A

WEB BASED BOOKING AND RESERVATION SYSTEM FOR VISUALLY IMPAIRED COMMUTERS

RESEARCH PROJECT

BY

BASSEY-THOMAS EDIMA UDOH

AK14/NAS/CSC/003

SUBMITTED TO

DEPARTMENT OF COMPUTER SCIENCE

FACULTY OF NATURAL AND APPLIED SCIENCE

AKWA IBOM STATE UNIVERSITY

IKOT AKPADEN, MKPAT ENIN LGA, AKWA IBOM

STATE, NIGERIA

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IKOT AKPADEN, MKPAT ENIN LGA, AKWA IBOM
STATE, NIGERIA
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF BACHELOR OF SCIENCE (B.Sc)
DEGREE IN COMPUTER SCIENCE

NOVEMBER, 2018

CERTIFICATION

This research work titled '**A Web-based Booking and Reservation System for Visually Impaired Commuters**' was carried out by **Bassey-Thomas, Edima Udoh (AK14/NAS/CSC/003)** of the Department of Computer Science, Faculty of Natural and Applied Sciences, Akwa Ibom State University. This work has not been presented elsewhere for the award of a degree, except as reference.

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BASSEY-THOMAS, EDIMA UDOH   DATE

(STUDENT)

APPROVAL PAGE

This research work titled '**Web-based Booking and Reservation System for Visually Impaired Commuters**' by **Bassey-Thomas, Edima Udoh (AK14/NAS/CSC/003)** has been approved by the Department of Computer Science, Faculty of Natural and Applied Sciences, Akwa Ibom State University as a document of the Department by:

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DEDICATION

This research work is dedicated to the almighty God for his immense love, mercy, grace, kindness, protection and guidance and also to my beloved parents, siblings and friends for their support.

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My gratitude goes to God almighty for his grace, kindness, and love upon my life. My Project Supervisor, Dr. Godwin O. Ansa for his patience, guidance, and understanding.

I also use this medium to say a big thank to Mr Thompson Tom Ikpe and Mrs Thomas Enobong Judy for their support towards the pursuit for academic excellence. I will not fail to acknowledge the admirable support and encouragement of my friends and course mates for their prayers and support throughout the period of this work.

ABSTRACT

In this present age, the need and use of websites cannot be over emphasized. The need for a medium to exchange information, marketing ideas, enhancing of business growth, entertainment and the need for a virtual identity has become a norm in this jet age. But even with this need a certain percentile of the world population have been left out because of certain conditions which are beyond their control; generally the disabled. Because of their disability, they have been left out from partaking in these societal norms and over time the world at large have tried in imbibing them by the emergence of ambience assistive tools and technologies. This research work aims at implementing an enhanced booking and reservation system for visually impaired commuters. This system will be able to combine virtual assistive technology such as speech-to-text, text-to-speech and speech command synthesis. The objectives of the system enables visually impaired commuters to register and book their travelling manifestos anywhere, anytime without the help of a second party. Additionally the system has a feature to save the commuters information and manifesto to a database for easy retrieval and cross referencing. The research methodology that has been chosen for this research work entails state-of-the art, online reviews and the use of Prototyping model. The tools that were used to achieve these aims and objectives are Hypertext Markup Language (HTML),MySql, Cascading Style Sheet(CSS), Hypertext Preprocessor(PHP) and JavaScript.

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CHAPTER ONE

INTRODUCTION

1.0   BACKGROUND OF THE STUDY

For the past decade, the importance and impact of the Internet and web technology cannot be said to have gone un-noticed, majority of business corporations or enterprises have developed websites so as to enlarge their consumer base which certainly leads to large profit inherently. With computer and internet being everyday part of workplaces almost everywhere, it becomes difficult for low vision/no vision users to fit in the working environment. Web based systems which are platform independent, are generally rich in user interface but they lack accessibility. Normal people can understand it because of their cognitive senses. However, Visually Impaired people have no such accessibility mechanisms that can bring them at par with the normal users, (Lele *et al.*, 2013).

According to Pascolini and Mariotti (2010), an estimated 253 million people live with vision impairment of which 36 million are blind and 217 million have moderate to severe vision impairment. 81% of people who are blind or have moderate or severe vision impairment are aged 50 years and above. Globally the principal causes of visual impairment are uncorrected refractive errors (43%) and cataracts (33%). Other causes are glaucoma, 2%, age related macular degeneration (AMD), diabetic retinopathy, trachoma and corneal opacities, all about 1%. A large proportion of causes of blindness, 18%, are undetermined. The causes of blindness are cataract, (51%), glaucoma, (8%), AMD, (5%), childhood blindness and corneal opacities, (4%), uncorrected refractive errors and trachoma, (3%), and diabetic retinopathy (1%), the undetermined causes constitute (21%) of all blindness.

Blindness affects a person's ability to perform many duties, which severely limits their abilities critically. Also, technology poses a major challenge for visually impaired individuals for example; their inability to read information on web pages. Browsing web pages requires screen reading software which will read information on websites, (Hanson & Johnson, 2008). The interest in accessibility and usability issues has increased in recent years. Actually, the use of websites has been widening, and the number of users accessing them is steadily increasing. Therefore, it is imperative that the information be easily reachable by all, including people with disabilities. Furthermore, for some user categories (e.g. blind users) the Web is one of their main sources of useful information about educational or cultural purposes. The difficulties in providing such universal access can be addressed through the application of usability and accessibility principles (Leporini & Paternò, 2008).

Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the web, and that they can contribute to the Web. Web accessibility encompasses all disabilities that affect access to the Web, including visual, auditory, and physical, speech, cognitive, and neurological disabilities. (World Wide Web Consortium - Web Accessibility Initiative, 2012) Research has confirmed that people with disabilities are most at risk of being excluded from access, and in particular people who are blind or visually impaired (Brophy & Craven, 2007). According to outcomes of the study by Mereu and Kazman cited in Rajapakse *et al.*, (2012), the accuracy level of identifying a target in a sound-only environment of visually impaired users is higher than of sighted users. Since the target group is visually impaired, accessibility depends on the ability to listen. According to Lele *et al.*, (2013), visually impaired individuals use screen reader tools to interact with the system. Screen readers speak aloud, what is on a computer screen, including desktop icon labels, document contents, and drop-down and

tool bar menu items. They also speak each keystroke; provide auditory cues and an audible hierarchy for navigating within and among applications.

Thus, audio-based interaction mode has been seen to be effective in enhancing the interaction of visually impaired users with web-based applications. An audio based interface with positional information is considered as a possibility for visually impaired persons.

Based on this principle, this research work is geared towards the development of an audio-based interaction interface in a web-based booking environment for the visually impaired commuters, to eliminate the problems faced by the visually impaired individuals in booking their seats in a transportation agency.

1.1   STATEMENT OF THE PROBLEM

Based on the experience of Alonso *et al.*, (2006), the idea to create a simple to use computer interface for the blind stemmed from the fact that available programs are not easily or independently usable by the average blind person is to the fact that they work by reading out Graphical User Interfaces (GUIs) which are not designed for blind people. There are specific usability requirements that have to be met when developing dual interfaces (graphical user interfaces that are adapted for blind users.)In the existing system, booking and reservation system for visually impaired users are performed manually or handled online by another sighted individual. The problems with the existing system include:

- Inability for visually impaired commuters to carry out online booking and reservation with travel agencies by themselves.

- The existing system requires the visually impaired commuters to be physically present at the branch before they can book for their seats which is disheartening especially when 81% of visually impaired are aged 50 years and above.

- Inability for visually impaired user to interact with the system due to the fact that the interface is a Graphical User Interface.
- Manifold access: this simply means accesses to information on websites are non-linear, occurring in multiple layers which would be difficult to process for a visually impaired user.

1.2   AIM OF THE STUDY

The aim of this research work is to develop a web-based commuter system to handle activities of visually impaired commuters' seat booking and reservation. The proposed system will enhance information sharing and effective booking and reservation management at anywhere and anytime through text-to-speech applications. The proposed system will allow blind people to be able to easily interpret and comprehend the information that is presented to them.

1.3   OBJECTIVES OF THE STUDY

The following are the objectives of the study:
- To conduct an extensive literature review on Assistive technology in order to understand and observe the drawbacks of the existing system.
- To create a system that is able to generate and print travel manifestos for the visually impaired.
- To create a system for registration of blind commuters and their travelling manifestos.
- To create a system that will mitigate queues as visually impaired commuters can register and book for their seats and travelling manifestos without having to be physically present.
- To create a system that will facilitate for storage and downloading of registered commuter's information to any storage memory.

1.4 SIGNIFICANCE OF THE STUDY

The significance of this research work is that this project will help enhance Akwa Ibom State Transportation Company's information system necessary for the registration of visually impaired commuters, booking and reservation of seats. It also profer solutions to adequate and timely registration of commuters' travelling manifestos as well as to serve as a reference material to any student that will find the subject interesting to further research on.

1.5 SCOPE OF THE STUDY

The scope of this study covers the method of registration of visually impaired commuters and their travelling manifestos for booking and reservation of seats using Akwa-Ibom Travelling agency (AKTC), Uyo branch as a case study.

1.6 LIMITATIONS OF THE STUDY

During the research process to the moment of documentation, the following limitations were encouraged;

- Finance constraints: due to our present economy and price for acquiring browsing data to do detailed research may have been a bit disadvantaged for gathering fully in-depth and relevant materials and papers.
- Maintenance constraints of the software: due to large amount of data that will process in the users database, and constant update of user accounts, it might be a bit tasking for the maintenance team.

1.7   DEFINITION OF TERMS

- **Booking**: An arrangement by which something such as a theater seat or hotel room is kept for somebody's use at a specific time or an arrangement made to have a hotel room, seat, tickets, etc. at a particular time in the future.

- **Commuters**: This refers to a person or someone who travels regularly between places, such as between home and work.

- **Information System**: Information system (IS) is the study of complementary networks of hardware and software that people and organizations use to collect, filter, process, create, and distribute data.

- **Interactive**: Interactive computer systems are programs that allow users to enter data or commands. Most popular programs, such as word processors and spreadsheet applications, are interactive.

- **Management**: Management can be seen as person or group of persons that take(s) decisions affecting the totality of an   organization. They are entrusted with the responsibilities of planning, organizing, leading, directing, and controlling in an organization.

- **Registration**: The act or an instance of registering somebody or something, or the process of being registered.

- **Reservation**: This refers to an arrangement to have something (such as a room, table, or seat) held for use at a later time.

- **Visually Impaired Individuals**: Visually impaired individuals or users range from those who are mildly near or far sighted, to those who are legally blind, to those who have no vision at all.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

Some websites continue to be inaccessible to people with disabilities. However, there has been a steady increase in the interest of accessibility and usability issues in recent years. In fact, the use of websites has been widening, and the number of users accessing them is steadily increasing. Therefore, it is imperative that the information be easily reachable by all, including people with disabilities. Additionally, for some user categories (e.g. blind users) the Web is one of their main sources of useful information about educational or cultural purposes, etc. The difficulties in providing such universal access can be addressed through the application of usability and accessibility principles.

This chapter provides an insight into the State-of-the-Arts and looks at the contributions from several authors on this research subject matter. It gives a brief overview of the Internet, its merits and demerits, Information System and so on.

2.1 INTERNET OVERVIEW

The Internet is generally defined as a global network connecting millions of computers. More than 190 countries are linked into exchanges of data news and opinions (Beal, 2018). According to Kaushalya (2012), the Internet is a global system of interconnected computer networks that use the standard Internet protocol suite, Transmission Control Protocol/Internet Protocol (TCP/IP) to serve billions of users worldwide. It is a network of networks that consists of millions of private, public, academic, business, and

government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies. The Internet carries a vast range of information resources and services, such as the interlinked hypertext documents of the World Wide Web (WWW) and the infrastructure to support electronic mail. Casarosa (2014), stipulates that a network is a group of two or more computer systems linked together while the internet is the largest computer network in the world, connecting millions of computers.

