

# **Enhancing Online Access to Sikh Cultural Heritage**

*Thesis submitted in partial fulfillment of the requirements for the award of  
degree of*

**Master of Engineering  
in  
Software Engineering**

*Submitted By*  
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**June 2012**

## CERTIFICATE

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I hereby certify that the work which is being presented in the thesis entitled, "*Enhancing Online Access to Sikh Cultural Heritage*", in partial fulfillment of the requirements for the award of degree of Master of Engineering in *Software Engineering* submitted in Computer Science and Engineering Department of Thapar University, Patiala, is an authentic record of my own work carried out under the supervision of Dr. (Mrs.) Seema Bawa and refers other researcher's work which are duly listed in the reference section.

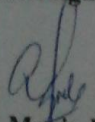
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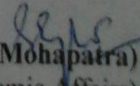
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## Abstract

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Human Computer Interaction (HCI) is currently in Social Computing phase and now is overlapping with Cultural Computing (Kansei – Mediated Interaction). Social networking websites act as tools for social networking. Cultural Computing is an emerging field. Cultural Computing aims the development of tools to help people understand different cultures and promotion of culture, through efficient use of different computing trends.

This thesis focuses on the use of computing technology for enhancing online access to Sikh cultural heritage. Sikhism possess many cultural objects which need urgent attention, otherwise they will be lost for forever. The combination of Social Networking and Cultural Computing will help in achieving the main goal of this thesis. This thesis presents data and information collected from literature survey of the various trends of Social Networking. It is observed that these days' youth remains deprived of the knowledge of their cultures, due to various changes in their lifestyles. Based on the literature survey, it has been observed that the youth spends maximum of their time using Social Networking websites, without any fixed agenda in their minds. To make our young generation understand different cultures, the need of the hour is to make them understand their culture, through the websites/portals where they visit. These findings are published in the form of cultural portal synchronized with social networking website, Facebook.

In this thesis, effort is made to develop a cultural portal. This portal preserves the old Sikh Scriptures (both handwritten and printed) using CAPTCHAs. The words in these Scriptures appear one by one to every user in sequence during the login process. After each CAPTCHA is generated, it gets stored and digitized in a folder. Another important feature of the cultural portal is semantic search of data – Page Rank wise search and searching metadata, for intelligent access to information related to Sikh cultural heritage. This search facility makes the system intelligent enough to understand the information required by the user. Links of pages relevant to the search are made available to the user (Page Rank wise); that is, the most relevant result at first position, next relevant result at the second position and so on. Searching metadata helps the user to know about the information available on website and contribute new cultural information. Also, depending upon the age and type of user using the cultural portal, games (Sikhism special) are made accessible to the user type – kids, beginners and learners. Three games – Kaun Banega Crorepati, Pehchan Kaun and Tic – Tac – Toe; are provided on the portal. These games will help in easy learning about Sikhism. Kaun Banega Crorepati asks the user questions related to Sikhism. Pehchan Kaun game challenges the users to identify different pictures related to Sikhism. Picture identification puts a mark on user's mind and the user learns and understands cultural information in play – way style. It is concluded that, in order to make cultures easily accessible and learnable to the users, need of the hour is to incorporate technology in the cultural objects.

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Social networking websites have become part of youth's life these days. These are capable of providing social environment and have become very popular among many communities in the world. Users can share contents like photos, educational links, multimedia and much more using these social networking websites. These websites act as tools for social networking. Tools for social computing were built around WEB 2.0 model. Some of these websites are Facebook, Orkut, Twitter, Linked In, etc. Users get free registration, can create new applications, and can build their social networks and groups. Social Computing paradigms head the path of Cultural Computing milestone.

### 1.1 Human Computer Interaction (HCI)

History of HCI is very rich, but complex. There is a long list of methods by which the human has been interacting with computers till date. The journey still continues; as lots of new technologies and systems appear every day. Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive systems for human use and with the study of relevant phenomena surrounding them [1]. Some of the major paradigms are Personal Computing, Cooperative Computing, Social Computing and Cultural Computing, as shown in Figure 1. The research in this area has been growing very fast in the last few decades.

The journey of HCI started from Man-Machine interaction with the emergence of Personal Computing Paradigm. In the 80s, HCI investigated media rich computing with the paradigm of networked computer mediated interaction. At the turn of the century, HCI was about the social computing paradigm with community mediated interaction. Several concepts have emerged in recent years for the future directions of HCI like ubiquitous computing, nomadic computing, and mixed-reality computing, and so on. These new directions have some common properties:

Disappearing computers, ease of use and positive experience, building of communities etc.

The running applications, the benefits and effects these have on the user are accountable. More recently, the new paradigm for HCI is Cultural Computing. Currently, HCI is in Social Computing phase, but it is also overlapping with Cultural Computing phase.

From 1960s to current time, the computers have disappeared from the focus of users. It is generally the functionalities or services provided to the user that are accountable to him.

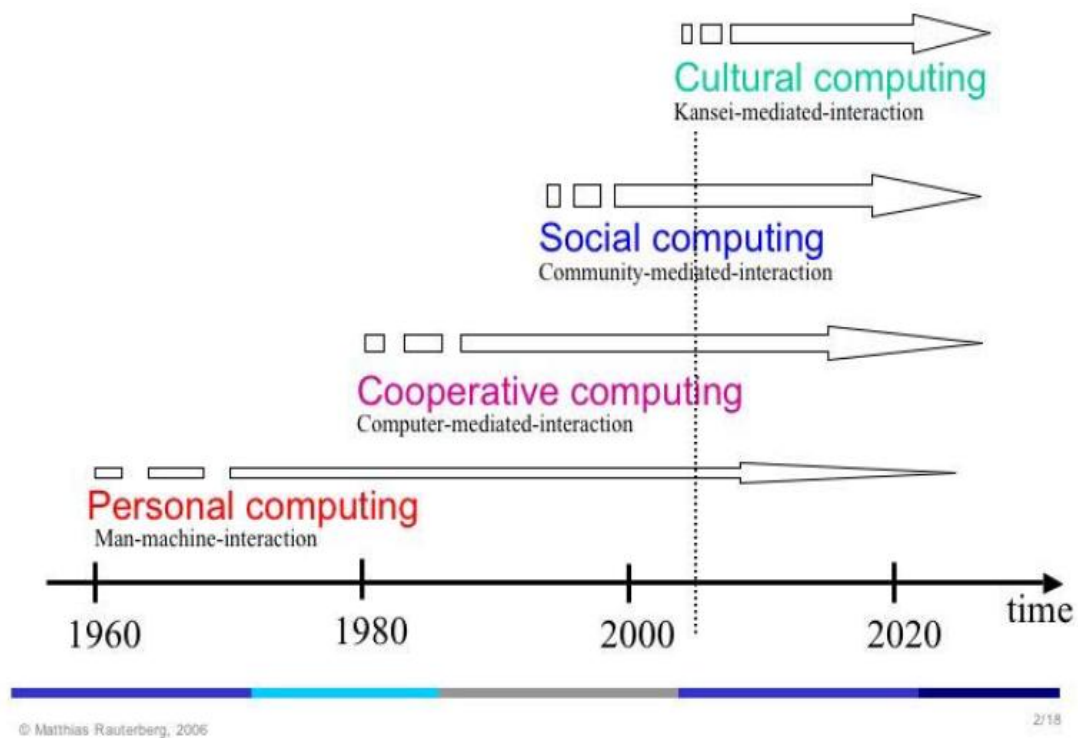


Figure 1.1 – HCI paradigms – From Personal Computing to Cultural Computing [2]

Related Computing Paradigms which have emerged are

- Ubiquitous Computing – It is also known as ambient intelligence and pervasive computing. It is the third wave of computing. As, in the first wave, it was mainframe era (many people, one computer). Then, in the second wave of computing, it was PC era (one person and one computer). Then, the third

wave, Ubicomp (one person, many computers). Example - embedded or wearable devices, videoconference connections.

- Nomadic Computing (Mobile Computing) – Nomadicity means the independence of location, motion, computing platform, communication device and communication bandwidth. Example - use of laptops plus mobile communications technologies.
- Mixed Reality Computing – Merging of real and virtual worlds. Example - from e-learning to s- learning.

## **1.2 Definition of Culture**

The word *culture* (from the Latin ‘colo, -ere’, meaning ‘to cultivate’, ‘to inhabit’ or ‘to honour’) has been defined and used in many ways in different contexts. More than 156 different definitions are compiled for culture by Kroeber and Kluckhohn (1952). One of the most popular definitions of culture in the field of anthropology is Culture is the integration of human behaviour that includes attitudes, values, beliefs, communications and religious and social groups. Culture features as a sophisticated and complicated type of content, which deepens the essence of human life and history.

According to Kroeber and Kluckhohn (1994), culture is ‘an abstraction from concrete behaviour but is not itself behaviour’. According to Tylor (1994) culture is, ‘complex whole which includes, knowledge, belief, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society [6].

Over the last 3000 years the peoples of four distinct regions of the world created the religious and philosophical traditions that have continued to the present day - Confucianism and Daoism in China; Hinduism and Buddhism in India; monotheism in middle east; and philosophical rationalism in Greece.

### **1.3 Social Media and Social Networking**

Social media means sharing or transmitting information with wider range of audience. Anyone can create and distribute information, using an internet connection. It does not support manipulating comments, likes for your business or personal benefit. So, it is difficult to measure Return on Investment (ROI) using social media. It acts as a system for spreading information to others, that is, a communication channel. Social networking is the way the 21st century communicates today. A social network is a social structure made up of individuals called nodes, which are connected by one or more specific types of interdependency. It is the engagement of groups of people having common interests and building of relationships through communities.

Conversations among people in a network depend upon the topic of discussion. It is worthy to invest time in this, as with the help of social network one can tell people in his/her network about his/her new business or blog and make it a success. There is a direct communication between user and people; the user chooses to connect with. Conversations are more purposeful and the network grows as the user meets and gets introduced to others.

### **1.4 Cultural Computing**

Cultural Computing is an emerging field. It is a method for translation of culture. It uses scientific methods to represent essential aspects of culture. It includes computation of emotion, story and culture. Cultural computing is more than integrating cultural aspects into the interaction [2]. It is about allowing the user to experience an interaction that is closely related to the innermost aspects of his/her culture. It is important to understand one's cultural aspects and how to interact about them. Cultural computing is emerging as an extension of processing information closely related to basic human behaviours, human emotions, and even human consciousness.

Cultural computing is the implementation of computing and digital media in our way of learning, communication and having information, about a culture. In an article “A Computational Approach to Culture” by Ryohei Nakatsu and Naoko Tosa, some early

research results in cultural computing were introduced, from the authors and their research group at Kyoto University. A system was described that aims to make Zen Buddhism accessible through traditional ink painting. Another system was also described that explores the Haiku Poetry form.

## **1.5 Why Cultural Computing is needed?**

Cultural Computing is important due to certain reasons - The young generation today, remains deprived of the knowledge of their cultures, due to various changes in their lifestyle, like the trend of nuclear families is prevalent these days, parents working, changes in education system, etc. Also, some of the cultural contents are not receiving much attention and they are getting deteriorated day by day. So, the need of the hour is to digitize and preserve cultural objects for our future generations to know about their cultures, to understand these cultures in a simple and easy manner and to preserve them for forever.

An important target of cultural computing is the development of tools to help people understand different cultures. It is very difficult for people to gain an understanding of another culture from some books or lectures only, because of the depth of historical background that gives information about each culture. It should be possible to develop interactive cultural computational models that make cultural differences easier to grasp for people. The purpose of Cultural Computing is to promote culture through effective and efficient use of computing trends. Cultural Computing includes: digitization and preservation of digital cultural objects, intelligent access to cultural information like images, music, manuscripts etc., experience different cultures in an interactive way and applying virtual and augmented reality in presenting cultural objects.

## **1.6 Thesis Outline**

This section discusses the framework of this thesis, which is organized as follows:

### **Chapter 2: Literature Survey**

In this chapter, concepts for future directions and survey results of the various social networking trends have been discussed. Then, in the next section overview of

different projects in cultural computing field have been discussed. Finally, in the last section the literature related to Sikhism available has been reviewed.

### **Chapter 3: Problem Formulation**

This chapter discusses the research gaps, problem formulated; objectives and the methodology used to solve the problem formulated are discussed. Statistical collection of usage pattern data of various Social Networking websites has been gathered. Some of the cultural contents related to Sikhism have not received much attention. To preserve these cultural objects, a cultural portal has been developed and digitization of these objects has been done. Search facility is another important feature of this cultural portal.

### **Chapter 4: Cultural Portal Development**

This chapter presents the implementation details of the cultural portal developed for the purpose of promotion of Indian culture (Sikhism) through cultural computing. This chapter discusses the various features of the cultural portal, like, CAPTCHAs for digitization of scriptures, Semantic Search on the website, Games for Kids and Beginners (Sikhism Special) developed for the purpose.

### **Chapter 5: Increasing Efficiency of Cultural Portal**

This chapter describes the methodology used to reach the goal, that is, solution to problem formulated in chapter 3. The detailed working of important features of the portal, like, CAPTCHAs, Semantic Relatedness is discussed in this chapter.

### **Chapter 6: Conclusions and Future Work**

This chapter presents the conclusions of this thesis and important future research directions in this field based on the findings.

The 21<sup>st</sup> century communicates these days using social networks. Most of the popular websites are social networks for attracting people. There are a number of social networking websites available these days. These social networking websites are mainly Business Networks and Entertainment Networks. The most popular among these are Facebook, Twitter, Linked-In, Orkut, etc.



#### Business Networks



#### Entertainment Networks

Figure 2.1 – Some Social Networking Websites

## 2.1 Social Networking Trends

Some of the important social networking trends:

Life streaming – Posts are sent and published on these sites to gain the attention of users and get some response from them.

Privacy protection – The number of users of a particular social networking site will be more, depending on the privacy protocols offered by it. It creates the atmosphere of trust between the user and the social network, leading to longer relationship.

Social graph – This includes the people with whom you are connected through interests, location, work, etc.

Crowd sourcing – Smart brands recognize the value of customer’s needs as in this we have to compete with the crowd basically.

Open social – This means supporting interoperability. Example, facebook ‘opened their platform’ for the users to create useful and entertaining applications.

Social shopping – Companies advertise their products on these sites. 76% of users do not believe that companies give true information in their advertisements. 68% of users trust other people in their touch.

Portability – Social networks should meet the demands of their customers anywhere i.e. are we enabling all points of distribution of our content across the web?

There are various technological trends of the web:

- i. WEB 2.0

Web 2.0 was the term found during a brainstorming session by O’ Reilly’s Dale Dougherty. It is more than a new user interface for an old application. It is a way of thinking, a new perspective on the entire business of software — from concept through delivery, from marketing through support [2].

Web 2.0 improves the databases (become richer) as more people interact with them, applications become smarter as more people use them, marketing is improved by user experiences, etc. The trend towards networked applications is increasing at faster pace. Web 2.0 initially took hold in consumer-facing applications, infrastructure requirements to build these applications, and scale at which they operate (PCs took over from mainframes).

Principles of WEB 2.0 are –

- The Edge: The users profile is portable and they can share their content over the web easily.
- The Web as Platform: Not only the web page boundaries (800 x 600) but also the desktop widgets, bookmarks, and browser extensions (upgrades of browsers) support the users.
- The Network Effect: Based on user participation statistics and some computing, we find the amplified user value.
- The Long Tail: It lets to efficiently serve the community of millions of members along with community with small number of members.
- The del.icio.us principle emphasizes usefulness to the individual first, and then the usefulness to the community will follow it.

