test plan:

> **Section A:** General Workflow in Career Center Phone-based Application
> **Section B:** Retrieving FAQs and Submitting Voice Inquiry
> **Section C:** Login Section of Career Center Phone-based Application
> **Section D:** Retrieving Latest Job Posts in Career Center Phone-based Application
> **Section E:** Applying for a Job via Career Center Phone-based Application

2.0 System Testing Schedule

Developer: 4th April 2008 – 6th April 2008

The testing will use BeVocal Café Vocal Scripter as it really simulates a telephone.

3.0 Test Cases

Section A: General Workflow in Career Center Phone-based Application

Purpose: General workflow covers the welcome message, main menu, global menu link, and global help link and goodbye message.

Test Case Description	Yes	No	Not Tested	Comment
Once connection successfully established, the welcome message is prompted.				
Keyword *start over* and *help* of global menu and help links are prompted after the welcome message.				
The main menu is prompted after the global links message.				
Say *login* and verify the login section is prompted.				
Say *profile* and verify the company's profile is prompted.				
Verify that after company's profile finished, the callers are returned to the main menu.				
Say *enquiry* and verify that the enquiry section is prompted.				
Verify that if no menu option is selected *noinput* error message is prompted.				
Verify that if *noinput* error occurs more than 3 times, the application is terminated.				
Say other than *login, profile & enquiry* and verify that error message *nomatch* is prompted and the main menu is re-prompted.				
Verify that if *nomatch* error occurs more than 3 times, the application is terminated.				
Say *exit* and verify the goodbye message is prompted and the application then is terminated				

Section B: Retrieving FAQs and Submitting Voice Inquiry

Purpose: To retrieve pre-set Frequently Ask Questions (FAQs) and to submit Voice Inquiry into data center.

Test Case Description	Yes	No	Not Tested	Comment
From the main menu, say *enquiry* to go to enquiry section. Verify that the enquiry menu is prompted				
Say *faq* and verify the FAQ menu is prompted.				
Say *website* and verify that the answer for website is prompted.				
Repeat step #3 with other keyword: *address, phone, email, fee, membership.*				
From the FAQ menu, say *menu* and verify the main menu is prompted.				
From the FAQ menu, say *exit* and verify that the call is terminated after a good bye message is prompted.				
Repeat Step #1 and say *voice*. Verify that a message "you have 15 second to record and start after the beep..." is prompted.				
Verify that after 15 second, you will be asked to provide a contact number.				
After providing a contact number, verify that the the recorded audio is prompted and you will be asked to confirm whether to continue submitting the inquiry to the data center.				
Verify that, after saying *yes* the voice inquiry will be processed.				
Verify that, after saying *yes* the voice inquiry will be processed.				
Verify that, if the process is successful, a success message will be prompted.				
Verify that, if the process is successful, you will be asked whether to make another voice inquiry.				
Verify that, if the process is unsuccessful, a failure message will be prompted.				
Verify that, if the process is unsuccessful, you will be asked whether to make another voice inquiry.				

Section C: Login Section of Career Center Phone-based Application

Purpose: To verify a valid member can login and has access to the secured menu.

Test Case Description	Yes	No	Not Tested	Comment
From the main menu, say *login* and verify that a message "you must be a registered member of Career Center..." is prompted.				
Verify that you will be asked for user type.				
Verify that you will be asked for pin number after the user type is specified.				
Verify that, if the inputs are valid, the user will be directed to secured menu area.				
Verify that, if the inputs are invalid, the user will be prompted with error message and directed to the main menu.				

Section D: Retrieving Latest Job Posts in Career Center Phone-based Application

Purpose: To verify logged-in callers can retrieve latest 10 job application available in the Career Website via phone call.

Pre-requisite: Logged in into the system. Refer Section C.

Test Case Description	Yes	No	Not Tested	Comment
From the secured menu area, say *latest* and verify latest 10 job posts which are available on web-based simulator are prompted in speech format.				
Verify that after the latest posts are prompted, you will be re-directed the secured menu area.				