Internet has been the most useful technology of the modern times which helps us not only in our daily lives, but also our personal and professional lives developments. The internet is widely used by students for educational purposes. Even business professionals and professionals such as doctors, access the Internet to filter the necessary information for their use. The Internet is therefore the largest encyclopedia for everyone, in all age categories. The Internet has served to be more useful in maintaining contacts with friends and relatives who live abroad permanently (Kaushalya, 2012).
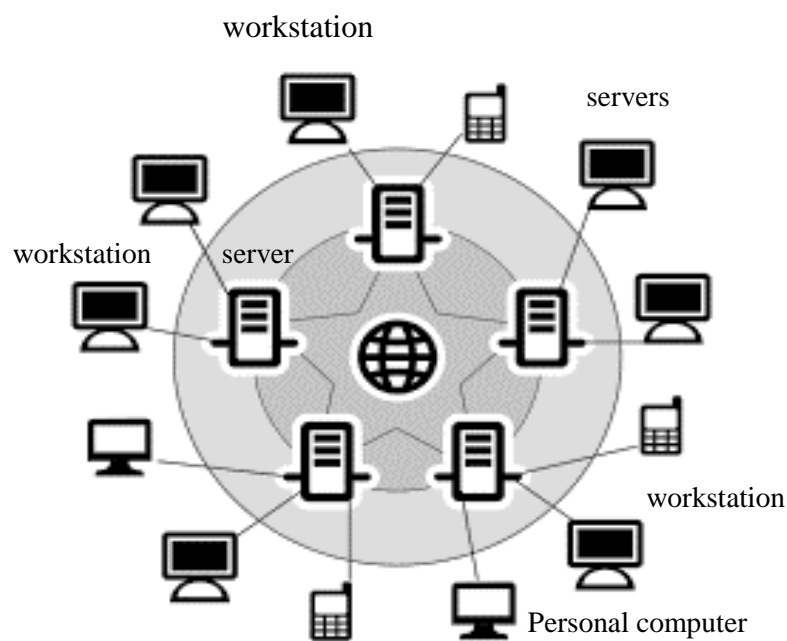
Fig. 2.1   **Internet Network Scheme Diagram**

2.1.1 Merits of Internet

The advantages of Internet are seen in the following areas (Kaushalya, 2012):

- **Email**: Email is now an essential communication tools in business. With e-mail someone can send and receive instant electronic message, which works like writing letters. Ones messages are delivered instantly to people anywhere in the world, unlike traditional mail that takes a lot of time.

- **24 hours a Day Services**: Internet services are available, 24 hours a day and 7 days of the week for usage.

- **Information**: Information is probably the biggest advantage Internet is offering. There is a huge amount of information available on the Internet for just about every subject, ranging from government law and services, trade fairs and conferences, market information, new ideas and technical support. Someone can almost find any type of data on almost any kind of subject that one is looking for by using search engines like google, yahoo, msn, etc.

- **Online Chat**: People can access many 'chat rooms' on the web that can be used to meet new people, make new friends, as well as to stay in touch with old friends. One can also chat in MSN and yahoo websites.

- **E-commerce**: Along with getting information on the Internet, users can also shop online. There are many online stores and sites that can be used to look for products as well as buy them using a credit card. Users do not have to leave their houses and can do all the shopping from the convenience of their homes. It has a real amazing and wide range of products from household needs, electronics to entertainment.

2.1.2 Demerits of Internet

The disadvantages of the Internet are (Kaushalya, 2012):

- **Theft of Personal Information**: Electronic messages sent over the Internet can be easily snooped and tracked, revealing who is talking to whom and what they are talking about. If a person uses the Internet, the user's personal information such as the name, address, credit card, bank details and other information can be accessed by unauthorized persons. If one uses a credit card or Internet banking for online shopping, then the details can also be 'stolen'.

- **Negative Effects on Family Communication**: It is generally observed that due to more time spent on Internet, there is a decrease in communication and feeling of togetherness among the family members.

- **Internet Addiction**: There is some controversy over whether it is possible to actually be addicted to the Internet or not. Some researchers claim that it is simply people trying to escape their problems in an online world.

- **Virus Threat**: Today, not only are humans getting viruses, but computers are also. Computers are mainly getting these viruses from the Internet. A virus is a program which disrupts the normal functioning of a computer system. Computers connected to Internet are more prone to virus attacks and they can end up crashing a system's hard disk.

- **Spamming**: It is often viewed as the act of sending unsolicited email. This multiple or vast emailing is often compared to mass junk mailings. It needlessly obstructs the entire system. Most spam is commercial advertising, often for dubious products, get-rich-quick schemes, or quasi-legal services. Spam costs the sender very little to

send — most of the costs are paid for by the recipient or the carriers rather than by the sender.

2.2 COMPUTER-BASED INFORMATION SYSTEM

Information Systems (IS) involve a variety of information technologies (IT) such as computers, software, databases, communication systems, the Internet, mobile devices and much more, to perform specific tasks, interact with and inform various actors in different organizational or social contexts. Of general interest to the field of IS are therefore all aspects of the development, deployment, implementation, use and impact of IS in organizations and society (Alter, 2013; Bulchand-Gidumal and Melián-González, 2011; Cecez-Kecmanovic *et al.*, 2014).

Paul, (2010) defines information system in many ways: "In a general sense, the term information system (IS) refers to a *system* of people, *data* records and activities that process the data and *information* in an organization, and it includes the organization's manual and automated processes." More so, "In a narrow sense, the term information system (or computer-based information system) refers to the specific *application software* that is used to store data records in a computer system and automates some of the information-processing activities of the organization. Computer-based information systems are in the field of *information technology*."

A Computer-Based Information System (CBIS) is an information system that uses computer technology to perform some or all of its intended tasks. Such a system can include as little as a personal computer and software. Or it may include several thousand computers of various sizes with hundreds of printers, plotters, and other devices, as well as communication networks (wire-line and wireless) and databases. In most cases an information system also includes people (Sarmad, 2011).

2.2.1 Components of Information Systems

The following are the various components of information system (Sarmad, 2011):

- **Resources of people**: These are the end users, which use the information system and Information System specialists, system analyst, programmers, data administrators etc., which develop and operate the information system.

- **Hardware**: These are computers and other equipment along with all data media, object on which data is recorded and saved.

- **Software**: These are all the resources including all sets of information processing instructions. These refer to the programs, applications and procedures.

- **Data**: This includes data which is a raw material of information systems and database. Data can take many forms, including alphanumeric, voice, image, video, etc.

- **Networks**: These refer to all the resources of networks such as communications media and network support.

2.2.2 Types of Information System

According to Mindmeister (2018), there are five (5) types of Information Systems

- **Transaction Processing Systems**: A transaction processing system provides a way to collect, process, store, display modify or cancel transactions. Most of these systems allow multiple transactions to take place simultaneously. The data that this system collects is usually stored in databases which can be used to produce reports such as

billing, wages, inventory summaries, manufacturing schedules, or check registers.

- **Management Information Systems**: A Management Information System (MIS) is an information system that uses the data collected by the transaction processing system and uses this data to create reports in a way that managers can use it to make routine business decisions in response to problems. Some of the reports that this information system creates are summary, exception and ad hoc reports. All this is done to increase the efficiency of managerial activity.

- **Decision Support Systems**: A decision support system helps make decisions by working and analyzing data that can generate statistical projections and data models. This system gives support rather than replacing manager judgements while improving the quality of a manager's decision. A DSS helps solve problems while using external data.

- **Expert Systems and Neutral Networks**: An expert system, also known as a knowledge-based system, is a computer system that is designed to analyze data and produce recommendations, diagnosis and decisions that are controlled. A neutral system uses computers to foster the way a human brain may process information, learn and remember that information.

- **Information Systems in Organizations**: This information system collects stores and processes data to give organization real time useful and accurate information. This information system encompasses data gathering information from the people and machines that collect, process, output and store data. Also in the networks that transmit and receive data and the procedures that govern the way data is handled.

2.2.3 Characteristics of a Good Information System

The most important characteristics of a good Information System are those that give decision-makers confidence that their actions will have the desired consequences *(*Markgraf, 2018).

- **Relevance**: The information a manager receives from an MIS has to relate to the decisions the manager has to make. An effective MIS takes data that originates in the areas of activity that concern the manager at any given time, and organizes it into forms that are meaningful for making decisions. If a manager has to make pricing decisions, for example, an MIS may take sales data from the past five years, and display sales volume and profit projections for various pricing scenarios.

- **Accuracy**: A key measure of the effectiveness of an MIS is the accuracy and reliability of its information. The accuracy of the data it uses and the calculations it applies determine the effectiveness of the resulting information. The sources of the data determine whether the information is reliable. Historical performance is often part of the input for a Management Information System, and also serves as a good measure of the accuracy and reliability of its output.

- **Usefulness**: The information a manager receives from an MIS may be relevant and accurate, but it is only useful if it helps him with the particular decisions he has to make. For example, if a manager has to make decisions on which employees to cut due to staff reductions, information on resulting cost savings is relevant, but information on the performance of the employees in question is more useful. The MIS has to make useful information easily accessible.

- **Timeliness**: MIS output must be current. Management has to make decisions about the future of the organization based on data from the

present, even when evaluating trends. The more recent the data, the more these decisions will reflect present reality and correctly anticipate their effects on the company. When the collection and processing of data delays its availability, the MIS must take into consideration its potential inaccuracies due to age and present the resulting information accordingly, with possible ranges of error.

- **Completeness**: An effective MIS presents all the most relevant and useful information for a particular decision. If some information is not available due to missing data, it highlights the gaps and either displays possible scenarios or presents possible consequences resulting from the missing data. Management can either add the missing data or make the appropriate decisions aware of the missing information. An incomplete or partial presentation of information can lead to decisions that don't have the anticipated effects *(*Markgraf, 2018).

2.3 WEB-BASED INFORMATION SYSTEMS

A web-based information system is an information system that utilizes Web technologies to deliver information and services to users or other information systems/applications. Web-based information system is an information system which uses Internet web technologies for delivering information and services to users. This technology is a software system and is used to publish and maintain data by hypertext principle. Web-based information system is the combination of one or more web applications, specific functionality-oriented components. Basically in this type of information system web browser is used as a front end and all the databases are used as a back end. (Essays UK, 2013).

2.3.1 Features of Web-based Information Systems

Web-based information systems have evolved significantly over recent years with its improvement. Web-based applications have several advantages over traditional software based applications. Some of the core features of web-based applications are given below (Essays UK, 2013):

- **Cross Platform Compatibility**: Most web-based applications are compatible in different platforms than traditional installed software. The minimum requirement would be a web browser (Internet Explorer, Firefox, Netscape etc.). You can use different OS such as Windows, Linux or Mac to run the web applications.

- **Manageability**: Web based Information System only need to be installed on the server placing minimal requirements on the end user workstation, which makes the system easier to maintain and update as usually it can all be done on the server.

- **Multiple Concurrent Users**: Web-based applications can indeed be used by multiple users at the same time. It's not necessary to share screen or send a screenshot when multiple users see and even edit the same document at the same time. Web conferencing and online collaboration companies regulate some key transformations and users only explore what they really need to work effectively and co-edit documents together.

- **Reduced Cost**: Web-based applications can reduce cost due to support and maintenance, lower requirements on the end user system and simplified architecture. It doesn't require any distribution or marketing infrastructure.

- **Secure Live Data**: These applications can decrease the risk of losing data due to an unexpected disk crash or computer virus. Companies of

web-based applications provide extensive data backup service either as an integral part or basic service or sometimes as a paid service.