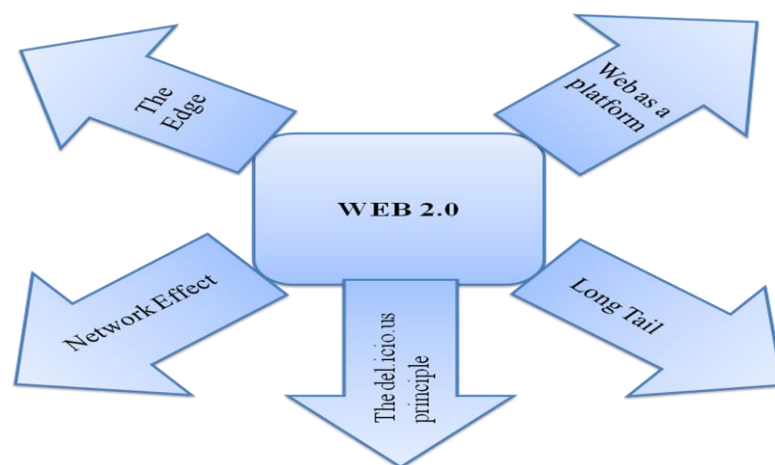


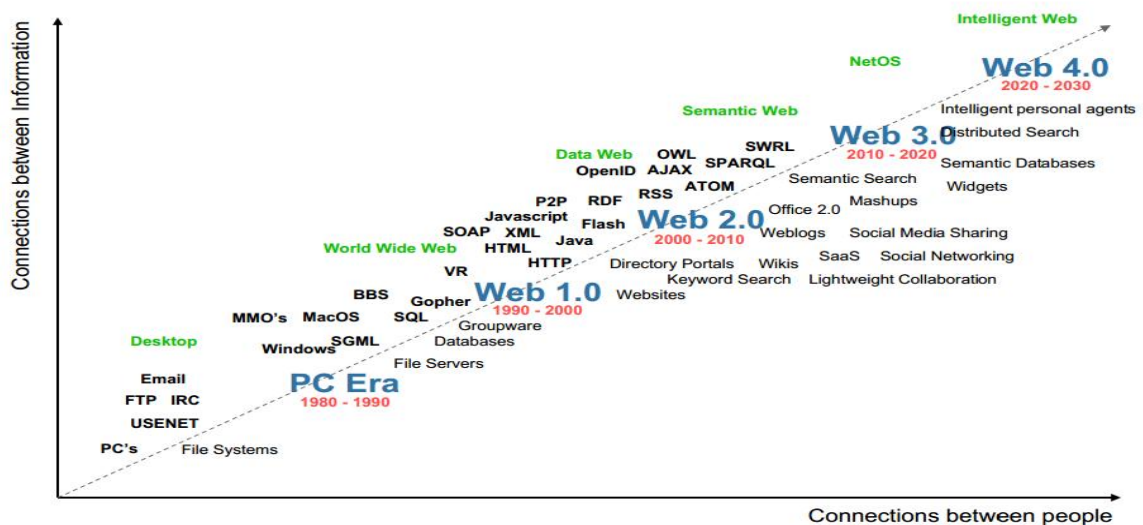
Figure 2.2 – WEB 2.0 Principles

ii. WEB 3.0

WEB 3.0 is the next generation of World Wide Web. It represents both evolutionary and revolutionary trend. Evolutionary trend as it provides the expansion of present WEB 2.0 activities in areas like social networking and mobility. Revolutionary trend as it introduces the increased use of semantic technologies, including the use of intelligent agents, semantic searches and open data.

With the growing usage of semantic searching and mobile web, it can be said that WEB 3.0 has already begun. 3D technologies are likely to play great role with WEB 3.0. The Virtual Reality Modelling Language (VRML) was introduced in the late 90s. So, the concept of 3D environment on internet is not new, but has not been widely utilized.

First Generation Web was PC based. According to Berners - Lee WWW or WEB 1.0 is “read only” WEB. It is a system of interlinked and hypertext documents, that could be accessed using internet. It allowed us to search information and read it. For a website, the website owner’s goal was to make the information available to anyone, at anytime.



Source: Radar Networks & Nova Spivack, 2007 - www.radarnetworks.com

Figure 2.3 – Developing WEB 3.0 (Connections Based) [18]

Table 2.1 – Comparison of WEB 1.0, WEB 2.0 and WEB 3.0

	WEB 1.0	WEB 2.0	WEB 3.0
Type of Web	Information Web	Social Web	Semantic Web
Read/Write/Execute features	Read – Only Web	Read – Write Web	Read – Write – Execute Web
Connection type	Connecting Information	Connecting People	Connecting Knowledge
Number of users	Millions of users	Billions of users	Trillions of users
Communication Type	Static Content – one way publishing of content without any interaction between readers or publishers	Two – Way Communication via social networking, tagging, wikis, blogging, etc.	Artificial Intelligence and web learning, giving a personalized web experience

The current scenario is infancy of WEB 2.0. According to Berners-Lee’s method of describing it, it is “read-write” WEB. It is an improved form of WEB 1.0 or WWW. This introduced the ability to contribute content and interact with other web users, that is, you can download as well as upload. The WEB 2.0 websites are of the types like E-mail, Wiki, Chatting, E – learning, Knowledge Base, Gaming, Blogging, Communities, Multi-media, File Sharing etc. Example of WEB 2.0 websites are – YouTube, Blogs, Orkut, Flickr, Scribd, Wikipedia, and so on.

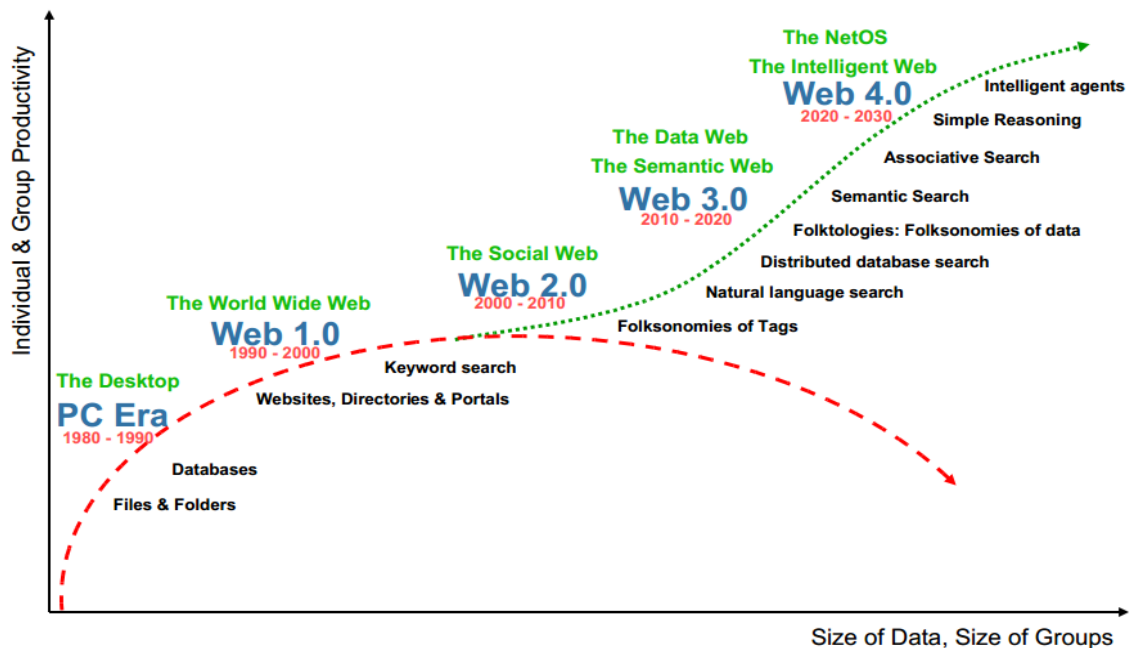


Figure 2.4 – Developing WEB 3.0 (Data Based)

### iii. ENTERPRISE 2.0

Enterprise 2.0 (or E2.0) describes a collection of organizational and Information Technology (IT) constructs that enable more flexible work models, knowledge sharing, and community building [8]. E2.0 represents the evolution and maturity of best practices for collaboration and Knowledge Management (KM). Rethinking about the fundamentals, understanding the success and failures of past, and examining evolving cultural situations can change past assumptions about collaboration and Knowledge Management efforts.

KM is positioned as a secondary focus area in some organizations that supports Customer Relationship Management (CRM), or to improve some functional capabilities, or is being used as a tactic or strategy to improve certain process activities (example, a product knowledge base for customer support).

The strategists examine popular social websites given below as templates that can be replicated within the enterprise to improve how people work together:

- Blog: An online service for news feeds and for personal bloggers.
- Facebook: A social network site that was originally meant for college and high school students but that now is popular with older age groups also.
- LinkedIn: An online network used to maintain professional networks
- MySpace: An online community and social networking website.
- Wikipedia: A free content encyclopaedia where articles are authored by volunteers in a community.

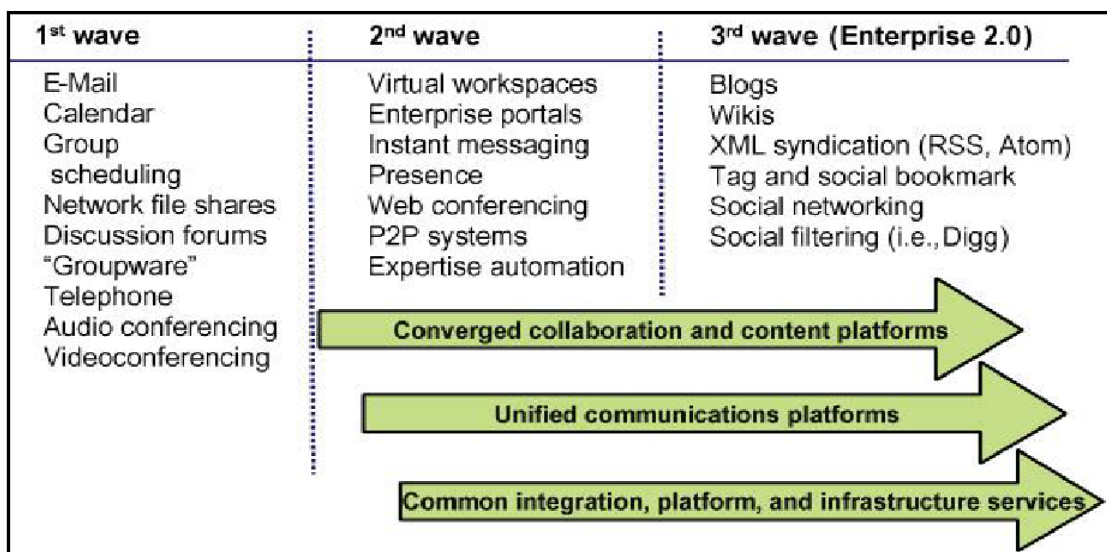


Figure 2.5 – Enterprise 2.0 in 3<sup>rd</sup> Wave of Attention [8]

## 2.2 Usage Patterns of Social Networking Websites

Usage pattern defines the kind of data accessed by youth on Social Networking sites. The Social Networking Websites Orkut and Hi5 were much popular among the adults in India. They have also attracted the young audiences of countries like India and Brazil. It has become a growing concern for parents, educators and others involved with the welfare, about the well-being of children and adults and concerned about the young people's ability to use these tools safely and effectively. It also presents challenges to young people's privacy, freedom of expression and physical and psychological well-being.

According to an article written by Singhal, Divya Shiraani, Fathimath Adhikary and Jyoti Regmi, based on a pre-pilot study, called Inclination of youth towards Social networking Sites: a three-nation exploration. It is mentioned in this article that, People join and partake in social networking websites for various reasons, such as to stay in touch with friends, make plans with friends, make new friends, or flirt with someone.

The pre-pilot study indicated that students from all three nations (India, Nepal, and Maldives) preferred common sites with at least ten million visitors world-wide. These common sites are Myspace, Facebook, Hi5, Friendster and Orkut. Prior use of the survey instrument for the final study, validity check of the questionnaire was carried out and expert views were incorporated to improve the design of the survey instrument [15].

Using the design instrument and other secondary data, the complete data set for the study was generated. The primary data used was collected based on the questionnaire through email from the selected respondents from India, Nepal and Maldives. This method of data collection was chosen for two reasons. Firstly, the survey was about online social networking sites users. Secondly, 'email surveys are quicker turnaround than the postal or face-to-face questionnaire, thus raising data quality by securing timely data'. Secondary data was obtained through published and non-published material i.e. from online journals, social networking sites, and informal interactions with the users.

Table 2.2 - Worldwide growth of usage of some key social networking sites

Social Networking Site	Jun-06	June-07	% Growth
MySpace	66,401	114,147	72
Facebook	14,083	52,167	270
His	18,098	28,174	58
IOrkut	13,588	24,120	78
Friendster	14,917	24,675	65

[15] Source: [www.comScore.com](http://www.comScore.com), accessed on 22 July. 2008

According to national survey of teenagers conducted by Pew Internet and American Life Project, it was found that about 55% of all American Online youths (ages 12-17) use Social Networking sites. It was also found that older teens especially girls are amongst the leading users. Girls basically use them in order to reinforce their pre-existing friendships, whereas boys use them to have the opportunities for flirting and making new friends.

Another survey was conducted by telephone from October 23 to November 19, 2006 among a national sample of 935 youths (ages 12 to 17) about the ways that teenagers use these sites and why they do so. “Teens say social networking sites help them manage their friendships” [9].

The major findings of this survey were:

66% of teens limit access to their profiles, so that their profiles are not visible to all users. 48% of teens visit these sites daily or often, 26% of teens visit once a day and 22% of them visit these sites several times a day.

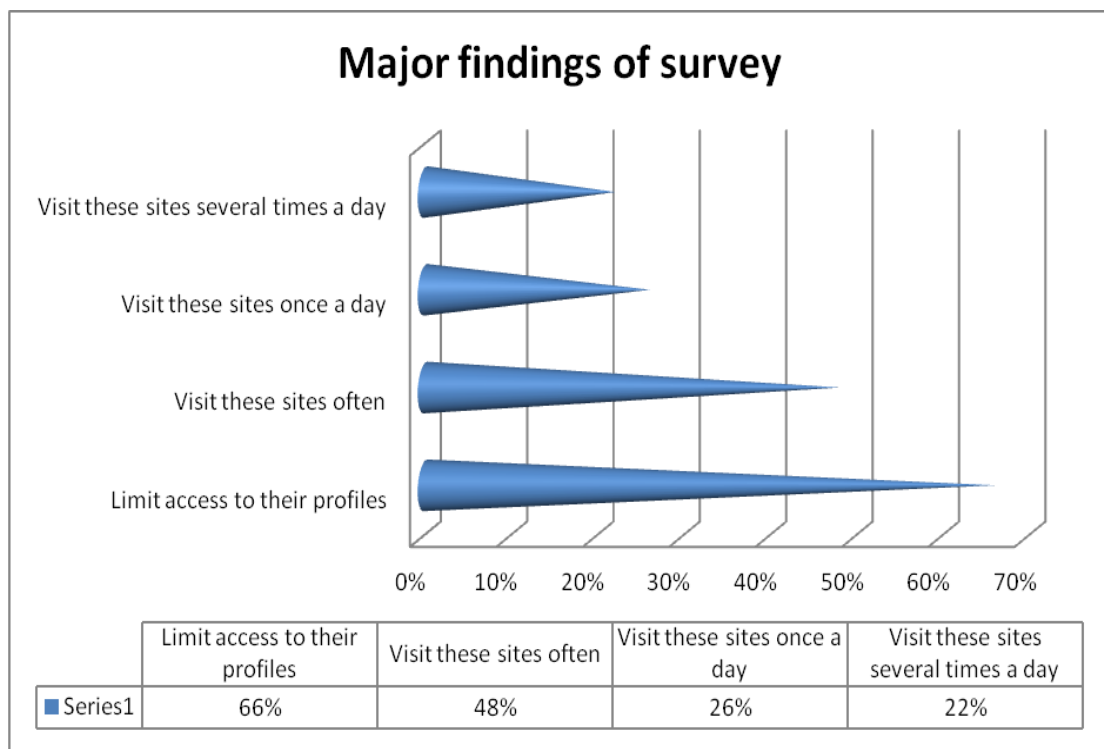


Figure 2.6 – Major findings of Survey conducted from October 23 to November 19, 2006 among a national sample of 935 youths (ages 12 to 17)

91% of social networking teens use the sites to stay in touch with friends they see frequently. 82% of them use these sites to stay in touch with friends they rarely see in person. 72% of teens use these sites to make plans with friends. 49% use the sites to make new friends. Only 17% of social networking teens use these sites to flirt, and these are the older boys.