Section E: Applying for a Job via Career Center Phone-based Application

Purpose: To verify the logged-in callers can apply for a job via phone call by specifying the job code and pin number.

Pre-requisite: Logged in into the system. Refer Section C.

Test Case Description	Yes	No	Not Tested	Comment
From the secured menu area, say *apply* and verify that you enter the job application section.				
Verify that you are asked to provide the pin number and the job code.				
Verify that a successful application will be prompted with a success message.				
Verify that after the successful application, you will be asked whether to make another job application or go back to secured menu area.				
Verify that a unsuccessful application will be prompted with a failure message.				
Verify that after the unsuccessful application, you will be asked whether to make another job application or go back to secured menu area.				
Say *more* and verify that you will be brought to the job application section.				
Say *menu* and verify that you will be brought to the secured menu area.				
Say *exit* and verify that your call is disconnected after the goodbye message is prompted.				

4.0 System Usability Scale (SUS)

SYSTEM USABILITY SCALE (SUS)
© Digital Equipment Corporation, 1986.
SUS is a measurement for degree of system usability.

EVALUATOR (name, role, company, etc)	
SYSTEM BEING EVALUATED	
SYSTEM VERSION	
EVALUATION DATE:	

		← Disagree			Agree →	
#	QUESTION	1	2	3	4	5
1	I think that I would use this system frequently.					
2	I found the system unnecessary complex.					
3	I thought the system was easy to use.					
4	I think I would need the support of a technical person to be able to use the system.					
5	I found that various functions in this system were well integrated.					
6	I thought there were too many inconsistencies in this system.					
7	I would imagine that most people would learn to use this system very quickly.					
8	I found the system very cumbersome to use.					
9	I felt very confident to use the system.					
10	I needed to learn a lot of things before I could get going with this system.					

APPENDIX III: GANTT CHART

		Task Name	Start	Finish
1		⊟ FYP Part I	Mon 7/30/07	Thu 1/31/08
2	▣	Proposal	Mon 7/30/07	Fri 8/3/07
3	▣	Literature Review	Thu 9/13/07	Wed 9/19/07
4	▣	Collection of Data [Step 1]	Mon 10/1/07	Sun 10/7/07
5	▣	Analyzing Data [Step 2]	Mon 10/8/07	Sun 10/14/07
6		⊟ Design & Development [Step 3 Part 1]	Mon 10/15/07	Thu 1/31/08
7	▣	Prototype/Static Application	Mon 10/15/07	Wed 10/31/07
8	▣	Database Design	Sat 12/1/07	Sun 12/9/07
9	▣	Website Design	Mon 12/10/07	Thu 1/31/08
10				
11		⊟ FYP Part II	Tue 1/1/08	Sun 4/13/08
12		⊟ Design & Development [Step 3 Part II]	Tue 1/1/08	Sun 3/30/08
13	▣	Dynamic Application witl All Functions	Tue 1/1/08	Sun 3/30/08
14		⊟ Testing [Step 4]	Thu 1/3/08	Wed 4/2/08
15	▣	Design Test Cases	Mon 3/31/08	Wed 4/2/08
16	▣	Run Test Cases	Thu 1/3/08	Sun 1/6/08
17		⊟ Deployment & Documentation [Step 5	Mon 4/7/08	Sun 4/13/08
18	▣	Identifying Future Improvement	Mon 4/7/08	Mon 4/7/08
19	▣	System Documentation & Guides	Tue 4/8/08	Sun 4/13/08

APPENDIX IV: KEY MILESTONES

Reports on Data Collection and Analysis		
Prototype: Static VXML Application	Nov 2, 2007	2.5W
Database & Website Design		
Dynamic VXML Application	Mar 30, 2008	3M
Test Plan & Test Result		
	Apr 13, 2008	1W