2.4   VISUALLY IMPAIRED USERS AND WEB ACCESSIBILITY

In recent years, the interest in accessibility and usability issues has increased. In fact, the use of websites has been widening, and the number of users accessing them is steadily increasing. For this reason, it is important that the information be easily reachable by all, including people with disabilities. Moreover, for some user categories (e.g. blind users) the web is one of their main sources of useful information about educational or cultural purposes. The difficulties in providing such universal access can be addressed through the application of usability and accessibility principles (Leporini & Paternò, 2008). Undeniably, accessibility and usability are frequently addressed as two separate issues but disabled users need to have both accessible and usable applications. In fact, accessibility and usability are two intertwined aspects of Web site interaction and if they are not properly integrated, Web sites can turn out to be either accessible but barely usable, or usable but barely accessible. In both cases Web site navigation by disabled users is likely to be seriously compromised, since they either may not be able to access the desired information (i.e., it is not accessible) or may find difficulty in arriving at what they need (in this case it is not usable) (Leporini & Paternò, 2008). As the web allows access to a large amount of information, searching has become a daily activity for many people who now turn to the web for a diverse range of tasks (Kellar, Watters & Shepherd, 2006). This ease of access to information has benefited most people, but has particularly been a blessing for people with disabilities, for example, visually impaired people, as they have access to much of the same information available to sighted people. Therefore, the web has empowered visually impaired users and has played a significant role in combating social exclusion (Sahib, *et al.*, 2012).

Visually impaired people usually access the web using screen-reader software that processes web pages sequentially from top to bottom and reads their content out in computer synthesized speech. This sequential access imposes numerous challenges on visually impaired users (Andronico *et al.*, 2006; Borodin *et al.*, 2010), for example, lack of context and information overload. The screen-reader interface, like all auditory interfaces, suffers from a lack of persistence and in a search environment; it requires the user to increasingly depend on their memory to keep track of encountered information. Given the challenges imposed by the screen reader, searching can be considered to be a challenging problem for visually impaired users. The type of search task also impacts the search process as it represents the searcher's information needs and drives the information-seeking process (Sahib, *et al.*, 2012).

2.4.1 Assistive Technologies

After Braille, no invention has enabled blind and visually impaired people to communicate as effectively as the assistive technologies that make computers and the Internet accessible. This include:-

2.4.1.1 Screen Readers

Screen readers speak aloud, what is on a computer screen, including desktop icon labels, document contents, and drop-down and tool bar menu items. They also speak each keystroke; provide auditory cues and an audible hierarchy for navigating within and among applications. However their drawback is that they don't react intelligently to the dynamic contents on the screen (Lele *et al.*, 2013).
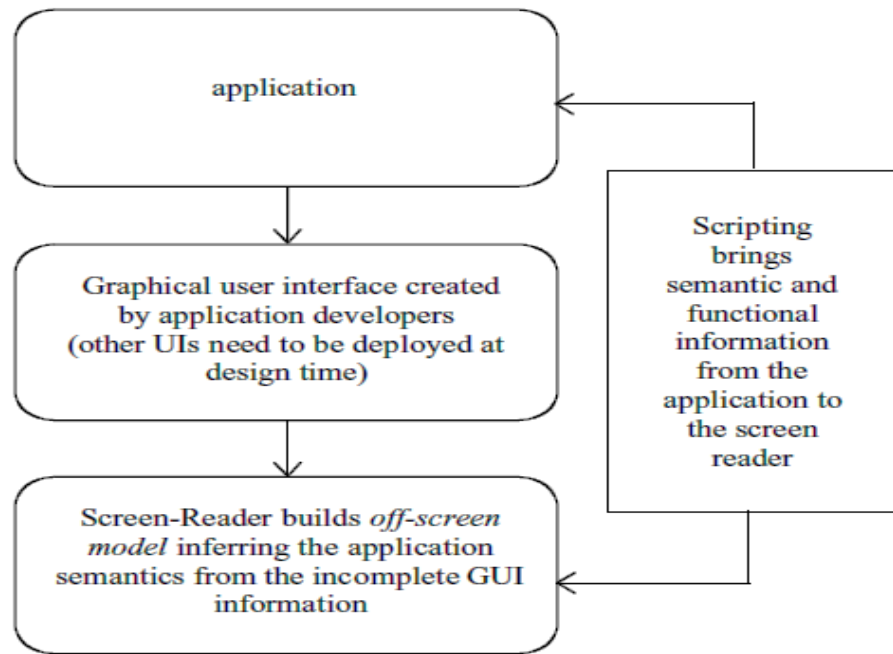
Fig. 2.2   Relationship between the Screen-Reader, the GUI and the Application (Freitasa & Kouroupetroglou, 2008).

Most screen readers that are in popular use today are rather similar, and most have common insufficiencies that result in similar problems for users.

- **Desktop Screen Readers**: Traditionally, screen-reader users have used Windows operating system. Although Microsoft Windows provides a choice of accessibility options such as the magnifying glass, text narration, etc., the majority of screen-reader users do not use the built-in accessibility features, giving preference instead specialized screen-readers (SuperNova, 2009) and magnification software (MAGic, 2009), that limit users mostly to the Windows platform. The recent improvement of Apple's built-in VoiceOver screen reader has boosted the number of Mac users.   The name "screen reader" quite accurately describes how these tools first operated and, to a large extent, how they continue to operate today. Screen readers provide keyboard shortcuts

that allow navigation of the content to be rendered to the screen in a non-visual way. Although popular due to their ability to make access to most content possible, they can often be severely limited in the usability they deliver, leading to the popularity of *non-visual web browsers* in the research and open source communities.

- **Non-visual Web browsers**: While enabling computer interfaces to the fullest is a challenging engineering effort, a number of projects have taken an easier approach and targeted only web browsing. The general goal of non-visual web browsers is to make a first-class aural interface to web browsers, drawing from the work of T.V. Raman's emacspeak (Borodin, *et al.*, 2010).

- **Voice Browsers** are often implemented by augmenting existing web browsers (Hanson *et al.*, 2008). One of the oldest representatives of voice browsers is IBM's Home Page Reader (Borodin, *et al.*, 2010). The latest IBM's prototype aiBrowser (Miyashita *et al.*, 2007), implemented as a plug-in for the Microsoft Internet Explorer has mostly been targeting multimedia web content. FireVox (Thiessen and Chen, 2007), supported by Google is a Firefox browser extension enabling the basic browsing functionalities, as well as the support of ARIA on Windows, OsX, and Linux platforms. More recent work in this space includes the HearSay web browser (Borodin *et al.*, 2008), which integrates into various browsers on multiple platforms and converts web content into a VoiceXML dialog for aural interaction. WebAnywhere (Bigham *et al.*, 2008) is a server-side solution for remote web browsing from any computer terminal. Although voice browsers typically fare better than screen readers when it comes to web

browsing, they typically copy the screen reader interface and offer only minor improvements to the effectiveness of non-visual web browsing.

- The State of Assistive Technologies: The modern-day assistive technologies enable non-visual computer access and web access. Although these technologies empower blind users to browse the Web, most of the assistive tools available today perform minimal content analysis that could enable more intelligent non-visual interfaces; as a result the assistive tools limit their functionalities to navigation over the visual interface. Modern assistive technologies mostly leverage simple heuristics, such as determining labels for form elements by considering the labels located visually to the left. The latest version of Apple's VoiceOver does page-segmentation making it easier to navigate between segments. Overall however, the majority of assistive technology developers have been trying to make the Web more accessible, rather than trying to make non-visual web browsing more efficient (Borodin, *et al.*, 2010).Furthermore, if content were truly designed from the start for non-visual use, then many of the strategies that are common and necessary when using today's screen readers may not be required (Borodin, *et al.*, 2010).

2.4.1.2 Braille Translation Software

Braille translation software converts electronic files into braille that can be read on a refreshable display or printed on a braille embosser. Blind computer users use it to read text output. This solution however, requires involvement of an extra hardware (Lele *et al.*, 2013).

2.4.2 Web Accessibility Initiative – Accessible Rich Internet Applications

Web Accessibility Initiative – Accessible Rich Internet Applications (WAI-ARIA), WAI ARIA is an accessibility API provided by W3C and it defines a way to make Web content and Web applications more accessible to people with disabilities. It especially helps with dynamic content and advanced user interface controls developed with Ajax, HTML, JavaScript, and related technologies. Currently certain functionality used in Web sites is not available to some users with disabilities, especially people who rely on on-screen readers and people who cannot use a mouse. More specifically, WAI-ARIA provides a framework for adding attributes to identify features for user interaction, how they relate to each other, and their current state. WAI-ARIA describes new navigation techniques to mark regions and common Web structures as menus, primary content, secondary content, banner information, and other types of Web structures. For example, with WAI-ARIA, developers can identify regions of pages and enable keyboard users to easily move among regions, rather than having to press Tab many times (Lele *et al.*, 2013). WAI-ARIA provides Web authors with the following:

- Roles to describe the type of widget presented, such as "menu," "tree tem," "slider," and "progress meter".
- Roles to describe the structure of the Web page, such as headings, regions, and tables (grids).
- Properties to describe the state widgets are in, such as "checked" for a check box, or "has popup" for a menu.
- Properties to define live regions of a page that are likely to get updates (such as stock quotes), as well as an interruption policy for those updates —for example, critical updates may be presented in an alert dialog box, and incidental updates occur within the page.

- A way to provide keyboard navigation for the Web objects and events, such as those mentioned above (Lele *et al.*, 2013).

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2.5 INTERACTIONS MODES FOR VISUALLY IMPAIRED USERS

Visually impaired users or individuals range from those who are mildly near or far sighted, to those who are legally blind, to those who have no vision at all. Those with the most vision loss cannot rely upon sight at all to interact with the world around them. Approximately 161 million visually-impaired individuals live in the world (Hailpern *et al.*, 2010). Visually impaired users or individuals have learned to adapt to and augment many aspects of the world around them, for instance, with the Braille system (AFB, 2010). As computer systems have become ubiquitous, technology also has adapted to meet the needs of these users (Miyashita *et al.*, 2007).

According to Lele *et al.*, (2013), there are various human perception feedback modalities and the table below shows their pros and cons:

Table. 2.5   Human Perception Feedback Modalities

Modality	Pros	Cons
Visual	Parallel in space; large information transfer	Active eye contact necessary
Acoustic	Enforces attention allocation; enables perception of background activities; important for visually impaired people	Noise through environment, linear in time; exists only for a short time span
Haptic	Object recognition; texture and surface perception	Contact with objects necessary.

2.6   SPEECH-BASED INTERFACE FOR VISUALLY IMPAIRED

The Web (also known as WWW) is a main source for seeking information these days. Visually impaired users find it difficult to surf the WWW because of the reliance of hypermedia on visual layout. Goble *et al*. cited in Rajapakse *et al.*, (2012) have mentioned some issues with GUI for the visually impaired as listed below.

- Do not understand what is on the page

- Do not know the page length and where is he/she now

- Get confused and cannot figure out what to do next

- Difficulties on access frames, tables, spacer images, and large images

- Too much details on a single page makes it complex

- Experience of moving on the web is not satisfying or enjoyable

According to Freitasa and Kouroupetrogloub (2008), some of the major limitations that persons with visual impairments face are:

- To access written information,

- To operate devices with complex user interfaces,

- To get orientation and mobility support,

- To view television broadcastings, movies, live performances or shows.

The term *written information* is used to include all print material (mainly on paper but also on labels, signs or tags), electronic material (stored in information systems or WWW content and displayed in monitors or projected on screens) and handwritten material that include text, scientific symbols and graphical representations (e.g. diagrams, maps, pictures, drawings) (Freitasa & Kouroupetrogloub, 2008).