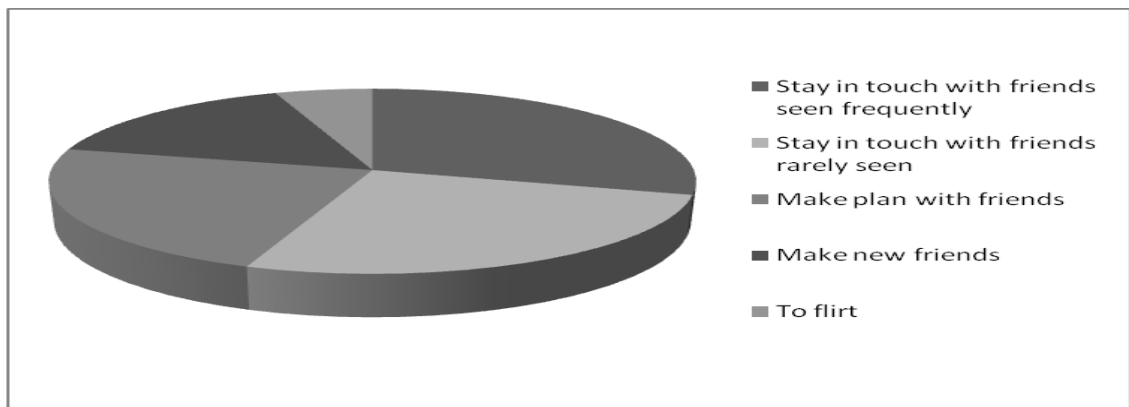


Figure 2.7 –Usage Trends of Survey conducted in 2006 among national sample of 935 youths

A research was conducted, in which group of 15 tweens (ages 11-13 years) of a small village in Sweden with one school only, were studied. Tweens are the young people who are in between being children and teenagers. They were involved in Sweden’s largest Internet community, Lunar Storm.

Lunar Storm is used by more than 80% of the Swedish teenagers. The research method used was “cyber ethnography”. Cyber language is the language used in digital communication. It is different from other written communication.

In order to make a statistical analysis, qualitative analysis were done for the content of 947 contributions in the participants’ guest books. Most of the participants’ communicated with their friends in their geographical neighbourhood. Most of the communication included that how things are going, what to do, when to meet etc. The contributions were divided into three categories [16] Social chat, Chain letters, and Messages not understandable by outsiders.

The main reason for participation of younger users seemed to stay in touch with their already known friends. Many other applications available on these social networking sites are finding new music, meeting people, playing online games like Mindjolt games; participating in causes like save girl child, support Anna Hajare to fight against corruption etc. Technology and social factors converge to create social computing.

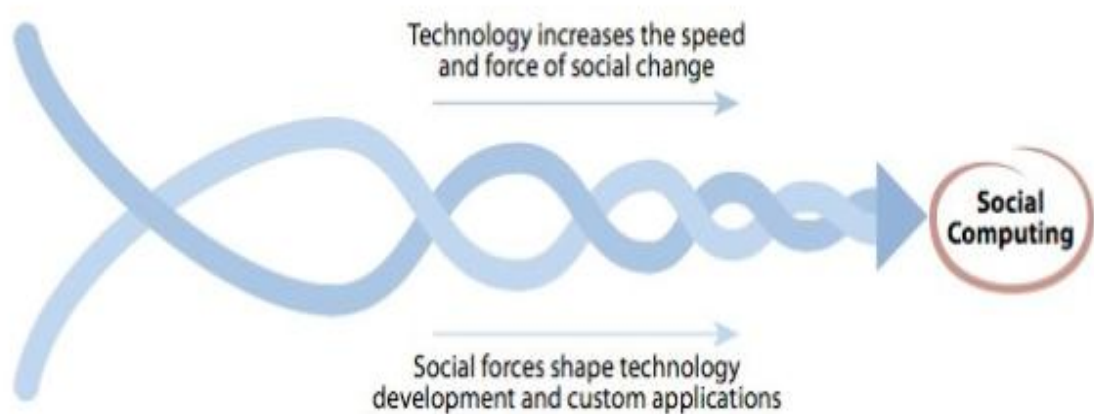


Figure 2.8 - Social Computing [7]

### 2.3 Cultural Computing

Cultural Computing is software that grasps culture and unconsciousness. Some early research results in cultural computing, of research group at Kyoto University are discussed in the literature review of Cultural Computing projects. Three steps used by them, to approach culture from computational viewpoint.

Step1: Focus on a specific culture.

Step 2: Extracting basic rules that govern culture.

Step 3: Development of computational models.

Using the first step they focused on Japanese culture (Asian culture). Second step is very delicate and difficult. As every culture constitute various aspects of human life and history. It becomes necessary to involve experts from history, philosophy, sociology and so on. The aim was of third step was to use the basic approach developed for different cultures.

Various Cultural Computing projects have been initiated –

i. ZENetic Computer

Zen is a school of Buddhism developed in China and later introduced to Korea and Japan. Students of Zen learn the basic principles through dialogues based around Zen riddles called ‘koan’. Due to this, it is assumed that Zen is very difficult for people to understand, mainly for westerners. An interactive system called “ZENetic Computer” was developed for experiencing Sansui paintings creation and Zen dialogues. It is a great help for teaching the basic concepts of Zen Buddhism. This system aims at making Zen Buddhism accessible through traditional ink painting. It is also available as an iPhone application.

While using a ZENetic Computer, firstly, user has to create a three-dimensional Sansui ink painting on the display by dragging icons (of water, wise man, bridge etc.) through an interface. It gives the user, some imagination of the concept. Then, the system classifies the state of the user’s consciousness based on design of the Sansui landscape, created by the user. System generates a story appropriate to the Sansui landscape and gives the feel of alternate world to the user. This story is non-linear collection of fragments of small stories.

ii. Hitch Haiku

Haiku is a classical Japanese poem style. A haiku poem is a short story consisting of Japanese characters in a five-seven-five pattern and includes a seasonal word called a ‘kigo’. An interactive system called “Hitch Haiku” has been developed that supports a user in composing a haiku. First, the user inputs several words or phrases into the system. The system then composes phrases consisting of five-seven-five characters

which fit with the user inputs [10].The system is known as Hitch Haiku because it allows users to experience Japanese Haiku creation by “hitching” various keywords. This system generates Haiku using the following procedure.

The user chooses arbitrary phrases from a chapter of a famous Japanese essay called 1000 Books and 1000 Nights that introduces more than 1000 books covering many genres from all over the world. Now, the system will carry out a syntactic analysis of each phrase and inspect the basic forms of nouns and verbs. The system will compose a phrase of a haiku by adding special prepositional particle called a ‘kireji’ to the user’s input. The system will generate new phrases (using six types of databases - a haiku thesaurus, kigo thesaurus, idiom thesaurus, case frame of onomatopoeia, thesaurus, and case frame) that can be combined with the starting phrases to extend the imagination of the reader. The system scores all the phrases using weights allotted to each database. The system chooses one of the phrases with the highest score, and by presuming the season of the haiku from the user. Then, Japanese haiku is translated into an English haiku.

## **2.4 Cultural Diversity in India**

India is a land of cultural diversity. This thesis discusses the religion aspect of Punjabi Culture. India is the earth’s central shrine in religion. The discovery of Indus valley civilization, takes back the cultural history of India, beyond the Vedic age and this culture includes spiritual achievements along with the material civilization. Religion has not been made an object of a vast experimentation, in any place in the world, except India.

To Kashmir we owe the Trika Philosophy and Saivism. The Punjab (including outermost north-western areas) gave us the hymns of Vedas, as also the magnificent Gandhara School of sculpture in Buddhism. The heart of Aryavarta gave us the earlier Upanishads, the epics and some other older Puranas. To Magadha, we owe the inspiring messages of Mahavira and Buddha. And to Bengal we owe the Caitanya movement and Tantras. Assam has given us the pure Vaisnavism of Sankara Deva and earlier the magico-religious systems of worship of the Tantrikas. Nepal has given

us the synthesis of Brahmanical and Buddhist religions. Orissa is celebrated for its magnificent Bauddha, Sakta, Vaisnava and Saura monuments. Orissa has also provided the Samba Purana in honor of Surya. Both in North and South India, every group with beliefs can point with pride to the various caves, temples, images and statues in religious architecture and sculpture.

In Punjabi culture, the focus of this thesis is Sikhism. The Sikh faith is hardly 548 years old as of today in the year 2012. Sikh faith is the fifth largest in the leading faiths of the world. It came into being with the birth of first Sikh Guru – Guru Nanak Dev Ji in 1469 A.D. The Sikh religion has a unique standing among all the religions in the world. It is the recent, modern, progressive and scientific religion being practiced in India today. Sikhs, those properly inducted into the faith, keep their hair uncut (treat them as gift of God) and they keep their heads covered with a turban of any size and colour. The Sikh women also keep their heads covered with a length of cloth (dupatta). They are fond of making an honest living. They share the boons with the needy and keep God in their minds. The evils of caste, creed, religion, social discrimination, hollow ritualism, and exploitation of people under such religious practices, were taken up not only by Guru Nanak Dev Ji, but also by the successive Gurus. The Guru Granth Sahib Ji, “The Bible of the Universal Religion”, as it is referred to by Duncan Greenless stands unique in the world today, as it is not just a sacred book, but also the living Guru of Sikhs. Guru Granth Sahib is a treasure house of Gurbani that God in his greatness made known to the Sikh Gurus. “Dhur Ki Bani Ayee, Tin Sagli Chint Mitayee” [14].

### **Sikh Religion**

Literature review of Sikh religion discusses the Sikh literature available online.

- Digitized form of ‘Sri Guru Granth Sahib’ (SGGS).
- Sikh prayers like Japji Sahib, Sukhmani Sahib, etc. are available online.
- Audio files of recitation of Guru Granth Sahib are available online.
- Daily ‘Hukamnama’ – Vaak from Sri Harmandir Sahib, Amritsar.

Also, different Journals were taken in consideration for literature survey. These include ‘Understanding Sikhism’, ‘XXI International CIPA Symposium, 01-06 October 2007, Athens, Greece’ and ‘Golden Research Thoughts’. Some of the major contributions are listed hereunder.

(I) ‘Understanding Sikhism’

i. “Dhur Ki Bani: What does it mean?” (Jan-Dec. 2009, Vol. 11, No 1-2)

Author – Dr. Sarjeet Singh Sidhu

In this research paper, meaning of ‘Dhur Ki Bani’ is explained according to three different views. The First view is given by Pashaura Singh and it states that ‘Dhur Ki Bani’ means Bani is an exact copy of pre-existing Bani that is with the Divine. The Second view (by Jagpal Singh Tiwana) states that some changes to the “received” Bani were made by Gurus, so the Bani we have is not an “exact copy”. The third view states that the revelation was not word-for-word, but in the form of concepts. The author’s opinion is that the third view is more realistic, that is, the person “receiving” the Divine message (Guru) is merely expressing what he felt when he had “contact” with the Divine. But, the religion is all about a matter of faith, not of reasons.

ii. Editorial – “Aad Guru Granth Sahib” (January-June 2000, Vol. 2, No. 1)

The Gurbani incorporated in Aad Guru Granth Sahib [AGGS], is the only authenticated source of Sikh Philosophy (that is authenticated by Guru Arjan Dev Ji and Guru Gobind Singh Ji) and AGGS is also helpful in resolving the discrepancies reported earlier in the Sikh literature. According to AGGS, M 5, P 186.

ਪੀਉ ਦਾਦੇ ਕਾ ਖੋਲਿ ਡਿਠਾ ਖਜਾਨਾ ॥  
ਤਾ ਮੇਰੈ ਮਨਿ ਭਇਆ ਨਿਧਾਨਾ ॥੧॥

It is inferred from the above verse that Guru Nanak Dev Ji handed over his Bani to Guru Angad Dev Ji. Guru Angad Dev Ji added his Bani in it and handed over to Guru Amardas Ji. Guru Amardas Ji added his Bani in it and handed over to Guru Ramdas Ji

and Guru Ramdas Ji added his Bani and finally Guru Arjan Dev Ji received it as an ancestral treasure, to which he added his Bani. Guru Nanak Dev Ji presents the honour of Guruship to the Sabd in his Bani: AGGS, M 1, P 943

**ਸਬਦੁ ਗੁਰੂ ਸੁਰਤਿ ਧੁਨਿ ਚੇਲਾ ॥**

And thereafter, all the Gurus of Guru Nanak's House taught the same principle i.e. Sabd (Bani - word) is the Guru. The day (in 1604 CE), the Pothi (Granth) was compiled, it was given the status of Guru, based on Philosophy given in the verse below: (AGGS, M 5, P 1226)

**ਪੋਥੀ ਪਰਮੇਸਰ ਕਾ ਥਾਨੁ ॥  
ਸਾਧਸੰਗਿ ਗਾਵਹਿ ਗੁਣ ਗੋਬਿੰਦ  
ਪੂਰਨ ਬ੍ਰਹਮ ਗਿਆਨੁ ॥੧॥ ਰਹਾਉ ॥**

The information about the authors of AGGS is also given in this article. The House of Nanak has been represented as Mahla by Guru Arjan Dev Ji. So, the Contribution of Guru Nanak Dev Ji (founder of Sikhism) is identified as Mahla 1, the verse of second Guru, Guru Angad Dev Ji is identified as Mahla 2 and so on. So, we conclude that the only authenticated source of Sikh Philosophy is Aad Guru Granth Sahib.

iii. "Akhand Paath In Sikhism"(January-June 2001, Vol. 3, No. 1)

Author – Prof. Devinder Singh Chahal

According to Bhai Kahn Singh, no Akhand Paath was performed, during the time of Gurus. The custom of Akhand Paath was started by Buddha Dal, who lived in forest and wanted to finish Paath in shortest possible time, due to the possibility of sudden attack by enemy.

According to Sikh Rehit Maryada (published by SGPC) accepts reading of Akhand Paath as code for Sikhs and describes how to perform the Akhand Paath. It also recommends that Paath should be read by family, or by relatives or by the Sangat. In case, the Paath is to be read by the hired Granthis, then the whole family should listen to it.

iv. “Ethics of The Sikhs” (January-June 2005, Vol. 7, No. 1)

Author – Dr. Jodh Singh

In this paper, the author discusses the ethics or virtues of Sikhs. These are wisdom, truth, temperance, humility, courage, justice and contentment as mentioned in AGGS. Ethical-spiritual precepts of the Sikh Gurus are for the Human Improvement, Brotherhood of human beings and Union of Atma with Parmatma [21]. The AGGS is the prime collection of ethics taught by the Sikh Gurus. Gurus show us the way to achieve our objectives through Gurbani. At every step, moral conduct is stressed.

v. “Guru Nanak’s Concept of God (Absolute Reality)”

Guru Nanak’s concept of God is unique; he laid the foundation of a strictly monotheistic religion (Sikhism) in India for the first time. He was a messenger of God and he narrated what he received in his divine communications; as mentioned in Aad Guru Granth Sahib, M1, P722 –

ਜੈਸੀ ਮੈ ਆਵੈ ਖਸਮ ਕੀ ਬਾਣੀ  
ਤੈਸਤਾ ਕਰੀ ਗਿਆਨੁ ਵੇ ਲਾਲੋ ॥

According to Guru Nanak, God is one and the sole reality in the universe and there is no other entity worthy of worship. In Sikhism, God is believed to be eternal, timeless (Akal), omnipresent (Sarav Viaapak) and has infinite qualities. In Sikh teachings there is no gender for God.