When the written information is language-based (i.e. text), it is straightforward to state that speech (i.e. the oral form of language), is the direct alternative or substitute modality to convey the information to a blind person and it is very helpful for the partially sighted persons. This is confirmed by the fact that, traditionally, recordings on audiotapes were widely used by the blind community to access information in books, magazines and newspapers. In case the written content is not in text form, language-based descriptions can be used to render the information, at least partially. The same approach, named *audio description*, has been used in theatres, live performances and in television (Freitasa & Kouroupetroglou, 2008). Furthermore, even persons without vision loss prefer to interact with computers, and other devices or appliances using speech commands, or even spoken dialogues. Thus, it is clear that speech technologies, i.e., coding, synthesis and recognition of speech signals (Fellbau & Kouroupetroglou, 2008), play an important role as assistive technologies for the visual impaired people to alleviate the major barriers described above (Fellbaum & Freitas, 2007).

More so, in the real world context, visually impaired people use auditory input to identify their surroundings. According to outcomes of the study by Mereu and Kazman cited in Rajapakse *et al.* (2012), the accuracy level of identifying a target in a sound-only environment of visually impaired users is higher than of sighted users. Rajapakse *et al.* (2012) reported that as the target group is visually impaired, accessibility depends on the ability to listen. In the proposed system, the interface was based on limited number of elements with captions/labels. The inaccessible components such as pictures and videos were eliminated. A common set of basic components, menu items or form items with captions were used instead of links, buttons, text boxes,

labels, etc. Functionalities were limited and simple, which made the system to be more comprehensive in nature.

Automatic conversion of text into speech or of speech into other text is more or less straightforward nowadays. It is being achieved more and more effectively (Huang *et al*, cited in Freitasa and Kouroupetroglou, 2008). Main problems affecting speech transmission are *signal to noise ratio* and *acoustic interference* that, more or less, compromise intelligibility and effectiveness of the communication channel. Other troubles are *lack of privacy*, *speech serial transmission* (pieces of information follow one another in a rather slow timeline, with a negative impact in cognition of longer messages), and the almost practical impossibility of *parallel speech channels* perception (Freitasa & Kouroupetroglou, 2008). A pre-processor module in speech-based interfaces transforms annotations and coded information into full-text with prosodic commands. VoiceXML, Speech Synthesis Markup Language (SSML), Semantic Interpretation for Speech Grammars (SISR), Speech Recognition Grammar Specification (SRGS), Voice Browser Call Control (CCXML) and Synchronized Multimedia Integration Language (SMIL) are some of the more important text annotation, processing and operation control languages in the field of automatic speech interfacing (Web Consortium, 2014).

2.7   VOICE BROWSERS AND VOICE PORTALS

Interacting with a web page using voice can be achieved to different extents. Voice output alone, allows speech rendering of the web page, using some page structural features. A Screen-Reader for example may just read out the web page contents. However, in general, this is not the most convenient approach because the user will have little chance to obtain an early overview of the page contents (Freitasa & Kouroupetroglou, 2008).

Using voice input as well allows a user to interfere dynamically with the reading, issuing commands and selecting options to get the desired reading and to operate with web services. A voice browser is a software that is capable of interpreting and executing voice mark-up languages that allow the generation of speech output and accept speech input, as well.

W3C (the World Wide Web Consortium) is undertaking a Voice Browser activity (Web Consortium, 2014) and has recently relaunched the Voice Bowser Working Group aiming at standardizing languages for capturing and producing speech and for managing the dialog between users and computers (Web Consortium, 2007). The Voice Browser Working Group has created the *W3C* Speech Interface Framework suite of specifications, which includes the VoiceXML Recommendation (Voice Extensible Mark-up Language) that specifies the flow control and exchange of information between users and computers, the SRGS Recommendation (Speech Recognition Grammar Specification), that specifies the words and phrases which a speech recognition system can convert from speech to text, the SSML Recommendation (Speech Synthesis Mark-up Language) that specifies how to render text as human-like speech by a speech synthesis system, the Pronunciation Lexicon, that specifies how words are pronounced, and the CCXML (Call Control Extensible Mark-up Language), that specifies how to manage the telephone system (answer incoming calls, initiate outgoing calls, create conference calls, etc.) (Freitasa and Kouroupetroglou, 2008).

VoiceXML is designed for creating audio dialogs that feature synthesized speech, digitized audio, recognition of spoken and DTMF key input, recording of spoken input, telephony, and mixed initiative conversations. SSML defines a mark-up language for prompting users via a combination of

pre-recorded speech, synthetic speech and music. The user can select voice characteristics (name, gender and age) and the speed, volume, pitch, and emphasis. There is also provision for overriding the synthesis engine's default pronunciation (Web Consortium 2014). A voice portal is a World Wide Web portal (or gateway) that can be accessed entirely by spoken dialogue technology through the common fixed or the cellular telephone. Ideally, any type of information or transaction found on the WWW could be accessed through a voice portal. Typical services offered by voice portals include phone directory, weather information, travel and hotel bookings, e-mail reading or sending, stock exchange information or transaction, banking, e-government transactions, etc. Voice portals are modern interactive voice response (IVR) systems (where old style IVR mostly used touch-tone input ("press 1 for sales, 2 for service", etc.). VoiceXML provides a simple interface between an IVR system and other XML applications, such as Web sites, allowing, for example, the spoken retrieval of information from databases (Freitasa & Kouroupetroglou, 2008).

Many companies offer development systems for preparation of web and telephone applications using the speech interface (Harris cited in Freitasa *&* Kouroupetroglou, 2008). Parsing of web page content is a necessary step in the way towards a desired speech rendering. Through a careful analysis, the structure or outline of a web page can be discovered and used as a table of contents for speech rendering. In *AudioBrowser*, a special web browser was developed with the capability of displaying separated but related frames of information. The created (or existing) table of contents of the page is displayed in one frame, the original page linked contents in a second one and the portion under observation in a third one with magnification (for low-vision users) (Freitasa & Kouroupetroglou, 2008).

The user of this application can freely navigate inside the contents of each frame or jump between frames from contents to table of contents or vice-versa in order to scan or navigate through the page in a more structured and friendly way. The Text-to-Speech device constantly helps a blind or low-vision user, following the navigation accurately. This browser accessibility model is less general but more structured, gaining in terms of speed and clarity of the browsing. Anyhow it may fall back to the traditional approach of page voice rendering if, by user option, the discovered structure is not followed. Voice manipulation in this case is even more important in order to signal the switching between windows. It can be achieved with one or with two voices in different speech modification styles (Freitasa and Kouroupetroglou, 2008).

2.8   SUMMARY OF LITERATURE REVIEW

Some contributions from authors based on various areas under this research topic have been reviewed. The impacts and benefits of Internet and web-based information system have been discussed, while the web accessibility and interaction modes for visually impaired users or individuals as well as speech-based interface and voice browsers have also been deliberated. This research work is geared towards developing a web-based commuter system to handle activities of visually impaired commuters' seat booking and reservation to enhance effective booking and reservation management at anywhere and anytime through text-to-speech applications so that blind people can easily interpret and comprehend the information that is presented to them. More so, to develop a web-based booking system, audio-based interface and speech-based technologies were examined.

CHAPTER THREE

SYSTEM ANALYSIS AND METHODOLOGY

3.0 INTRODUCTION

System analysis is a process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components. It is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose. Analysis specifies what the system should do. Systems analysis is the process of observing systems for troubleshooting or development purposes. This chapter takes overviews on the system analysis and various research methodologies and the entire research work.

3.1 ANALYSIS OF THE EXISTING SYSTEM

Commuter booking system is an information system that allows information of commuters to be processed and stored for further reference. Commuters queue to book and have their desired seats reserved so that they can travel to their various destinations. In the existing system, which allows the sighted individuals to have their information such as personal and travelling destination to be captured and stored on a file.

Visually impaired individuals find it difficult to make use of the system due to the fact that the interaction modality with the system does not allow visually impaired individuals to use it. The system uses a Graphical User Interface whereas the visually impaired individuals can only interact with the system through Voice-Based User Interface.

In the existing system, booking and reservation for visually impaired users are performed manually or handled online by another sighted individual.
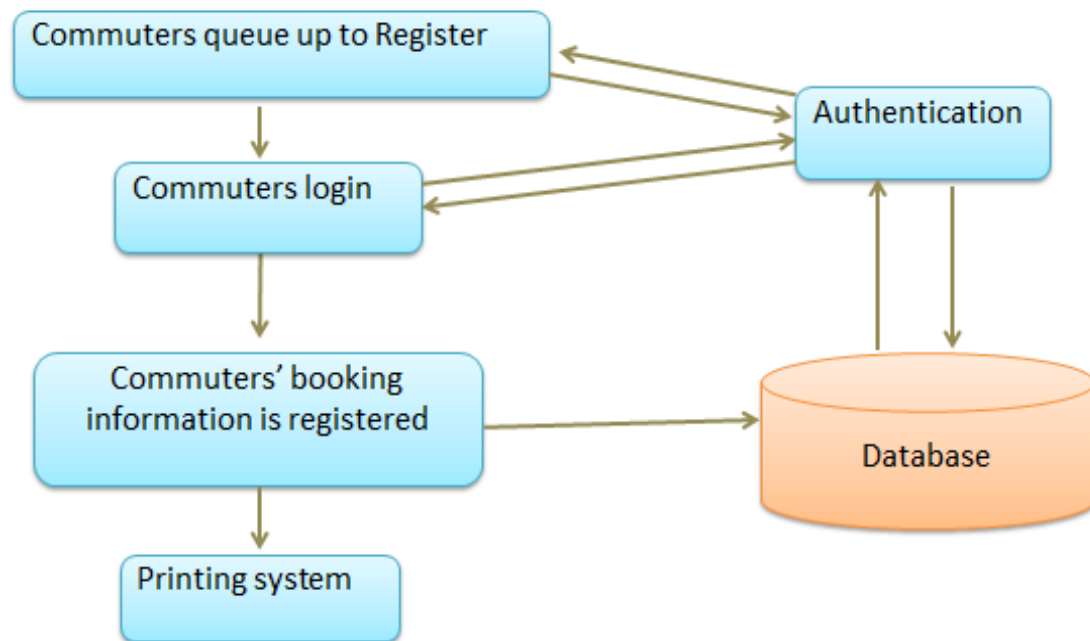
3.1.1 Existing System Architecture

Fig. 3.1   Existing System Activity Architecture

3.1.2 Advantages of Existing System

The advantages of the existing system are as follows:

(i.)   The existing system helps in registering sighted commuters.

(ii.) The existing system helps the management to share and disseminate information to commuters.

(iii.) The existing system helps in the processing of commuters booking information.

(iv.) The existing system helps in tracking commuter's bookings information as well as updating them.

3.1.3 Disadvantages of the Existing System

After a thorough investigation of the existing system, the following challenges were identified:

(i.)   Inability for visually impaired commuters to carry out online booking and reservation with travel agencies by themselves.

(ii.)   The existing system requires the visually impaired commuters to be physically present in the branch before they can book for their seat which is disheartening where 81% of visually impaired are aged 50 years and above.

(iii.)   Inability for visually impaired user to interact with the system due to the fact that the interface is graphical user interface.

(iv.)   Manifold access: this simply means accesses to information on websites are non-linear, occurring in multiple layers which would be difficult to process for a visually impaired user.

3.2 ANALYSIS OF THE PROPOSED SYSTEM

The proposed system is a web-based booking system that uses audio-based interaction interface for visually impaired commuters to eliminate the problems faced by the visually impaired individuals in booking their seats in a transportation agency. An audio based interface with positional information is considered as a possibility for visually impaired persons.

In this system, the visually impaired commuter interacts with the system through speech-to-text and text-to-speech technology. During the interaction process, the visually impaired commuter has to give some personal

information and travelling destination information, which the system will process, the audio feedback and saved as well as enabling the user to download it into any other storage.
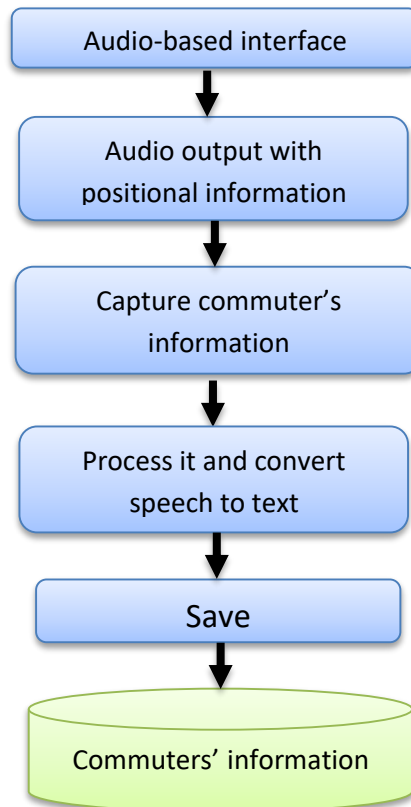

Fig. 3.2   System Flowchart for the Proposed Web-based Booking System

3.2.1 The Advantages of the Proposed System

The advantages of the proposed system are:

(i.)   The system makes commuter's interaction with web-based application for seat booking and reservation activities easy and user-friendly.

(ii.)   The system helps in the registration of blind commuters and their travelling manifestos.

(iii.) The system mitigates queues as visually impaired commuters can register and book for their seats and travelling manifestos without having to be physically present.

(iv.) The system facilitates for storage and downloading of registered commuter's information to any storage memory.

3.3   JUSTIFICATION OF THE PROPOSED SYSTEM

The justification for the proposed system include:

(i.) It will help enhance proper documentation of visually impaired commuters' information.

(ii.) It will help enhance Akwa Ibom State Transportation Company's information system necessary for the registration of visually impaired commuters.

(iii.) It will help the visually impaired commuters to book for reservation of seats anytime and anywhere.

(iv.) It will improve the interaction of commuter with the system since it is using audio-based interface.

3.4   RESEARCH METHODOLOGY

The process used to collect information and data for the purpose of making business decisions. The methodology may include publication research, interviews, surveys and other research techniques, and could include both present and historical information. The research methodology enables the team to organize their efforts into one cohesive and conceptual product idea generation task. It is a systematic plan for conducting research.

The research methodology used helps to ensure that a thorough study of the present system is effectively carried out, thus helping the project research team to completely understand the operation of the existing system so as to

know how the new system should be structured and the functionalities needed in it to address the seemingly existing problems discovered.

The research methodology's objectives are to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet.

3.4.1 Types of Research Methodology

There are varieties of research methodologies such as: qualitative and quantitative methods.

- Qualitative method: This method aims for a complete, detailed description of observations, including the context of events and circumstances. It covers experiments, questionnaire, survey research, personal interview and participant observation, etc., as well as data from Journal, Library source and Internet materials and electronic books, textbooks, etc.
- Quantitative method: This method aims to classify features, count them, and create statistical models to test hypotheses and explain observation.

3.4.2 Justification of Research Methodology

This research work adopts a combination qualitative and quantitative research methodology. Following a thorough literature review, the system development life Cycle model adopted is Prototype model. The reason behind the adoption of prototype model are that it enables exploration of the problem space with the users, it is used when requirements are not clear, it enables the understanding of customer requirements at an early stage of development. It helps get valuable feedback from the customer and helps

software designers and developers understand about what exactly is expected from the product under development.

3.4.3 Prototype Software Development Model

Prototyping is the process of quickly putting together a working model (a prototype) in order to test various aspects of a design, illustrate ideas or features and gather early user feedback. It is referred to as "A type of development in which emphasis is placed on developing prototypes early in the development process to permit early feedback and analysis in support of the development process." A prototype is a model or a program which is not based on strict planning, but is an early approximation of the final product or software system. A prototype acts as a sample to test the process. From the developed sample, it can be used for learning and building of a better final product. The Software Prototyping refers to building software application prototypes which displays the functionality of the product under development, but may not actually hold the exact logic of the original software.
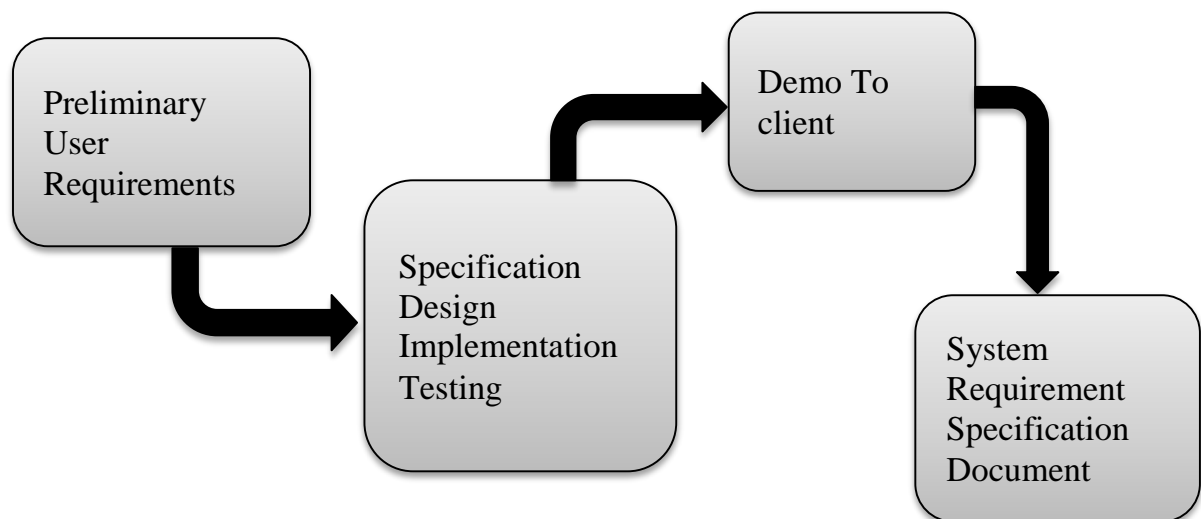
Prototype model has the following phases:

Fig. 3.3   Flow Diagram for Prototype Model

3.4.3.1   Advantages of Prototype Model

The advantages of the Prototype model are:

(i.) It increases user involvement in the product even before its implementation.

(ii.) Since a working model of the system is displayed, the users get a better understanding of the system being developed.

(iii.) It reduces time and cost as the defects can be detected much earlier.

(iv.) Quicker user feedback is available leading to better solutions.

(v.) Missing functionality can be identified easily.

(vi.) Confusing or difficult functions can be identified.

3.4.3.2   Disadvantages of Prototype Model

The disadvantages of the Prototype model are:

(i.) Risk of insufficient requirement analysis owing to too much dependency on the prototype.

(ii.) Users may get confused in the prototypes and actual systems

(iii.) Practically, this methodology may increase the complexity of the system as scope of the system may expand beyond original plans

(iv.) Developers may try to reuse the existing prototypes to build the actual system, even when it is not technically feasible.

(v.) The effort invested in building prototypes may be too much if it is not monitored properly.

3.4.3.3   Software Development Process Using Prototype Model

Prototype model is used when the desired system needs to have a high rate of interaction with the end users; it is best suited for online systems, as web interfaces have a very high amount of interaction with end users. It ensures that constant feedback from the user is provided. This is incorporated in the

prototype to result in a useable system. It is excellent for designing good human computer interface systems. The steps are;

- Basic Requirement Identification: This step involves understanding the very basics requirements for developing audio-based interface for visually impaired commuter on booking for vehicle seat.

- Developing the Initial Prototype: The initial Prototype of web-based system using speech-based interface for visually impaired commuter on booking for vehicle seat is developed in this stage, where the very basic requirements are showcased and user interfaces are provided. While, the workarounds are used to give the same look and feel to the customer in the prototype developed. The development is done with web technologies such as HTML, CSS, JavaScript, MySQL, etc.

- Review of the Prototype: The prototype software developed it will be presented to the AKTC and their commuters. The feedback will be collected in an organized manner and used for further enhancements in the product under development.

- Revise and Enhance the Prototype: The feedback and the review comments will be discussed during this stage and necessary changes made to prototype developed in order to have the actual implementation. The cycle repeats until the customer expectations are met.

3.5   PROPOSED SYSTEM ARCHITECTURE

The proposed system web-based booking system has a 3-tier architectural design, which consists of Presentation tier, Business Logic tier and Data tier
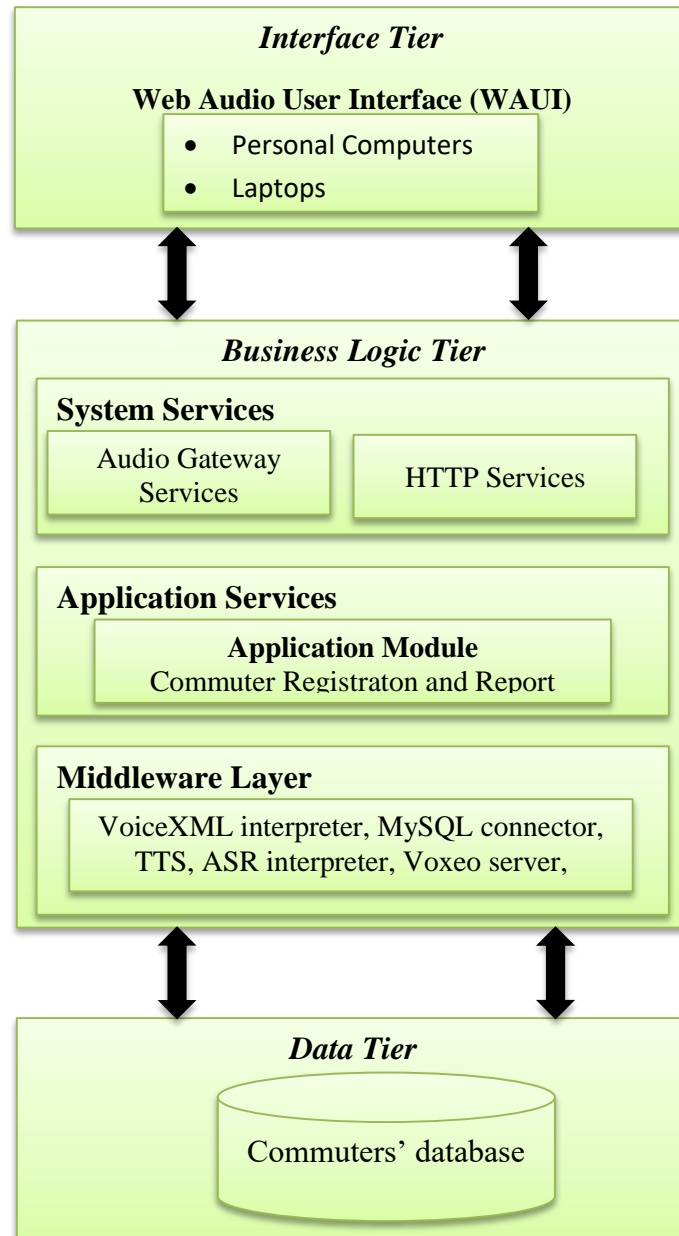

Fig. 3.4 System Architecture for Web-based Booking System

3.5.1 Description of Components of the Web-based Booking System

(i.)   **Presentation Tier***:* The presentation tier provides users interface for voice and web, and also gives users access to the system. The WAUI is made up of PCs and laptop. Commuters can have personal and booking information captured and registered.