Guru Nanak defines the concept of God through his attributes:

ੴ ਸਤਿ ਨਾਮੁ ਕਰਤਾ ਪੁਰਖੁ ਨਿਰਭਉ ਨਿਰਵੈਰੁ ਅਕਾਲ ਮੂਰਤਿ ਅਜੂਨੀ ਸੈਭੰ ਗੁਰ ਪ੍ਰਸਾਦਿ ॥

(Aad Guru Granth Sahib, Manglacharan (Commencing Verse) P1)

The One Supreme Being; Eternal Reality; the Creator Person; without fear; without Rancour; Unborn; Self-Existent; Realized through Divine Grace. Guru Nanak’s God is Nirankar or Nirakar (without any form), Nirguna (without physical attributes); unattached to maya and Time – transcendence (Akal-Murt). Also, in Sikhism, one

great departure is made by the Sikh Gurus in calling God as a bridegroom and individual souls as brides of God. The very first Sloka after Manglacharan, further elaborates the nature of ultimate reality:




ਆਦਿ ਸਚੁ ਜੁਗਾਦਿ ਸਚੁ ॥  
ਹੈ ਭੀ ਸਚੁ ਨਾਨਕ ਹੋਸੀ ਭੀ ਸਚੁ ॥੧॥


(II) XXI International CIPA Symposium, 01-06 October 2007, Athens, Greece

i. “Art Work in Historic Sikh Shrines: Need for Documentation and Conservation”

This paper is related to Sikh Shrines adorned with various art forms and their techniques. The major contribution in art work is of Maharaja Ranjit Singh. According to David Ross “Victories of Ranjit Singh enabled him to do much towards beautifying the temple and the city”. These art forms are mainly seen in Golden Temple, Amritsar; Darbar Sahib in Tarn Taran; Hazoor Sahib in Nanded; Baba Atal Rai in Amritsar and Dera Sahib in Lahore, Pakistan. The important components of Gurdwara (Sikh Shrine) such as Sarovar (water body), Langar (free community kitchen), Jora Ghar (place for keeping shoes), Serai (place for stay in) and Gathri Ghar (cloak room) etc.; depict the concept of equality. Region, religion and rituals collectively determine art. Various art works include Jaratkari (inlaid stone), Mohrakashi (frescos), Gatch (lime/gypsum), Tukri (mirror piece), and Gold Embossing.

Table 2.3 – Various Art Forms in Historic Sikh Shrines [13]

Various Art Forms	
<p>Jaratkari (inlaid stone) art work can be seen to some extent in Darbar Sahib, Tarn Taran and Hazoor Sahib, Nanded.</p>	
<p>Mohrakashi (frescos) art form can be seen in Darbar Sahib, Tarn Taran; Hazoor Sahib, Nanded; Dera Sahib, Lahore, Pakistan; Baba Atal Rai Gurudwara, Amritsar.</p>	
<p>Gatch Work can be seen in Darbar Sahib, Tarn Taran; Hazoor Sahib, Nanded (religious prayers ‘Jaap Sahib’, ‘Japuji Sahib’, ‘Anand Sahib’ are inscribed in this way).</p>	

<p>Tukri Work (mirror piece) is seen in ceiling of upper hall in Harmandir Sahib, Amritsar; Darbar Sahib. Tarn Taran and Hazoor Sahib, Nanded. Gatch inlaid with Tukri and precious stones is seen in Harmandir Sahib, Amritsar.</p>	
<p>Gold Embossing can be seen in Darshani Deori and the inside ceiling of Harmandir Sahib (main shrine), Amritsar. It is also applied in Darbar Sahib, Tarn Taran and Hazoor Sahib, Nanded and at some places in Baba Atal Rai and Dera Sahib, Lahore.</p>	

These various art forms in Sikh Shrines require urgent attention, documentation and conservation.

(III) Others

i. “Position of Women in Sikh Society” (Golden Research Thoughts Vol. 1, Issue II/ August 11pp.1-4)

In this research paper, position of women in Sikh society is explained by giving many examples and evidences. Guru Nanak Dev Ji, the founder of Sikhism, was the first in the religious history of humankind to strongly raise his voice against any discrimination of women. Also, for the first time, God has been given female attributes- in the Sikh Scripture; Guru Gobind Singh Ji calls God Mahakal – Kalika,

the combination of both male and female. While discussing the relationship between humankind and God, (in various scriptural hymns), humans are generally referred to as God's bride. Guru Nanak called women the mother of mankind.

**So ki᳚o mandā ākhī᳚ai jī᳚ jamēh rājān.**

ਸੋ ਕਿਉ ਮੰਦਾ ਆਖੀਐ  
ਜਿਤੁ ਜੰਮਹਿ ਰਾਜਾਨ ॥

Sri Aad Granth states that light of God rests equally with both men and women. Most of the Sikh missionaries sent by Guru Amardas Ji (3<sup>rd</sup> Guru of Sikh faith) had many of the women. Gurus gave Sikh men and women, the same dress (5 Kakkars). The Sikh Rehat Maryada (code of conduct) states that women should not cover their faces with veils. Bhai Gurdas Ji (scribe of original book as dictated by Guru Arjan Dev Ji) reveals that woman is one half of the complete personality of man. Sikh women have equal hereditary rights, as that of men. Guru considers women to be a princess, thus given her the surname 'Kaur'. Women can be a member of Panj Pyaras. In Sikh Faith, women have got (both spiritually and secularly) equal status to men.

ii. Sikh Coinage – Symbol of Sikh Sovereignty (Author – Surinder Singh, Published by Manohar, Delhi, A Review by Dr. M.S. Ahluwalia)

Surinder Singh is the person who has not only collected Sikh coins, but also carried out numismatic investigation, along with historical accounts and establishing coins as a symbol of Sikh Sovereignty. He made a sizeable collection of Sikh coins during his posting in Jullundur in early 80s. His attempt has been the first detailed study of Sikh coins.

iii. Origin of Nishan Sahib: The Sikh Banner (Author – Dr. Kulwant Singh)

At the worldly level, one of the identities is Nishan Sahib. A fluttering Nishan Sahib is a call to all those who are rejected by others and assures the comfort of free food, place for rest and selfless service; without any discrimination of caste, colour, faith, status, sex or country. Nishan Sahib is always triangular with its vertical axis at 90

degrees to its horizontal base. At its tip a black pompom (phuman) is tied with free length of black thread (helps in gentle fluttering of the flag). At the top of the pole, a khanda (double-edged sword) is fixed.

Nishan Sahib is of saffron colour. This colour stands for courage and sacrifice. The Sikh colour (Saffron) is also given political recognition (Editorial, “Akali” 24 Dec.1921). In 1929, Pandit Motilal Nehru and other members of Congress Party accepted the condition of Sikh colour in the Indian flag (proposed by Baba Kharak Singh).

The presence of any one of the symbols (Ik Onkar, or C Khanda-Kirpan-Chakkar) will be sufficient to convey, that it represents Sikhs. It is generally accepted that Nishan Sahib came into being at the time of Guru Hargobind Sahib Ji (6<sup>th</sup> Guru of Sikh faith). “Nishan” means a seal or stamp (mark of identity) and “Sahib” is added as respect.

The Sixth Guru fixed two flags at a place named Akal-Bunga in front of Akal-Takht Sahib, Amritsar. One flag is towards Akal-Takht Sahib and other towards Golden Temple. The one towards Akal-Takht Sahib is one foot shorter than the other (meaning that temporal power should be under the reins of the spiritual authority). In Gurbani, the words like Dhwja, Jhanda, Nishan (means a flag) have been used.

At the time of Guru Gobind Singh Ji, the colour of Nishan Sahib was blue and the Nihangs maintain Guru Gobind Singh Ji’s tradition of blue Nishan Sahib. But, there is no mention in the history as to how and when the blue colour changed to saffron. The respected Nishan Sahib is pride of all those who believe in Guru’s philosophy and they always keep ready to offer their lives for its glory.

## **2.5 Spreading Cultural Knowledge through Latest Computing Paradigm**

The need of the current scenario is to make the young generation connect to the roots of their culture. For this, need of the hour is to digitize the data that is not available on

the internet and make it available to people across the globe through internet. In addition to this, creating a cultural portal in the domain of 'Sikhism' will help in achieving an important milestone in this domain. Using technological trend WEB 3.0 for semantic searching on the cultural portal is another step in the domain of Cultural Computing. Making the data easily available to the users, using new technologies and promoting the cultural portal through social media like Facebook, Blogs, and Twitter etc. is another milestone in this domain of Cultural Computing and will serve our purpose.

#### 3.1 Research Gaps

Various research gaps have been found during this study –

Based on the usage trends studied earlier, it has been observed that youth spends their maximum time using social networking sites without any fixed agenda in their minds.

Use of technology is not much done for attracting youth towards a particular culture.

- i. Many of the Sikh scriptures especially handwritten scriptures need urgent attention.
- ii. Many of the Sikh shrines associated with sacred trees are lying unattended.
- iii. Lesser use of advanced technologies including security on cultural portals of Sikhism.
- iv. Lesser focus on the technology in order to make the children and youth learn a particular culture easily.
- v. Search facility is not available on many of the cultural portals.
- vi. Cultural portals' integration with Social Networking websites is not practiced on many of the cultural portals.
- vii. Understanding the meaning of user's search or requirement is not taken into consideration on the cultural portals available.
- viii. Use of Cultural computing is not practiced exactly, in the domain of Sikhism.
- ix. Authenticity of information provided on many of these cultural portals is not confirmed.

#### 3.2 Problem Formulation

- i. Statistical collection of usage pattern data of various Social Networking websites.
- ii. To link various resources of information about Sikhism.
- iii. To digitize Sikh scriptures using CAPTCHAs.
- iv. To provide search facility on the cultural portal using Semantic Relatedness.
- v. To make the users learn about Sikh culture in play – way style using popular games.

- vi. To provide the information related to the domain of Sikhism in a brief and easy manner.
- vii. To integrate cultural portal with Social Networking websites.

### **3.3 Objectives**

- i. To study and analyze the current status of Sikh cultural information, cultural objects and usage of social networking websites amongst youth.
- ii. To develop a portal for Sikhism, that present the Sikhism related information in brief and easy manner, preserving its cultural objects and providing intelligent access to Sikh cultural information.
- iii. To digitize the handwritten and printed scriptures using CAPTCHAs and providing security simultaneously.
- iv. To promote the cultural portal through Social Networking websites.

### **3.4 Methodology used**

To implement the proposed objectives of the problem, following set of have steps have been followed:

- i. Contacted various domain experts of Sikhism, gathered the information related to Sikhism from various books and other resources and explored related websites and studied various usage trends of youth towards social networking websites.
- ii.
  - a. Developed cultural portal using ASP.NET, C#.NET and SQL Server.
  - b. Provided search facility using semantic relatedness, understanding the meaning of the words searched by the user and analyzed the user's search by recording the words searched by user on the cultural portal and recorded track of user activities on the cultural portal.
  - c. Integrated various resources related to this domain on the cultural portal.
  - d. Developed three games for beginners/learners or kids for easy learning about Sikhism in play-way style.
- iii. Digitized the handwritten and printed scriptures' page, using two different approaches (discussed in further chapters) with CAPTCHAs.
- iv. Integrated the cultural portal with Social Networking website Facebook using FacebookLike tool in .NET.

# **Design and Implementation of Sikh Cultural Heritage Portal**

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To integrate various resources of information on Sikhism and present this information in brief and easy manner, a cultural portal has been built. The handwritten and printed form of scriptures related to Sikhism, are digitized using CAPTCHAs, providing security simultaneously. Search facility is also provided on this cultural portal, using the concept of Semantic Relatedness. The words searched by the users are recorded in the database, to understand user's interests. This cultural portal is also integrated with social networking websites, in order to promote the cultural portal.

### **4.1 Technology used for Cultural Portal**

For this cultural portal, ASP.NET is used. ASP.NET is a web application framework, which is developed and marketed by Microsoft. It allows the programmers to build dynamic websites, web applications and web services. It was first released in January 2002 with version 1.0 of .NET framework. It is successor of Active Server Pages (ASP) technology. ASP.NET is built on Common Language Runtime (CLR). This allows the programmers to write ASP.NET code using any supported .NET language.

#### **4.1.1 Common Language Runtime (CLR)**

Programs that are written for the .NET framework execute in a software environment that manages the program's runtime requirements. This runtime environment is also a part of the .NET framework and is known as the Common Language Runtime (CLR). CLR has some features listed hereunder –

- CLR provides the appearance of an applications virtual machine, so that programmers need not consider the capabilities of the specific CPU that will execute the program.
- The CLR also provides other important features such as security mechanisms, memory management, and exception handling. The class library and the CLR together compose the .NET Framework.

- This Framework is intended to make the development of computer applications easier.

#### **4.1.2 Development of Web Applications through .NET**

##### **i. Easy Development of Web Applications**

ASP.NET technology on .NET platform is beneficial for developing dynamic and data driven web applications. It provides an event driven programming model that simplifies the development of web pages with complex user interface. ASP.NET server controls (in toolbox) provide advanced user interface elements (like GridView) that save lot of coding work on programmer's side. The cultural portal developed used various tools like gridview, label, textbox, imagebuttons, buttons, and so on, available in ASP.NET toolbox.

##### **ii. Multi-Language Support**

Whenever a new language is invented, then existing languages are outdated. So, for making the programmers learn new language, the training cost is increased. But, in case of .NET framework, if a person has skills in one language, he has to just mould them to suit the .NET environment. Example – VB.NET (VisualBasic.NET), C#.NET (C-Sharp), Jscript.NET etc. are available. Even though the syntax of each language is different, the basic capabilities of every language remain at par with one another. I have developed the portal using ASP.NET and C#.NET, as C# provides the security feature to the website developed.

##### **iii. Automatic Memory Management**

Memory leaks were major reason in failure of applications. .NET removes this consideration from the developer side by handling memory on its own. The garbage collector takes care of freeing the unused objects at appropriate intervals. Memory management has been made easy using ASP.NET during development of portal, as all this overhead is taken up by .NET.

#### iv. OOPs Support

.NET provides a fully object oriented environment. Languages like Visual Basic.NET now support many of the Object – Oriented features that were lacking traditionally. Even primitive types like integer and characters can be treated as objects – something not available even in Object – Oriented languages like C++. OOPS concepts made the application easy to manage as all the back end code has been written using classes.

#### v. Security

.NET platform is safe and secure for enterprise applications. Features such as type safety, code access security and role based authentication make overall applications more robust and secure. Type safety helps in isolating the objects from each other, so helps protect them from malicious corruption. Type – safe code cannot directly read the values from another object’s private code areas.

#### vi. Rich Functionality

.NET framework provides a rich set of functionality as it contains hundreds of classes that provide variety of functionality ready to use in applications. The developer need not go into low level details of many operations such as file IO, network communication etc. Example - DateTime class for accessing date – time functions, Exception class for exception handling and many more. Users can make their own classes as well. I have created connection class in the Cultural portal developed for the purpose.

### **4.1.3 Installation Requirements for .NET Framework SDK**

Hardware Requirements:

- Computer/Processor: Intel Pentium class, 133 megahertz (MHz) or higher.
- Minimum RAM Requirements: 128 megabytes (MB) (256 MB or higher recommended).
- Hard Disk :
  - i. Hard disk space required to install: 600 MB.
  - ii. Hard disk space required: 370 MB.