(ii.)   **Business Logic Tier***:* The business logic tier separates the presentation tier and the data tier. It comprises of the system services, application services and the middleware layer. The system service components are the audio gateway and Hypertext Transmission Protocol (HTTP) services. The application services are made up of the application modules such as commuters and report. A user gets access to the application through the WAUI using a personal computer or laptop. The Text-To-Speech (TTS) and Automatic Speech Recognition (ASR) interpreter, which are the middleware tools, are used for the voice translation. The VoiceXML interpreter communicates through the HTTP services to the Voxeo server. The middleware layer comprise of the tools engaged in the system development such as expert system, voice technologies, server side processing and database.

(iii.)   **Data Tier***:* The data tier provides Database Management System (DBMS) functionalities. The data tier contains information about the registered commuters and their booking manifestos. MySQL was used to implement the database.

CHAPTER FOUR

SYSTEM DESIGN AND IMPLEMENTATION

4.0   INTRODUCTION

Systems design is the process of defining elements of a system like modules, architecture, components and their interfaces and data for a system based on the specified requirements. It is the process of defining, developing and designing systems which satisfies the specific needs and requirements of a business or organization. Systems implementation is the process of defining how the information system should be built, which has to do with the physical system design, while ensuring that the information system is operational and meet quality standard (i.e., quality assurance). Furthermore, System Implementation involves installation of all the essential components, the guidelines and principles to be followed in order to achieve the desired goal and objectives of the proposed system successfully and on schedule. This chapter encompasses the system design, design architecture, system requirements, justification of the programming language, system implementation, system testing, method of system conversion, evaluation of results and discussion of results

4.1   SYSTEM DESIGN

System design is the description of how the proposed system would work or function. It could also be seen as the application of system theory to product development and the system configuration that meets an identified or required set of requirements
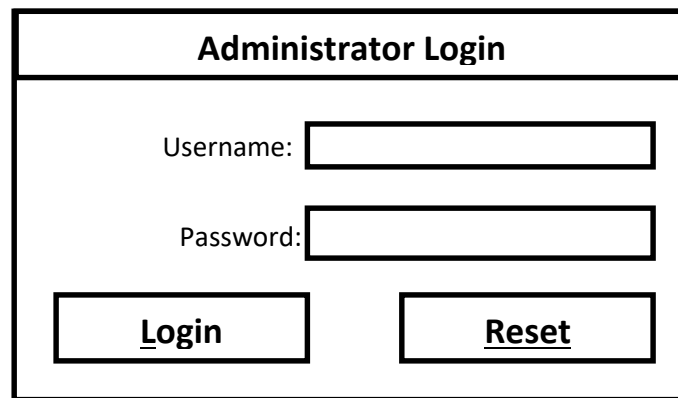
4.1.1 Input Design

The designs of the screen are commonly or essentially made for data entry. In developing a user-friendly interface for capturing commuters' voice data, process it and converting the speech to text for getting quality data into the information system in an accurate format, a secured input data entry form are being designed. The interface that provides space for the capture of information is the input form that links data entry to the database for storage.

There are two input forms that would be used in the input design of the system, these are Commuter Registration form and Login form for Administrators.

Registration form
First name:
Last name:
Gender:
Phone:
Destination:
Travel Period:
Date:

Fig. 4.1   Commuter Registration Form

Fig. 4.2 Administration Login Form

4.2.2 Database Design

Database can simply be defined as a structured collection of records. In a database, we have tables consist of columns (attributes) and rows(records). Databases allow for easy retrieval and manipulation of data. A database management system can basically be seen as tool which provides users with a systematic way of handling, storing, retrieval and updating of data in a system .The database management used in this research work is MySQL databases.

The required entity (table) of the database is structured as follows:

Table. 4.1 Registration table

Field	Data type	Field size
SN	Auto Inc	10
Firstname	Text	15
Lastname	Integer	15
Gender	Text	6
Phone	Text	11

Destination	Text	30
Travel_Period	Text	11
Date	Date	

4.2.3 Output Design

The output design helps deliver meaningful timely and purposeful information in a specified format. Information stored in the database which could be retrieved at any time for viewing and printing. The output design illustrated as shown below:

Table. 4.2 Table of Visually Impaired Commuters' Report

Sn	Firstname	Lastname	Gender	Phone	Destination	Travel Period	Date

4.3 DESIGN ARCHITECTURE

Design architecture entails the various software components and their interfaces to establish the framework for the development of a whole system. It details system block diagram, Activity diagram, Sequence diagram and Use case diagram.

4.3.1 System Block Diagram

System block diagrams can be expressed as a high-level, specialized flowchart used to design describe new or existing system showing major system components and important working relationships. These relationships are represented by lines which connect principal parts which are represented as blocks.
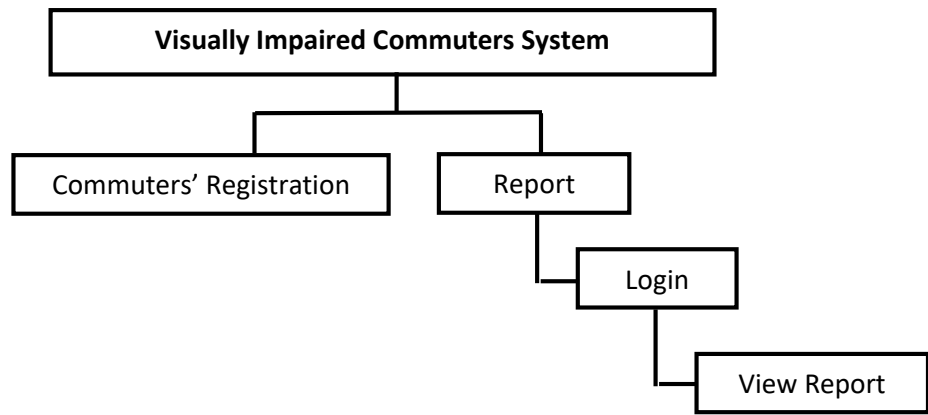
Fig. 4.3   System Block Diagram for the Web-Based Booking System

4.3.2 Activity Diagram

An activity diagram can be said to be one of the diagrams of unified modelling language which describes the dynamic aspects of the system. It is essentially an advanced version of flow charts that model the flow of operations from one activity to another.
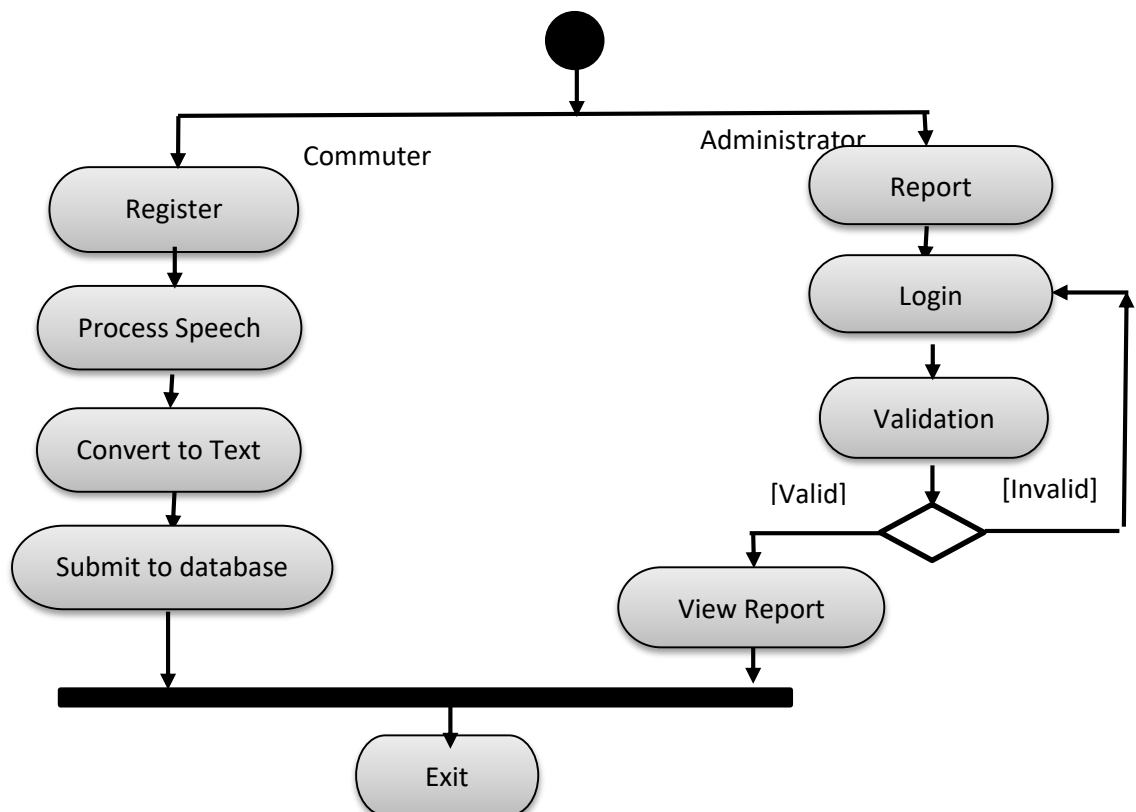

Fig. 4.4 Activity Diagram for the Web-Based Booking System

4.3.3 Sequence Diagram

Sequence diagrams describe how objects, or groups of objects, interact within a system. Interacting objects can, for example, be classes, program components or real world instances. Sequence diagram is an "interaction diagram" that models a single scenario executing in a system.
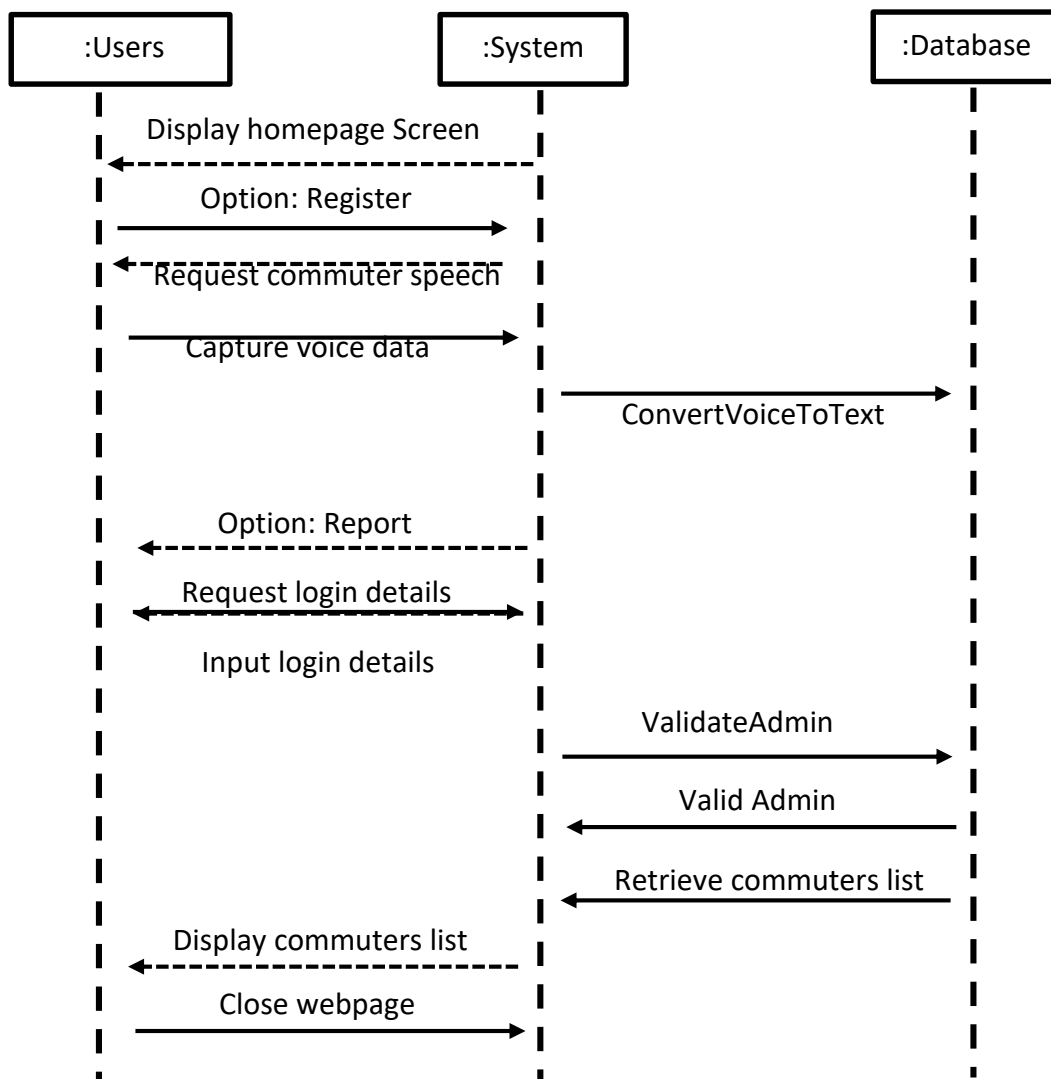

Fig 4.5 Sequence Diagram for the Web-Based Booking System

4.3.4 Use Case Diagram

This can be defined as a methodology used in system analysis to identify, clarify and organize system requirements. A use case diagram is a graphic depiction of the interactions among the elements of a system.