- Display: Video: 800x600, 256 colors.
- Input Device: Microsoft mouse or compatible pointing device.

#### Software Requirements:

- Microsoft Internet Explorer 5.01 or later is required.
- Microsoft Data Access Components 2.6 is also required (Microsoft Data Access Components 2.7 is recommended).
- Operating System :
  - i. Microsoft Windows® 2000, with the latest Windows service pack and critical updates available from the Microsoft Security Web page.
  - ii. Microsoft Windows XP – (Microsoft Windows XP Professional to run ASP.NET)
  - iii. Microsoft Windows NT® 4.0

#### **4.1.4 Active Server Pages (ASP)**

ASP stands for Active Server Pages. It is a program that runs inside IIS (Internet Information Services). IIS comes as a free component with Windows 2000 and is also a part of the Windows NT 4.0 Option Pack. An ASP file is same as an HTML file and can contain text, HTML, XML, and scripts. Scripts in an ASP file are executed on the server. An ASP file has the file extension ".asp". ASP is a server side technology which is used to display dynamic content on the web pages. ASP in itself is not a language; it uses VBScript or Jscript to display dynamic content.

There are some differences between ASP and HTML. When a browser requests an HTML file, the server returns the file. On the other hand, when a browser requests an ASP file, IIS passes the request to the ASP engine. The ASP engine reads the ASP file, line by line, and executes the scripts in the file. Then, the ASP file is returned to the browser as plain HTML.

ASP has following main features:

- Allows dynamically editing or adding any content of a Web page.
- Customize a Web page to make it more useful for users.

- Simplicity and speed are other important features.
- Respond to user queries or data submitted from HTML forms.
- Access any data or databases and return the results to a browser.
- Provide security since the ASP code cannot be viewed from the browser.

## 4.2 Design of Cultural Portal

The design of the cultural portal is kept simple and easy to understand. This enhances the quality attribute - usability of website. For the cultural portal, I have used Capsicum by CSS Templates for free. This template provides the simple design at the background as well as an easy to locate menu on the right side.

### 4.2.1 Navigation System of Cultural Portal

The Navigation system of website is Parent – Child relationship type. The sitemap page defines the navigation system of the whole portal. To make it easy for the users (to locate the item required by them), the menu is provided on the left hand side. It also gives the category layout way of the portal.

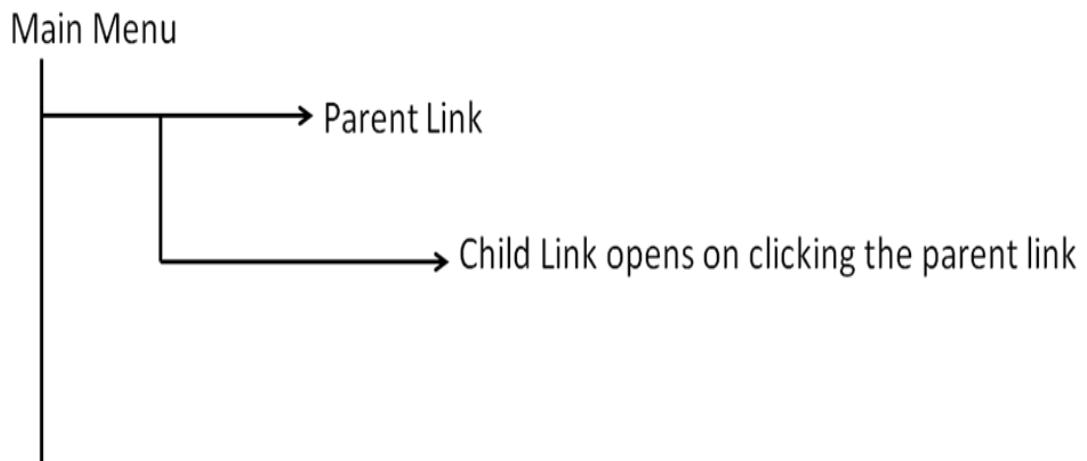


Figure 4.1 – Menu Navigation of Portal

Here is the home page of the website

**Enhancing Online Access to Sikh Cultural Heritage**

## Sikh (ਸਿੱਖ)



When a devout, committed to Naam and to the path of God, is alone, he is called a **Sikh**; When more than one person are together and discuss his virtues, they become Sadh Sangat. When they are four, five or more and involve themselves in Katha, Kirtan, these Gurmukhs become Guru Roop.

**Characteristics of Sikhs:** Smiling, soft spoken, compassionate, caring and helping, understanding, honest, sincere, courageous, fearless, hard working, adjusting, value their duties, forgiveness, struggle (for eliminating injustice, slavery, inequality, cruelty and torture), no discriminations.

The Sikh is one who follows the following -

- He/she worships only one God and nothing else.
- He/she believes in Guru Granth Sahib.
- He/she has faith in ten Sikh Gurus.
- He/she does not follow any other faith.
- No superstitions, no discriminations and no belief in caste system.
- Equality of all, including that of women.
- Follows decisions of Khalsa Panth (Akaal Takht Sahib).
- He/she keeps ready to perform selfless service (Sewa) and share God given benefits with the needy.
- He/she sticks to Sikh discipline and procedures.
- Maintains dignity of his or her faith and doesn't hesitate to help and protect the weak.
- He/she does not accept cruelty, discrimination and does not commit them.

**Sikh Faith - An Introduction**

The Sikh faith is most recent, hardly 548 years old as of today in 2012 A.D. It came into being with the birth of first Sikh Guru - Guru Nanak Dev Ji in 1469 A.D. Sikh faith is the 5th largest in the leading faiths of the world.

*The Sikh faith recommends an ethical life that is to pray for well being of everyone ("Tere Bhane Sarbat Da Bhala" as in Sikh Prayer- ARDAS) and for peace in the world.*

**Triad of Sikh Faith>**

It includes the following:

- **Honest Earning (Kirat Karo)** Honest, hard earning.
- **Sharing boons with the needy (Vand Chhako)** It is selfless service. Protecting the weak even risking his or her own life. Sharing God given boons with the needy.
- **Recitation of Name of God (Naam Japo)** Reciting the name of God. (and Nit Nem Karo i.e. recitation or reading holy scriptures of Sikh faith)

References

1. Dr. Kulwant Singh Khokhar, Thousand Petal Lotus

**Home**

Search Website

Sikh Gurus

Sikh Gurdwaras

Sikh Gurdwaras Related to Trees

Sikh Guru Sakhis (Tales from Sikh History)

Important Sikh Information

Member's Login

Sign Up

Games for Kids - Sikhism Special

Articles and Websites List

Sikhism Gallery

Sikh Glossary

Site Map

Like 3 likes. Sign Up to see what your friends like

Figure 4.2 – Home Page of Cultural Portal

The background of the portal is kept simple, with easily accessible menu items. At the end of the menu, there is a social plugin of Facebook. This is a tool of .NET components, 'FacebookLike'. Any person can like the pages of the cultural portal, through this social plugin.

## 4.2.2 Links Provided to Existing Online Resources

The links to existing online resources of the Sikh cultural information available online are published on a page. On clicking any of the links available on this page, the link opens up in the same window, avoiding any confusion to the user. After finishing the browsing, user can click on the back button of the browser and return to the cultural portal.

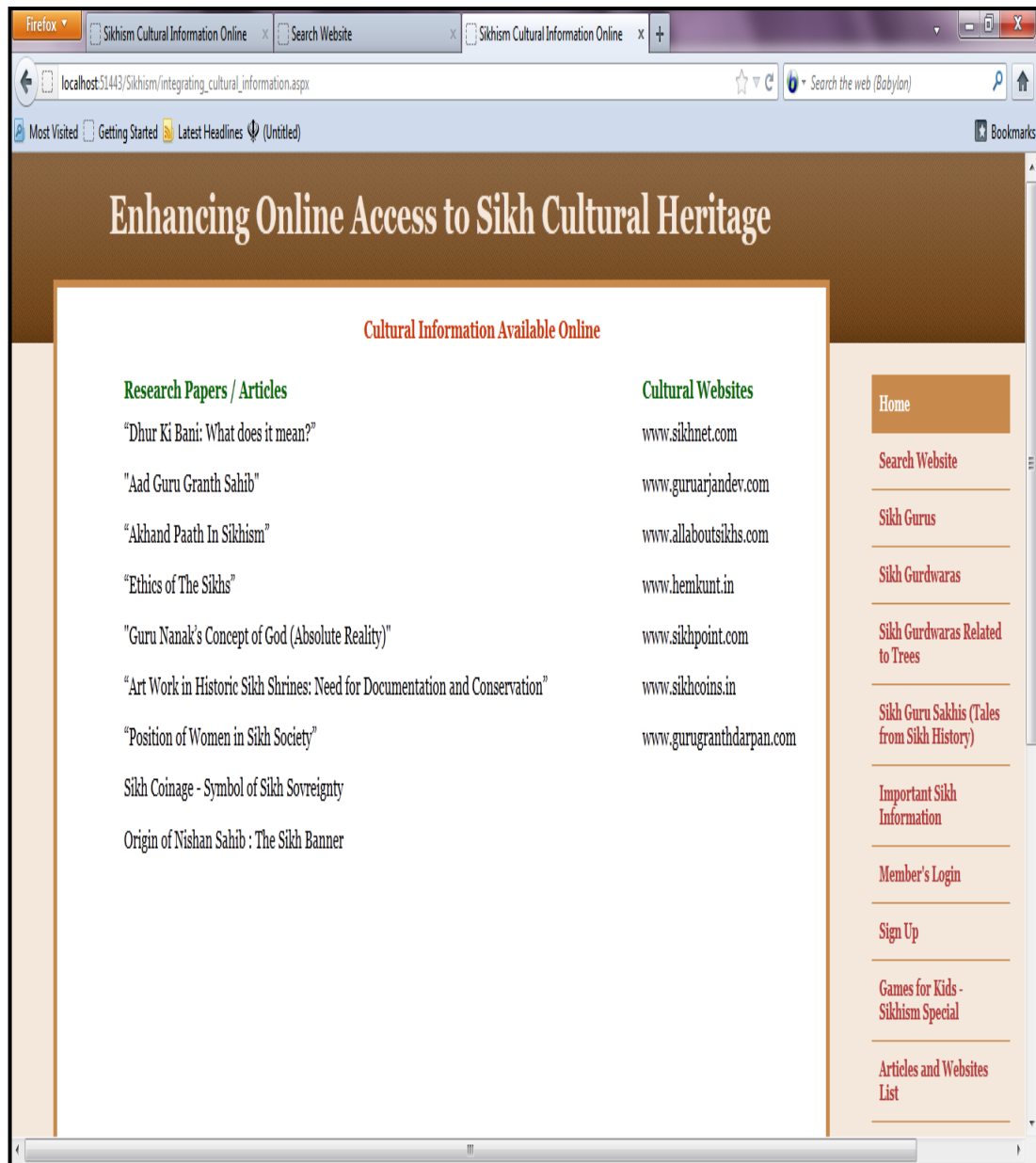


Figure 4.3 – Links Provided to Existing Online Resources

### 4.2.3 Site Map

In this cultural portal, we have more than 50 pages. So, it is very useful to provide a sitemap for users to easily locate the information they are looking for.

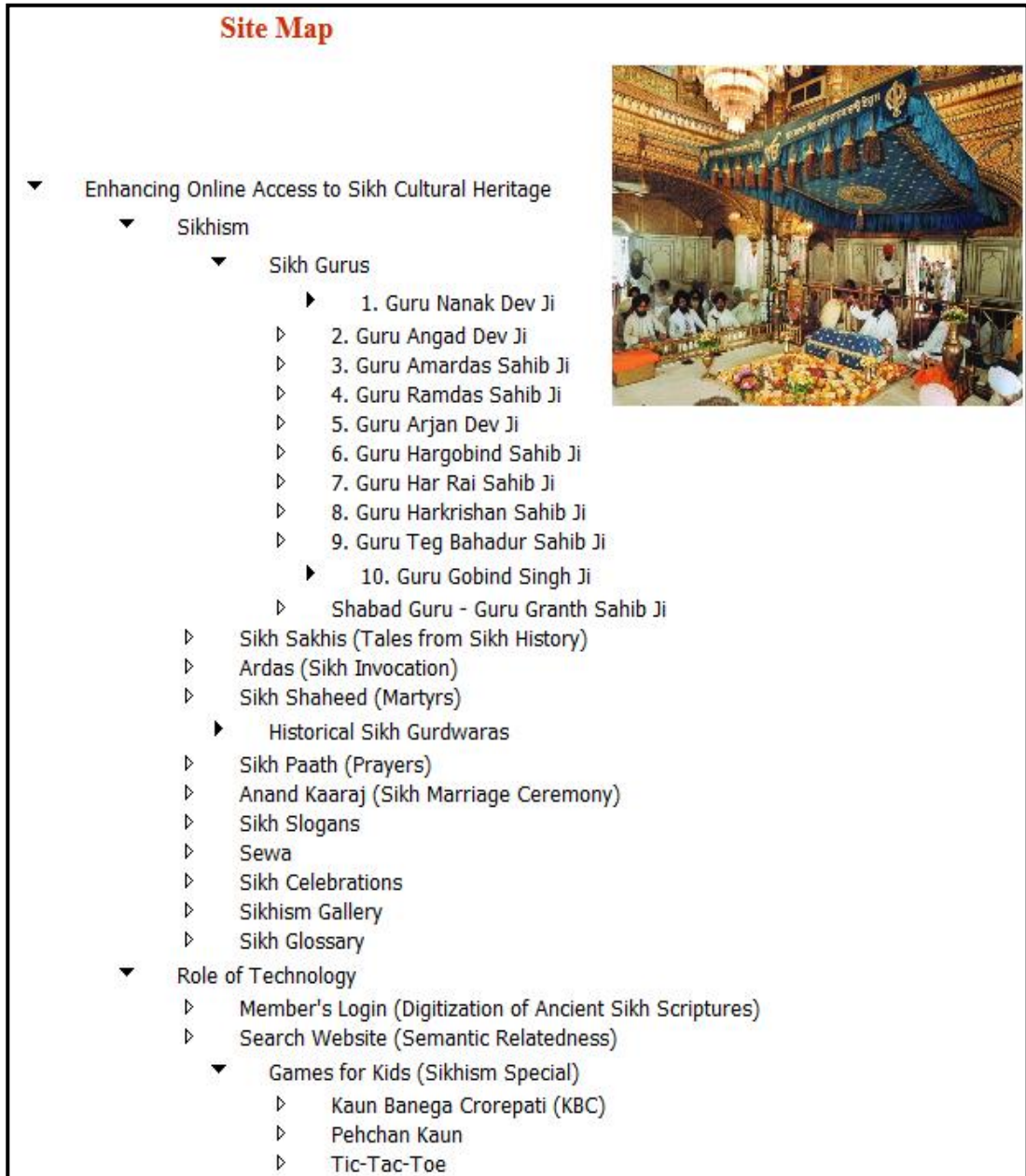


Figure 4.4 – Site Map of Portal

Site Map provides links to all the pages in the website. On clicking any of the links in the site map, the user can open a particular page and access the desired information. It simplifies the portal browsing by the user.

#### 4.2.4 ‘Search Website’ feature

Search Website feature on the portal provides two types of search – Search by Relevance and Searching Metadata. Both of the search features give best results with smaller phrases of words.