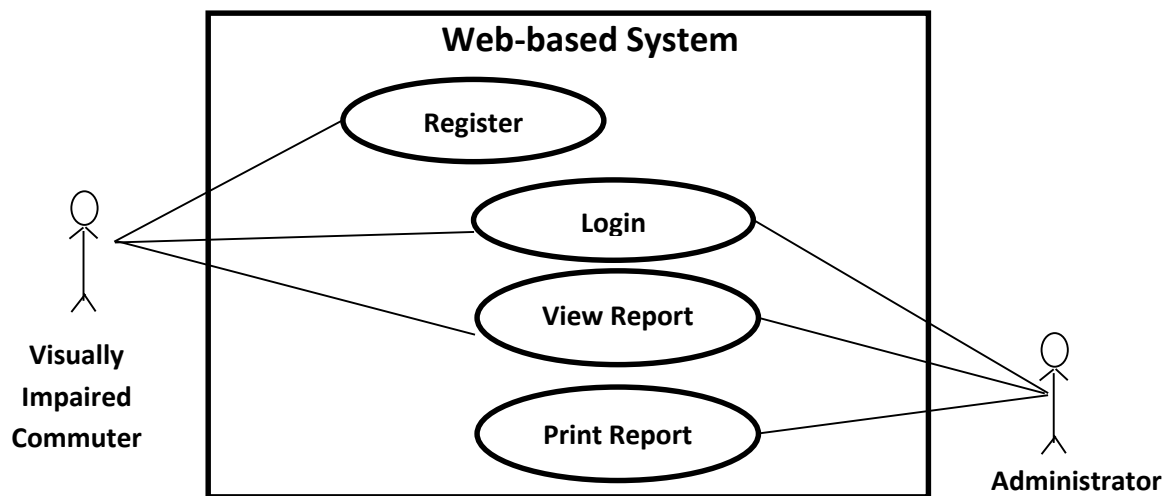The purpose of the use case is to demonstrate the different ways that a user might interact with a system.

Fig. 4.6   Use Case Diagram for the Web-Based Booking System

4.4   SYSTEM REQUIREMENTS

A System requirements specification is a document use to describe the features and behaviour of a system. It consists of hardware requirements and software requirements.

4.4.1 Hardware Requirements

For the effective operation of the newly designed system, the following minimum hardware specifications are recommended.

- A computer system.
- The Random Access Memory (RAM) of at least 128mb.
- A hard disk of at least 10GB.

- An E.G.A(Enhanced Graphic Adapter)/V.G.A(Video Graphic Array) colored monitor.
- An uninterruptible power supply (UPS) units of specifications of 60Hz frequency and power rating of 1000VA.
- It should be internet ready with speed of at least 4-6mbps.
- Speakers should be attached to the system.
- Internal/Microphone.

These listed configurations are the minimum requirements, but if the configurations are higher the reports derived will definitely be better and the program will run much faster.

4.4.2 Software Requirements

The software requirements for the proposed system are:-
- Brackets Text Editor
- Chrome browser with v30 and above
- MySQL database
- XAMPP server

4.5 JUSTIFICATION OF PROGRAMMING LANGUAGE

- The programming language chosen for the development of the system are: HTML: - Hyper Text Markup Language is the basic language for developing web based applications.it basically describes the structure of web pages using markup.

- CSS: - Cascading Style Sheet was used for the controlling the appearance of the web-based application. It is used in describing the presentation of a document written in a markup language.

- JavaScript: - was used with Web Speech Application Programming Interface (API) to capture process and convert speech to text. this is one the core technologies of the World Wide Web which enables interactive web pages which is an essential part of web applications.

- PHP: Hypertext Preprocessor was used for saving data to database. It is a widely used open source general-purpose scripting language that is especially suited for web development and can be embedded into html.

4.5   System Implementation

System implementation can be said to be the process of determining how the proposed system should be built and ensuring that the proposed system meets quality standards. This deals with the project Sample implementation and the input as well as output snapshots are:

4.5.1 System Implementation Input Snapshot

Commuter Registration form: This web-based module captures voice (speech) data from visually impaired commuters, process the speech and convert to text as well as submitting the text to the database.

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Administrator Login form: This web-based module enables the administrators to enter valid username and password in order to have access to the registered commuters' information.

4.5.2 System Implementation Output Snapshot

Commuters Report: This is a web-based application module that enables visually impaired commuters travelling information list to be retrieved from the database, viewed or printed.

4.6 SYSTEM TESTING

System testing is a process of executing a program or application with the intent of finding the software bugs. It can also be stated as the process of validating and verifying that a software program or application or product, meets the business and technical requirements that guided its design and development. The system has been tested and the technical requirements have been met.

4.7   METHOD OF SYSTEM CONVERSION

System conversion is the process of replacing the old system with the new system. There are four different ways of replacing the old system with the new system. The reasons for choosing a particular changeover type over another depend upon; how quickly must the changeover happen? How important is it to prevent data loss? What will the cost of the changeover be?

The follow are various implementation processes:

- **Direct Changeover**: In this system, the old system is no longer available and everything must run on the new system. Problems with the new system can cause major problems for the business. Direct Changeover is only suitable for non-critical systems.

- **Phased Implementation**: Takes longer to complete the implementation but the risks to the business are less than for Direct Changeover. The new system can be split into separate working parts e.g. sales, marketing, payroll etc. Part of the old system is replaced with the new one until the replaced part is working properly. Continue the process until the entire old system has been replaced by the new system.

- **Parallel Running**: is highly fault tolerant. The new system and the old system are used with extra staffs recruited to run the new system but it is very expensive. Both systems continue to run until the new system is working properly then the old one is discarded.

- **Pilot Running**: If the business has many different offices or sites then this is an option. One single site is chosen and the old system is replaced with the new system in the same way as Direct Changeover

but only on one site. The rest of the business continues to use the old system. Once the new system is shown to work well in that one 'pilot' site then the new system can replace the old one in the rest of the company.

The system conversion method chosen for this work is the Parallel Running. This is to users can be acquainted with the new system.

4.8   EVALUATION OF RESULTS

The evaluation of software system after its development cannot be overemphasized because it plays a major role in the software development life cycle. Like every other developed software, evaluation of the web-based system for visually impaired commuters was called implemented and the result showed that the system was capable of handling activities of visually impaired commuters' seat booking, enhancing information sharing and effective booking management at anywhere and anytime through text-to-speech and speech-to-text applications and allowed the visually impaired commuters to be able to easily interpret and comprehend the information that were presented to them through assistive technology. The management was able to generate and print travel information as well as downloading registered commuter's information to any storage device.

4.9   DISCUSSION OF RESULTS

Talking about the result of the system, it helped enhance Akwa Ibom State Transportation Company's information system necessary for the registration of visually impaired commuters and booking of seats. It also proffers solutions to adequate and timely registration of commuters' travelling information.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0   INTRODUCTION

This chapter is focused on illustrating an aphoristic of the project. It scrutinizes the problem skirmish during the design and implementation phase of the project. Based on the objectives and aims, it assesses the system functionality which has led to some inference and repose in major areas of the system.

5.1   SUMMARY

Due to the need to provide ever more efficient, better, accessible and usable booking websites to enhance the rate and ease at which visually impaired commuters travel from place to place, has caused this project work to be ever more relevant.

This project work has been able register visually impaired computers, enable the visually impaired commuters' book their travelling schedule and save their travelling manifestos for cross-referencing. It also provides a simple interactive interface which makes use of assistive technologies to enable text-to-speech and speech-to-text between users and the system. This work when deployed will drastically reduce queues at local booking centers. Visually impaired commuters do not need to be physically present at these centers to book for their journeys because they can do this on their own by their self anywhere and anytime.

A database is integrated into the system to store commuter's personal information and travelling manifesto. When working with databases, security

and integrity of vital and sensitive data in the system was a major concern. To enhance the security of the new application, a PHP encrypted script which would help block hackers or unauthorized users has been integrated at the coding phase of the project work.

5.2   REVIEW OF ACHIEVEMENTS

So far this research work has been successfully developed and implemented to enhance the usability and accessibility factors of a web based booking system for visually impaired commuters. The project work was successfully developed using HTML, CSS, JavaScript, MySQL and PHP. The benefits of this work cannot be overemphasized, it has led to the ease in usability of booking platforms for visually impaired commuters, reduced cost, increased customer/user base and convenience for the target users thereby reducing the stress of physically being present at a booking center.

5.3   CONCLUSION

Commuting has been seen to be daily need as hundreds even thousands of people tend to commute every day and we see that at least 20% of these people are visually impaired. Inability for these individuals to access and use these booking systems has been a great hindrance and has caused enormous concern of the past years. This project work addresses this issue by enhancing booking commuter systems through assistive technology.

5.4   CONTRIBUTIONS / AREA OF APPLICATION

This research work provides a more efficient, operable and accessible booking system for visually impaired by combining various assistive technologies such a speech-to-text, text-to-speech and voice command advancements. The system can be made applicable or integrated into various areas such business, marketing, and different travelling genres.

It pitches in the need to enhance and refine the processes of human life by improving little aspects which helps make the disable feel able.

5.5   RECOMMENDATIONS

The developed web based booking system is recommended for booking of visually impaired commuters. To help enhance usability and accessibility for visually impaired commuters to book travelling manifestos between place at anytime and anywhere, the system browsers would have to be updated every 6months so as to maintain efficient usability. The drivers that enhance the voice recognition and output synthesis would be needed to be updated regularly so maintain effective usage.

5.6   SUGGESTIONS FOR FUTURE WORK

The future work should be more focused on trying to transcend from a web based platform to a mobile based platform which does not increase the overall cost implication and hardware requirements whereby making it easier to use and increases security of data when requiring access to the system.

REFERENCES

Alter, S. (2013). Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future Work. *Journal of the Association for Information Systems* 14, 2, 72–121.

American Foundation for the Blind. (AFB) (2010). Facts and Figures on Americans with Vision Loss. (Online). Available at: http://www.afb.org/Section.asp?SectionID=15&DocumentID=4398

Andronico, P., Buzzi, M., Castillo, C., & Leporini, B. (2006). Improving search engine interfaces for blind users: A case study. Universal Access in the Information Society, 5(1), 23–40.