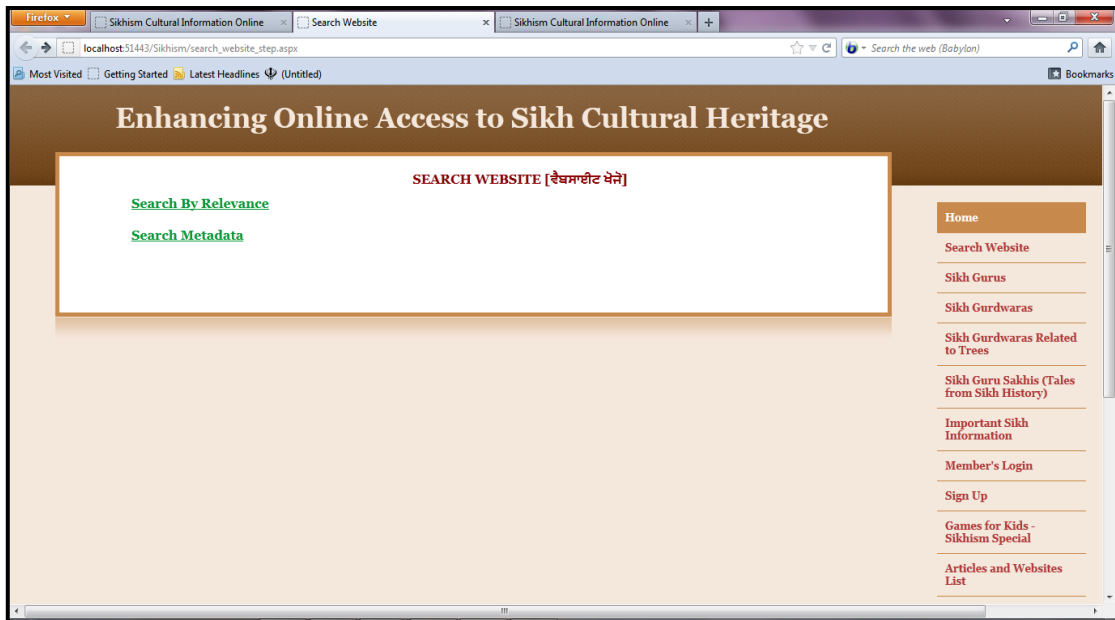


Figure 4.5 – Search Website Options on Portal

##### i. ‘Search By Relevance (English)’ feature

It allows the user to type a set of words about the information required by them. The most relevant search results’ links will appear (Page Rank Wise). The link’s title gives the idea about the information on that particular page. On clicking the relevant link, user can directly access the desired information. After clicking on the search button, the link appearing at first position is at the rank 1<sup>st</sup>, the link at the second position is at the rank 2<sup>nd</sup> and so on.

##### ii. ‘Search By Relevance (Punjabi)’ feature

As the major language of Sikh culture is Punjabi and Sikh Scripture written in Gurmukhi. For promotion of the language also, the search feature is also provided in Punjabi. On clicking the search button, control is redirected to the relevant page, required by the user.

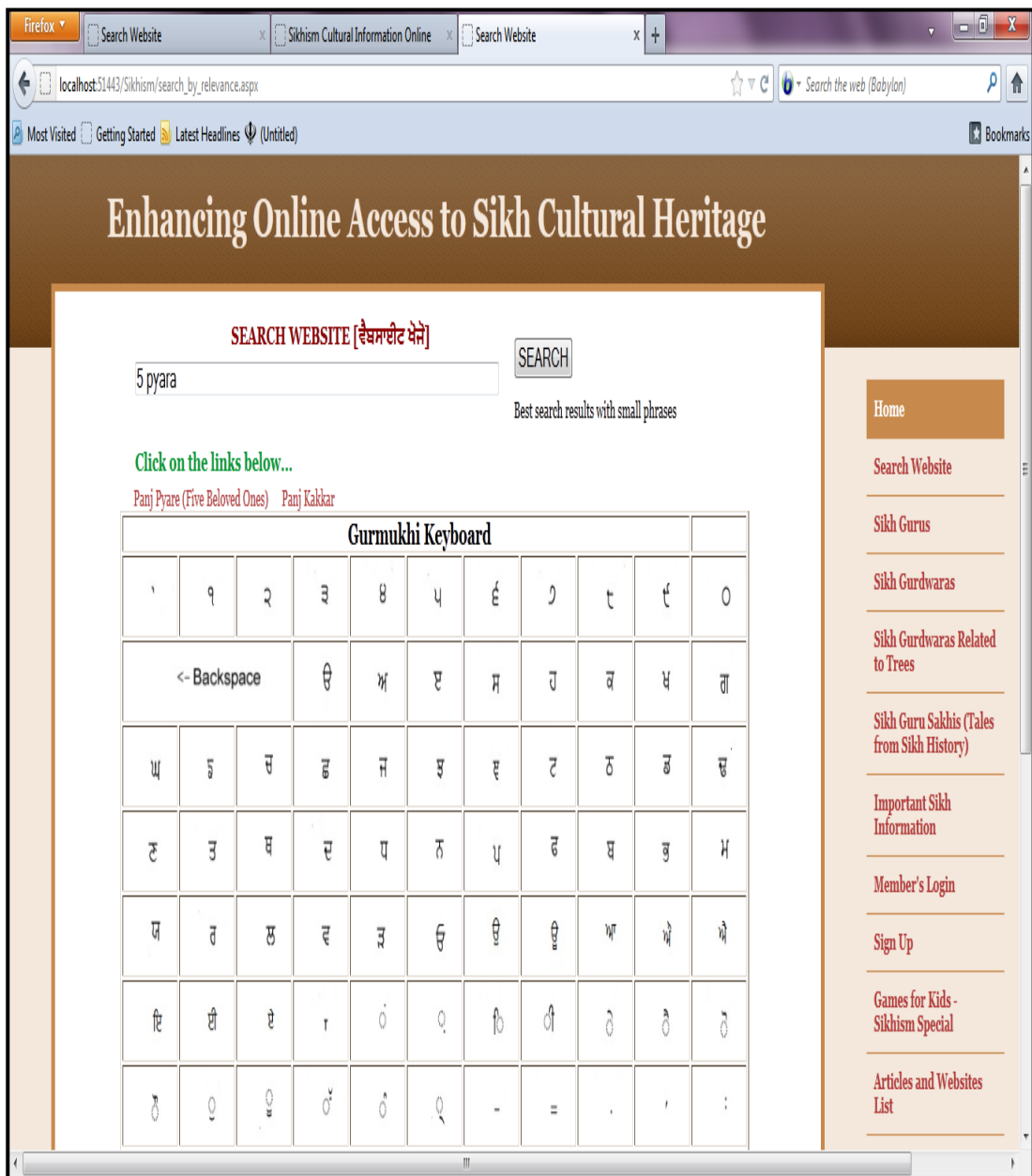
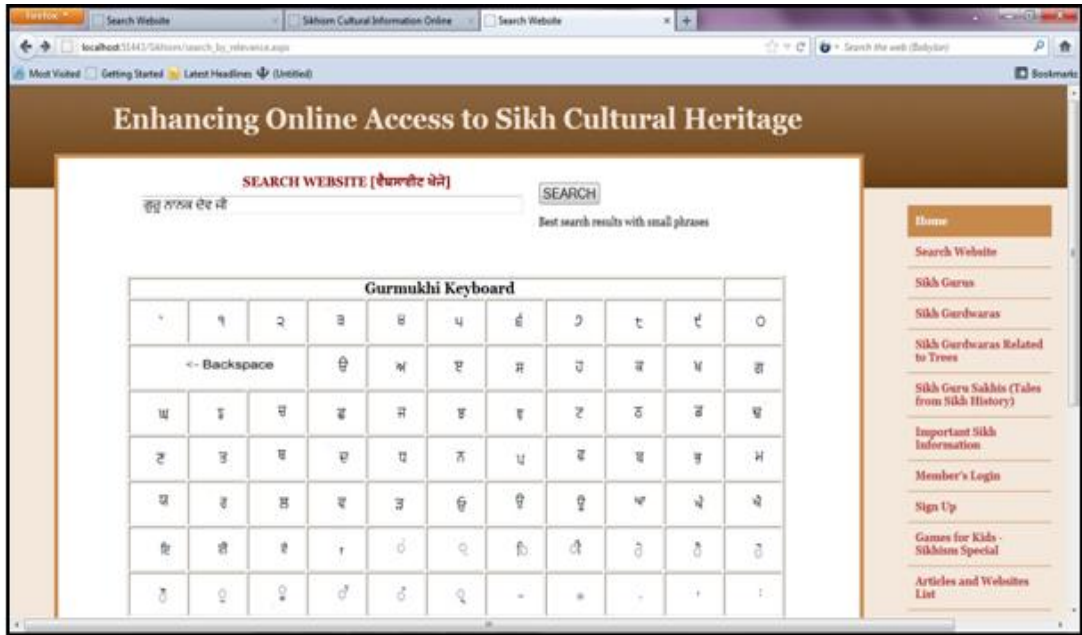


Figure 4.6 – Search by Relevance (English)

As in Figure 4.6, the phrase searched is '5 pyara'. It produces two search results. This means the first relevant result is having the title 'Panj Pyare (Five Beloved Ones)' and the second most relevant result has the title 'Panj Kakkar'. This search feature produces the associated results, according to the phrase searched for, Page Rank Wise. Here link 'Panj Pyare (Five Beloved Ones)' is at the first rank and link 'Panj Kakkar' is at the second rank of relevance.



Response.Redirect



Figure 4.7 – Search by Relevance (Punjabi)

### iii. Searching Metadata

Searching Metadata feature of the portal is provided for enhancement of the cultural portal. If any user wants to add more information at any page (Example – To add more Sikh Shrines etc.) of the portal, then he can first search the metadata of the

tables used on the portal and request to edit or add information, by filling the 'Edit Information Request' form. Searching metadata will generate the metadata (of table) of the search query and the contents of the table.

If a user requests to search metadata, he has to enter his/her email - address, to which administrator will respond and give access rights to the user for metadata search.

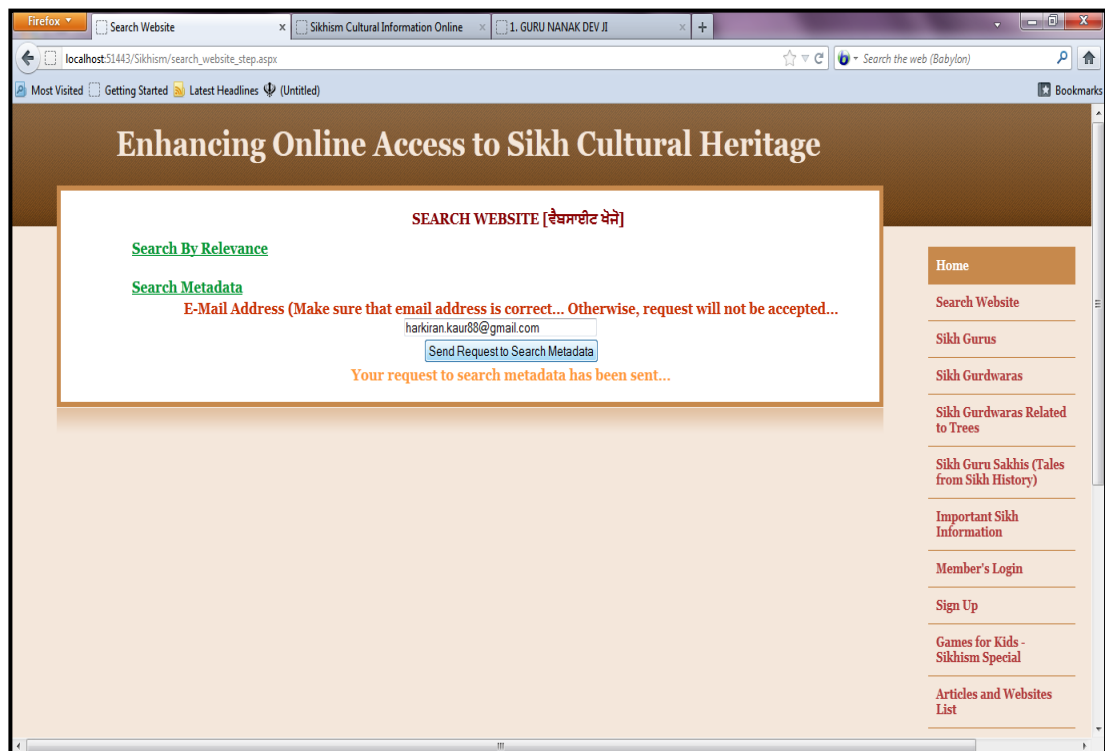


Figure 4.8 – Searching Metadata Request

#### 4.2.5 Login Form

Login Form is used to build relationship with user and provides user some features like Search Website, Access cultural information available online, Games for kids, etc. User enters his user id and password and click login button. For new users, Sign Up option is available. User enters all the information in the form and his id is created successfully, and he gets registered with the portal to access the pages discussed earlier.

**Enhancing Online Access to Sikh Cultural Heritage**

**Sign Up !**

First Name	Nancy	
Last Name	Arora	
Date of Birth	15-08-1989	(dd-mm-yyyy)
Age	22	
Desired User Id	nancy	Check Availability @sikh.org Available
Password		
Confirm Password		
Gender	Female	
Country	India	
Security Question	What is my favorite color ?	
Answer	red	
Mobile No.	9475612345	
User Type	Beginner or Learner	
Word Verification (Enter code in small letters)	bappearb79	bappearb79
User account created successfully		
		

Home

Search Website

Sikh Gurus

Sikh Gurdwaras

Sikh Gurdwaras Related to Trees

Sikh Guru Sakhis (Tales from Sikh History)

Important Sikh Information

Member's Login

Change Password

Sign Up

Games for Kids - Sikhism Special

Articles and Websites List

Sikhism Gallery

Sikh Glossary

Site Map

Like 6 likes. Sign Up to see v

Figure 4.9 – Sign Up

### Cultural Portal Accessibility:

#### According to User Type and Age

During Sign Up, depending upon the date of birth, system calculates the age of user and depending on the user type selected by the user, cultural data is accessible to the users. This is done so that users can learn about Sikhism, according to their respective levels. Example – Kids, beginners and learners can play games created for easy learning about Sikhism. Articles and Websites list published as links provided to existing online resources on a page and are accessible by experts only, to enhance their knowledge about Sikhism.

Table 4.1 – User Access Rights depending on user type

User Type	Pages Access Rights
Beginner or Learner	Games (Sikhism Special)
Kid	Games (Sikhism Special)
Expert	Articles and Websites List

After creating his/her account, user can login, by clicking on Member’s Login menu.

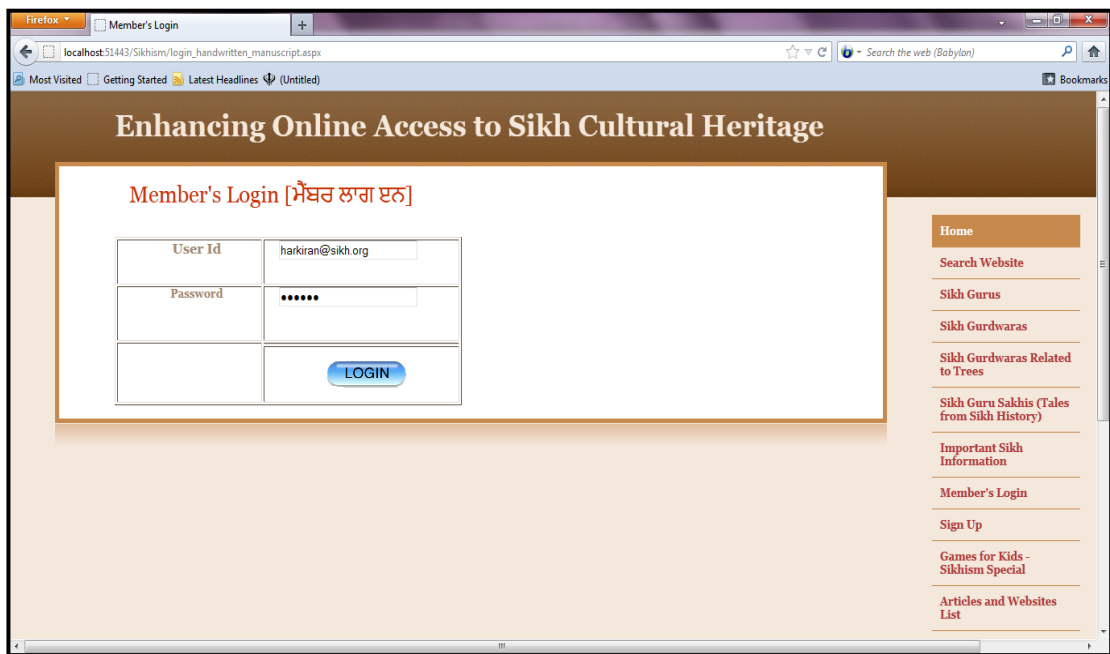


Figure 4.10 – Member’s Login (Step 1)

After clicking on the login button (Figure - 4.10), a screen appears generating a code (from Sikh Scripture – Sri Guru Granth Sahib). Gurmukhi Keyboard is available for users to enter the code. By clicking on these buttons, user has to type the code as shown in the CAPTCHA generated dynamically. After correctly entering this code and pressing the ‘Login’ button, login process completes.

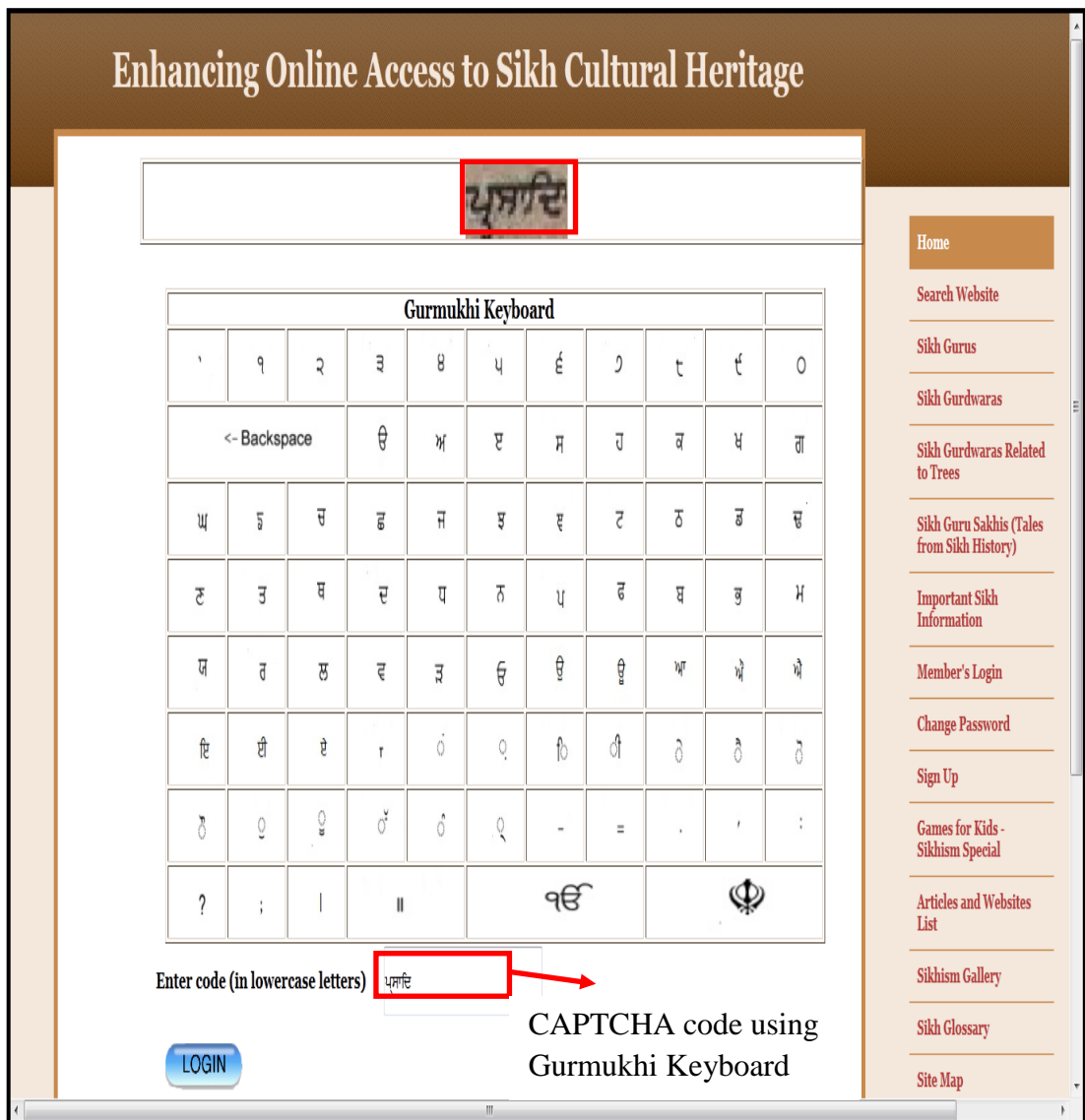


Figure 4.11 – Member’s Login Handwritten Code (Last Step)

### Digitization of Scripture using CAPTCHAs

This login processes digitizes the scriptures’ pages in sequence in a folder. In this portal, I have designed the system to digitize one page of Sri Guru Granth Sahib (both printed and handwritten). The printed scriptures’ one page gets digitized in 154 executions of the code, whereas, the handwritten scriptures’ one page gets digitized in 253 executions of the code. (Details discussed in further chapters)

## 4.2.6 Games for Kids, Beginners and Learners

Games are designed for beginners or learners of Sikhism and for kids. Kids get attracted by gaming and stuff, and learn in a playful manner about new things. The idea is to make them learn in an interactive way, than just reading about Sikhism.

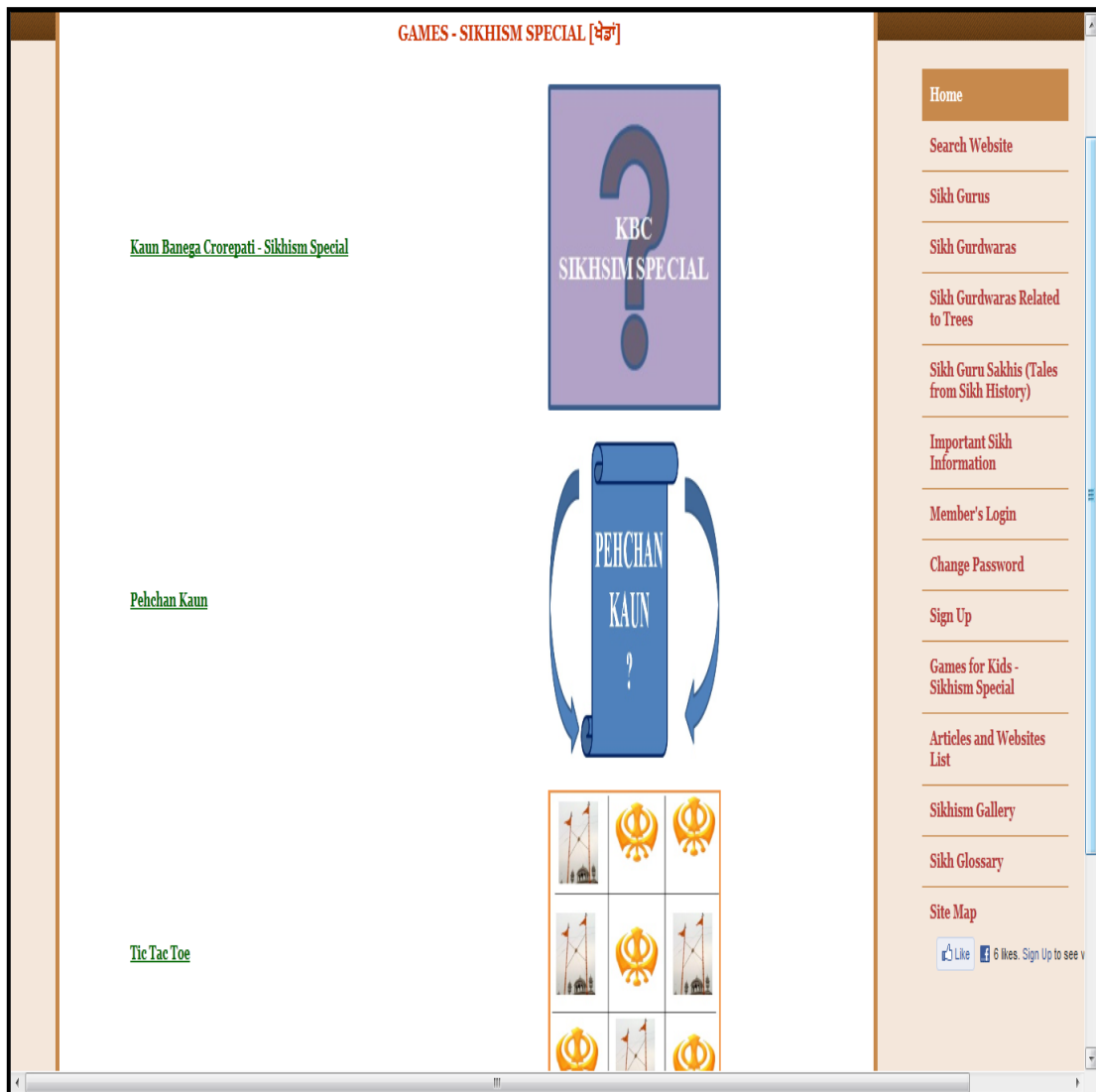


Figure 4.12 – Games (Sikhism Special) on Portal

### i. Kaun Banega Crorepati

This is a quiz game, like Kaun Banega Crorepati game show. The difference is that this game challenges players for questions related to Sikhism. There are two

lifelines, Odd - One Out (to remove one wrong option) and Expert Advice. As the user answers questions one by one, the points earned by user increases.

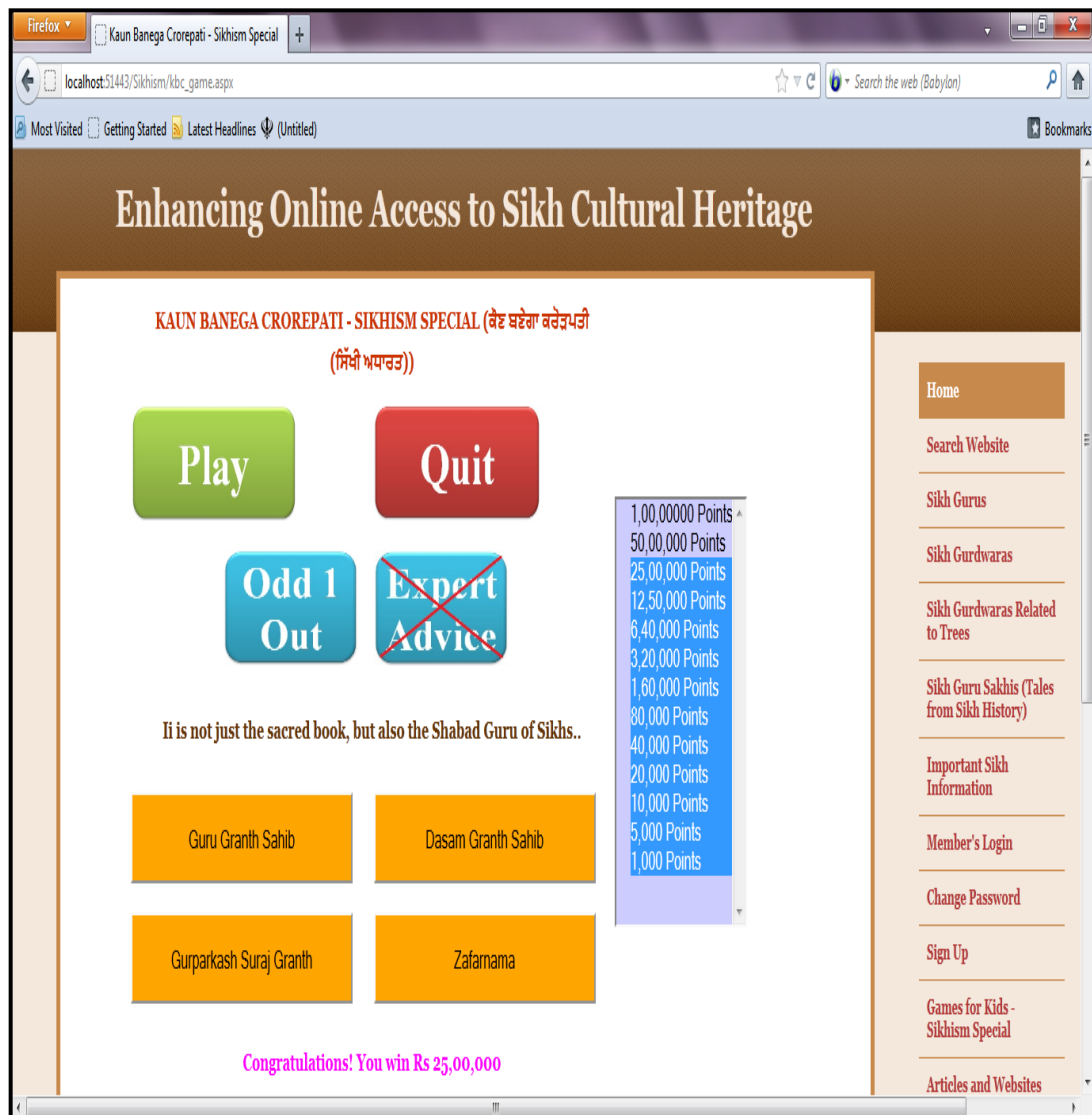


Figure 4.13 – Kaun Banega Crorepati (Sikhism Special) Game

## ii. Pehchan Kaun

This game questions the user about the picture given as question. Out of the two options user has to identify the correct option. Points are given for each correct answer and game over for wrong answer.



Figure 4.14 – Pehchan Kaun (Sikhism Special) Game

Kids learn easily by identifying pictures. For this reason, this game is designed to create a clear image about various contents in Sikhism, on their minds. It is easy to remember pictures rather than reading text.

### iii. Tic Tac Toe Game

This game is somewhat like kids' Tic – Tac – Toe Game. Two players add their names and click on 'Play' button. The next screen shows four stages. Each stage starts by clicking 'Go' button. Instead of 'O', I have used Sikh Symbol - Khanda and in place of 'X', Sikh Flag – Nishan Sahib is used. After each stage, user is shown a Gurdwara's (Sikh Shrine) picture, giving a feel to the user, that he has reached the Gurdwara as the destination of a particular stage.