Beal, V. (2018). Definition of Internet. (Online). Available at: https://www.webopedia.com/TERM/I/Internet.html

Bigham, J.P., Prince, C.M., and Ladner, R.E., (2008). *WebAnywhere: a screen reader on-the-go*, in *Proceedings of the 2008 International Cross-Disciplinary Conference on Web Accessibility (W4A)*. ACM: Beijing, China.

Bokhari, M. U., & Shallal, Q. M. (2016). A Review on Symmetric Key Encryption Techniques in Cryptography. *International Journal of Computer Applications*, *147*(10).

Borodin, Y., Bigham, J.P., Stent, A., and Ramakrishnan, I.V. (2008). *Towards one world web with HearSay3*, in *Proceedings of the 2008 International Cross-Disciplinary Conference on Web Accessibility (W4A)*. ACM: Beijing, China.

Borodin,Y., Bigham, J.P., Dausch, G., & Ramakrishnan, I.V. (2010). More than meets the eye: A survey of screen-reader browsing strategies. In Proceedings of the International Cross Disciplinary Conference on Web Accessibility (pp. 1–10). NewYork: ACM Press.

Brophy, P., & Craven, J. (2007). Web Accessibility. *Library Trends, 55*(4),950-972. Retrieved from: https://www.ideals.illinois.edu/ bitstream/ handle/ 2142/3752/ BrophyCraven554.pdf?sequence=2.

Bulchand-Gidumal, J. and Melián-González, S. (2011). Maximizing the Positive Influence of IT for Improving Organizational Performance. *The Journal of Strategic Information Systems*. 20, 4 (2011), 461–478.

Casarosa, E. (2014). Internet 101: What is the Internet? GCF- LearnFree.org (PDF). Available at: http://www.just.edu.jo/~mqais/cis99/PDF/Internet.pdf *(internet).*

Cecez-Kecmanovic, D., Galliers, R.D., Henfridsson, O., Newell, S., and Vidgen, R. (2014). The Sociomateriality of Information Systems: Current Status, Future Directions. MIS Quarterly 38, 3, 809–830.

Chow, K.M. (2017). E-service Quality: A study of Online Hotel Booking Websites in Hong Kong,pp.10-24.

Essays, UK. (2013). Web Based Information Systems. Retrieved from https://www.ukessays.com/essays/information-systems/web-based-information-systems.php?vref=1

Fellbaum, K. and Freitas, D. (2007). Speech Processing, in: *Towards an Inclusive Future*, P. Roe, ed., COST, Brussels, pp. 24–42.

Fellbaum, K. and Kouroupetroglou, G., (2008). Principles of Electronic Speech Processing with Applications for People with Disabilities, Assistive Technologies, *Technology and Disability* 20 (2008), 55–85.

Freitasa, D. and Kouroupetroglou, G. (2008). Speech technologies for blind and low vision persons. Technology and Disability 20 (2008) 135–156, IOS Press. (PDF) Available at: https://www.researchgate.net/publication/228800390_Speech_Technologies_for_Blind_and_Low_Vision_Persons

Hailpern, J., Reid, L. G. and Boardman, R. (2010). DTorial: An interactive tutorial framework for blind users in a Web 2.0 world. (PDF). Available at:https://static.googleusercontent.com/media/research.google.com/en//pubs/archive/35176.pdf

Hanson, V.L., Richard, J.T., and Swart, C., (2008). *Browser augmentation*, in *Web accessibility: a foundation for research*, S. Harper and Y. Yesilada, Editors. 2008, Springer Publishing Company, Incorporated. p. 215-230.

Kaushalya (2012). Introduction to Internet. (PDF). Retrieved from: *download.nos.org/coa631/ch3.pdf*

Kellar, M.,Watters, C., & Shepherd, M. (2006). A goal-based classification of web information tasks. In Proceedings of the Annual Meeting of the American Society for Information Science and Technology (pp. 1–22). Medford, NJ: Information Today.

Lele,Y., Kariya C., Kale N., Nandgaonkar, A., and Phatak, M. (2013). Human Computer Interaction for Visually Impaired Users in Web Based Applications A proposed solution to make rich internet application completely accessible to no vision/low vision users. International Journal of Scientific & Engineering Research, Volume 4, Issue 8, 1213, ISSN 2229-5518.

Leporini, B. and Paternò, F. (2008). Applying web usability criteria for vision-impaired users: does it really improve task performance? (PDF). 56124 - Pisa, Italy.

MAGic. (2009). *Magnification software from Freedom Scientific*. (Online) Available at: http://www.freedomscientific.com/products/lv/magicbl-product-page.asp.

Markgraf, B. (2018). Characteristics of a Good Management Information System. (Online) Retrieved from: http://smallbusiness.chron.com/characteristics-good-management-information-system-59060.html

Mindmeister (2018). Types of information system. (Online) Retrieved from: https://www.mindmeister.com/37310006/5-types-of-information-systems.

Miyashita, H., Sato, D., Takagi, H. and Asakawa, C. (20007). Making multimedia content accessible for screen reader users. In Proceedings of the W4A 2007. (Banff, Canada, 2007). ACM.

Miyashita, H., Sato, D., Takagi, H., and Asakawa, C., (2007). *Aibrowser for ultimedia: introducing multimedia content accessibility for visually impaired users*, in *Proceedings of the 9th International ACM SIGACCESS, Conference on Computers and Accessibility*. ACM: Tempe, Arizona, USA.

Pascolini, D., Mariotti, S.P. (2010). Global Estimates of Visual Impairment.

Pascolini, D., Mariotti, S.P. (2012). "British Journal of Ophthalmology".

Paul, (2010). Applications of Modern Cryptography: Technologies, applications and choices. (PDF).

Rajapakse, R., Dias, M., Weerasekara, K., Dharmaratne, A. and Wimalaratne, P. (2012). Audio User Interface for Visually Impaired Computer Users: in a Two Dimensional Audio Environment. World Academy of Science, Engineering and Technology *International Journal of Computer and Information Engineering,* Vol: 6, No:5. Available at: https://waset.org/publications/12136/audio-user-interface-for-visually-impaired-computer-users-in-a-two-dimensional-audio-environment

Sahib, N. G., Tombros, A., and Stockman, T. (2012). A Comparative Analysis of the Information-Seeking Behavior of Visually Impaired and Sighted Searchers *Journal of the American Society for Information Science and Technology,* 63(2):377–391.

Sandi, A. (2015). University of Wiscon Knowledge Base: Web Accessibility -Common Problems people with Websites.

Sarmad, (2011). Information Systems: Definitions and Components. Management Information Systems (MIS). (PDF).

SuperNova (2009). *Screen reader from Dolphin*. (Online). Available at: http://www.dolphincomputeraccess.com.

Thiessen, P. and Chen, C., (*2007*). *Ajax live regions: ReefChat using the Fire Vox screen reader as a case example*, in *Proceedings of the International Cross-Disciplinary Conference on Web Accessibility (W4A)*. ACM: Banff, Canada.

Web Consortium - Web Accessibility Initiative. (2012). *Introduction to Web Accessibility*. (Online). Available at: http://www.w3.org/.

Web Consortium (2007). Voice Charter. (Online) Available at: http://www.w3.org/2006/12/voice-charter.html.

Web Consortium (2014).Voice Browser Activity. (Online) Available at: http://www.w3.org/Voice/.

APPENDIX A

```html
<!doctype html>
<html lang="en">
  <head>

    <title>Visually Impaired Commuters-AKTC Uyo </title>

    <meta name="viewport" content="width=device-width, initial
    scale=1.0">
    <meta charset="utf-8"/>
    <meta http-equiv="X-UA-Compatible" content="IE=edge,chrome=1">
    <link rel="stylesheet" href="css/animate.css">
      <link href="css/bootstrap.css" rel="stylesheet">

   <script src="http://code.jquery.com/jquery-1.9.1.js"></script>
  </head>
    <body onload="welcome();">
    <div class="jumbotron" style="margin-top:-40px">
        <img src="img/img01.JPG" width="200" height="50" class="" />
      <br><br>

    </div>
    <div class="navbar navbar-default navbar-static-top" style="margin-
    top:-50px">
      <div class="container">
        <a href="index.php" class="navbar-brand">Uyo Branch</a>
```

```html
            <button class="navbar-toggle" data-toggle="collapse" data-
    target=".navHeaderCollapse">
            <span class="icon-bar"></span>
            <span class="icon-bar"></span>
            <span class="icon-bar"></span>
        </button>

        <div class="collapse navbar-collapse navHeaderCollapse">
            <ul class="nav navbar-nav navbar-right">

              <li class="active"><a href="index.php">Register</a></li>
                <li><a href="adminmain.php">Report</a></li>

            </ul>
          </div>
        </div>

    </div>

<div class="container">

<style>
  .speech {border: 1px solid #DDD; width: 400px;  padding: 0; margin: 0}
  .speech input {border: 0; width: 340px; display: inline-block; height: 30px;}
  </style>

    <div class="row">
```

```
<div class="panel panel-default" >

    <div class="panel-body" ><!--this panel gives me the boarder i have in my
        left div-->



    <center>


            <? php echo $display;                    ?>
                <!-- Search Form -->
                <form id="sendData" method="POST"
    action="index_submit.php">
                    <div class="speech">
                        <input type="text" name="fname" id="fname"
    readonly="true" size="30" placeholder="First name" />
                        <br/>
                                        <br/>
                        <input type="text" name="lname" id="lname"
    readonly="true" size="30" placeholder="Last name" />
                        <br/>
                                        <br/>
                        <input type="text" name="sex" id="gender" size="30"
    readonly="true" placeholder="Gender" />
                        <br/>
                                        <br/>
                        <input type="text" name="phone" id="phone" size="30"
    readonly="true" placeholder="Phone" />
```

```
                    <br/><br/>


<input type="text" name="dest" id="dest" size="30" readonly="true"
    placeholder="Destination" />
 <br/><br/>
<input type="text" name="tperiod" id="tperiod" readonly="true" size="30"
    placeholder="Travel Period" />
<br/><br/>
<input type="date" name="tdate" id="tdate" readonly="true" size="30"  />
<br/>
<br/>
<br/>
<audio id="sound" src="sound/chime.mp3" type="audio/mp3"></audio>
</div>
</form>
 </center>
</div>


</div>
  </div><br>
</div>
     <div class="panel panel-default">
      <div class="panel-body">
        <p class="">Developed by:<b> Bassey-Thomas, Edima Udo</b>
   ||    Matriculation Number:
<b>AK14/NAS/CSC/003</b><br/>
        Research Topic:<b> Web-based System for Visually Impaired
Commuters</b></p>
      </div>
```

```html
    <div class="panel-footer">
        <p>©2018 Bassey-Thomas, Edima Udo  - All rights reserved. </p>
    </div>
    </div>
  <script src="script/voicerec.js"></script>
  </body>
</html>
```

Submit Query Domain

```php
<?php
    $display = '';
    $con = mysql_connect("localhost","root","");
    if (!$con)
      {
      die('Could not connect: ' . mysql_error());
        $display = "Could not connect";
      }
        mysql_select_db("dbcommuter",$con);
            $fname = $_POST['fname'];
            $lname = $_POST['lname'];
            $gender = $_POST['sex'];
        $phone = $_POST['phone'];
            $destination = $_POST['dest'];
            $period = $_POST['tperiod'];
        $dates = $_POST['tdate'];


            $query = "insert into tblregister (Firstname, Lastname, Gender,
    Phone, Destination, Period, Date)
```

66

```php
values('$fname','$lname','$gender','$phone','$destination','$period','$dates')";

    $result = mysql_query($query);
    if($result > 0)
    {
    $display = "Commuter's data successfully registered";
        mysql_close($con);
    }
    else
    {
    $display = mysql_error();
    mysql_close($con);
    }

?>
```

APPENDIX B: SCREEN SHOTS