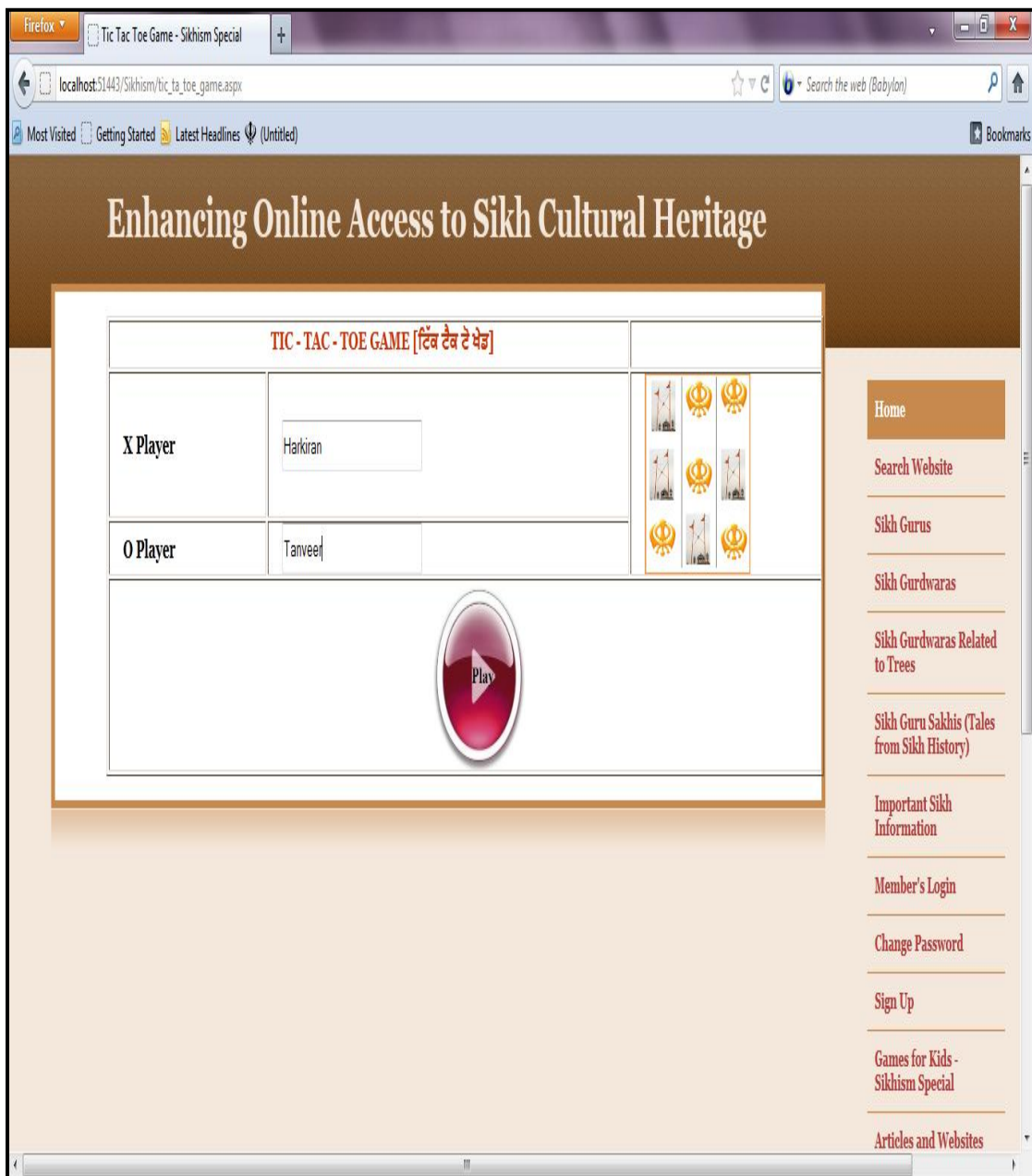


Figure 4.15 – Tic Tac Toe Game Start Page



Figure 4.16 – Tic Tac Toe Game

On moving the cursor on these buttons, Tooltip gives the information about the picture like Sikh – Flag Nishan Sahib and Sikh Symbol – Khanda, to give the users feel of Sikhism and know about these pictures on the buttons. On completion of every stage, the completed stage goes green in colour. After four stages game is over. At the completion of each stage, user reaches a destination (Sikh Shrine), and makes the user know about different Sikh Shrines.

Here is the destination page of Tic – Tac – Toe Game.

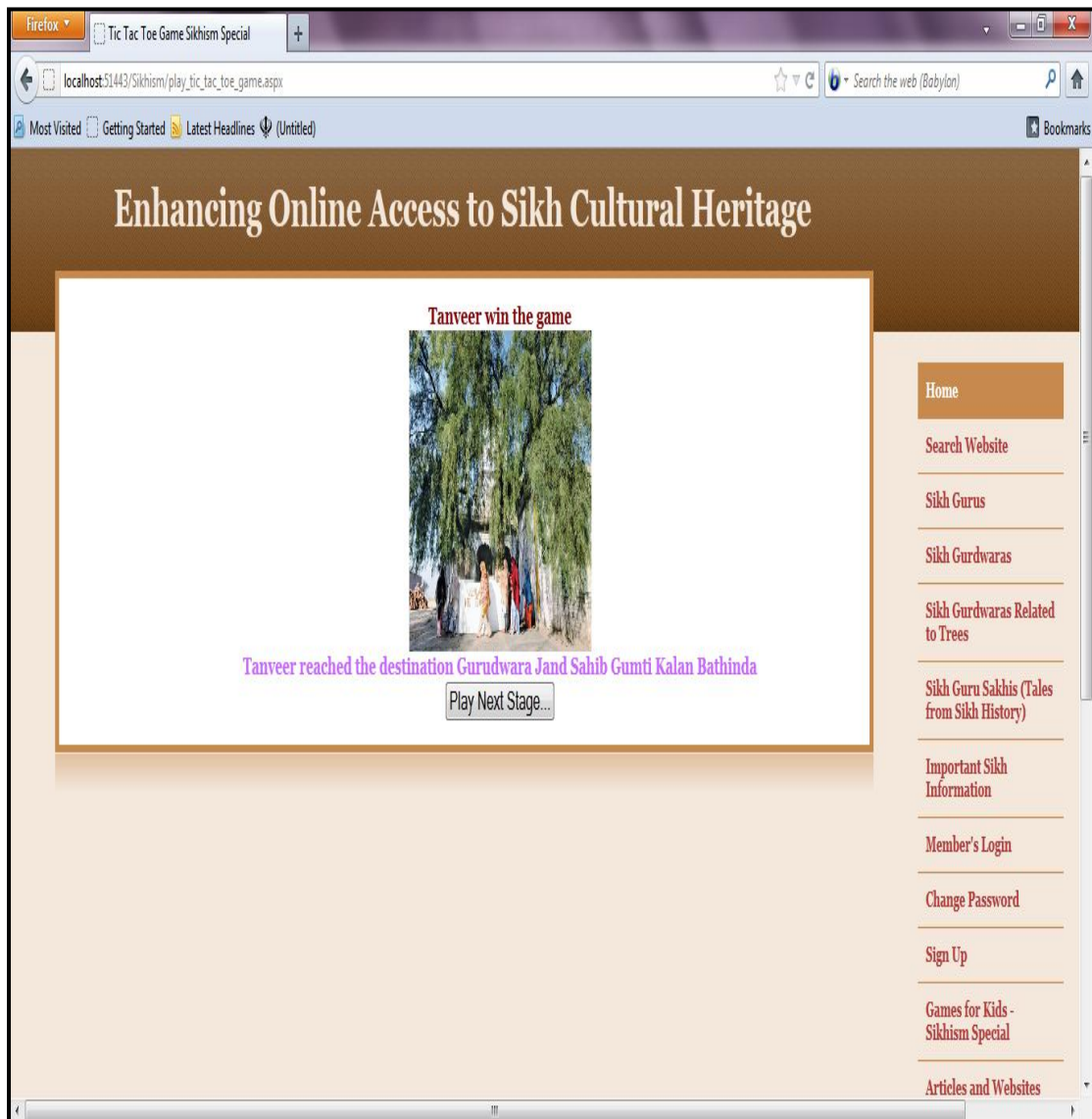


Figure 4.17 – Tic – Tac – Toe Game Stage Completion

#### 4.2.7 Social Plugins on Cultural Portal

Social Networking Websites are used for maximum time by youth these days. To make our youth understand about different cultures, the need of the hour is to use social networking and cultural computing altogether to achieve this goal. To solve this problem, a cultural portal using the concepts of Cultural Computing has been built. I focus on the enhancement of online access to Sikh cultural heritage. This cultural portal has been integrated with Social Networking website Facebook. For integrating

the cultural portal with Facebook, Social Plugins on Facebook Developers site are used.

The social plugins are not as it is compatible with ASP.NET websites. For this I have used SocialNetwork.dll libraries in the toolbox of ASP.NET.

Table 4.2 – SocialNetwork.dll

SocialNetwork.dll	
Tool	FacebookLike
Namespace	SocialNetwork.Facebook
Assembly Name	SocialNetwork (1.0.0.0)

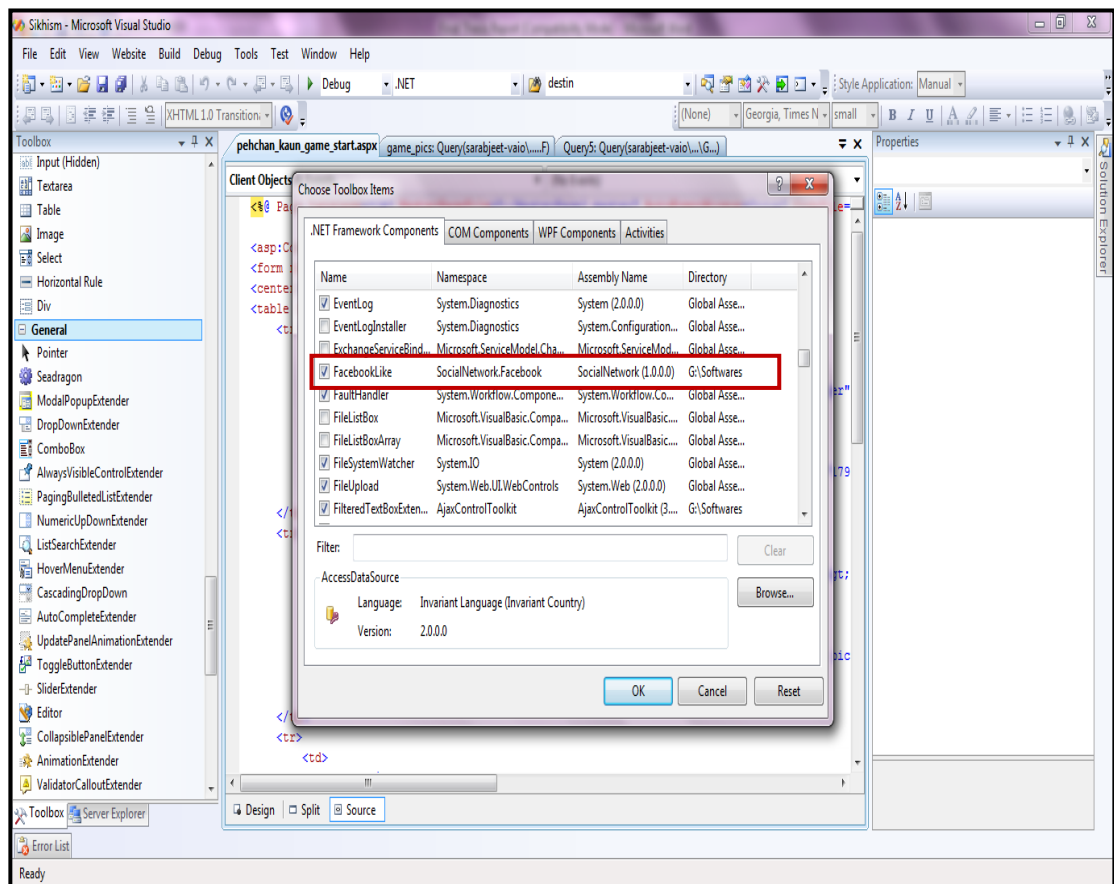


Figure 4.18 – Facebook like Tool in ASP.NET

## Social Plugins from Facebook Developers

A number of social plugins are available with Facebook developers, such as, like button, send button, comments, and many more. These social plugins let you see what your friends have liked, subscribed, commented or shared.

Here is the view of Facebook developers website.

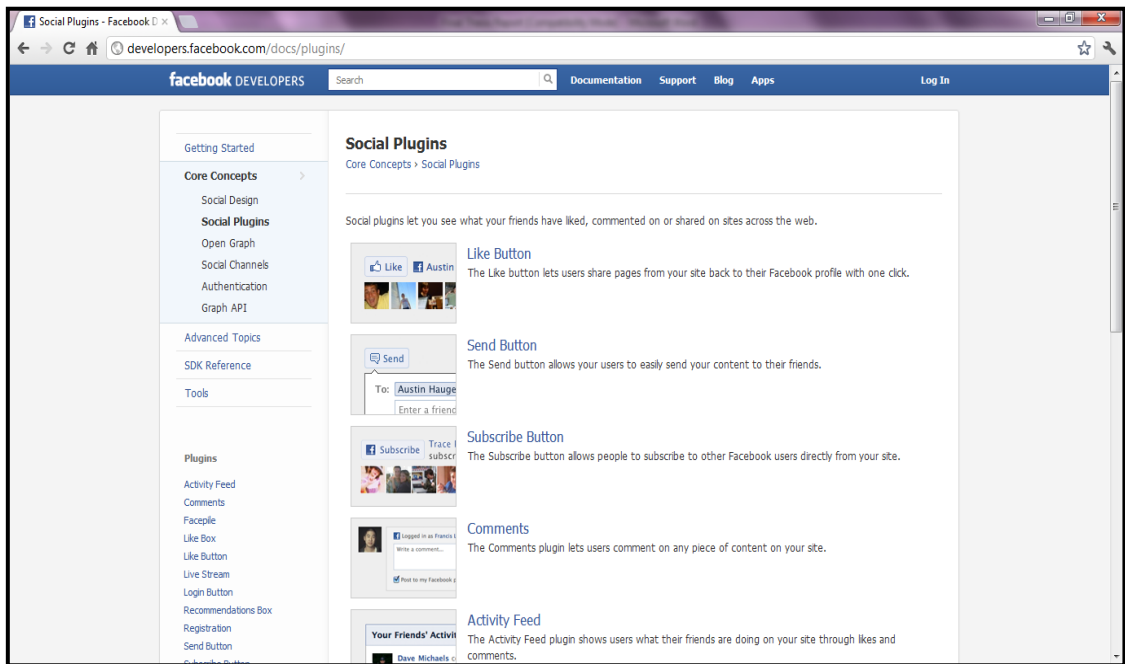


Figure 4.19 – Social Plugins of Facebook

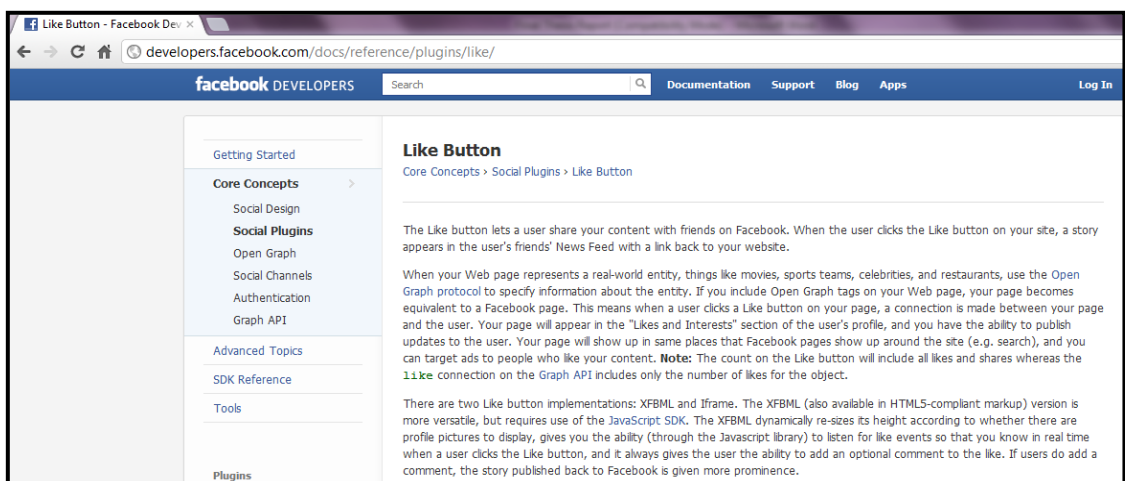
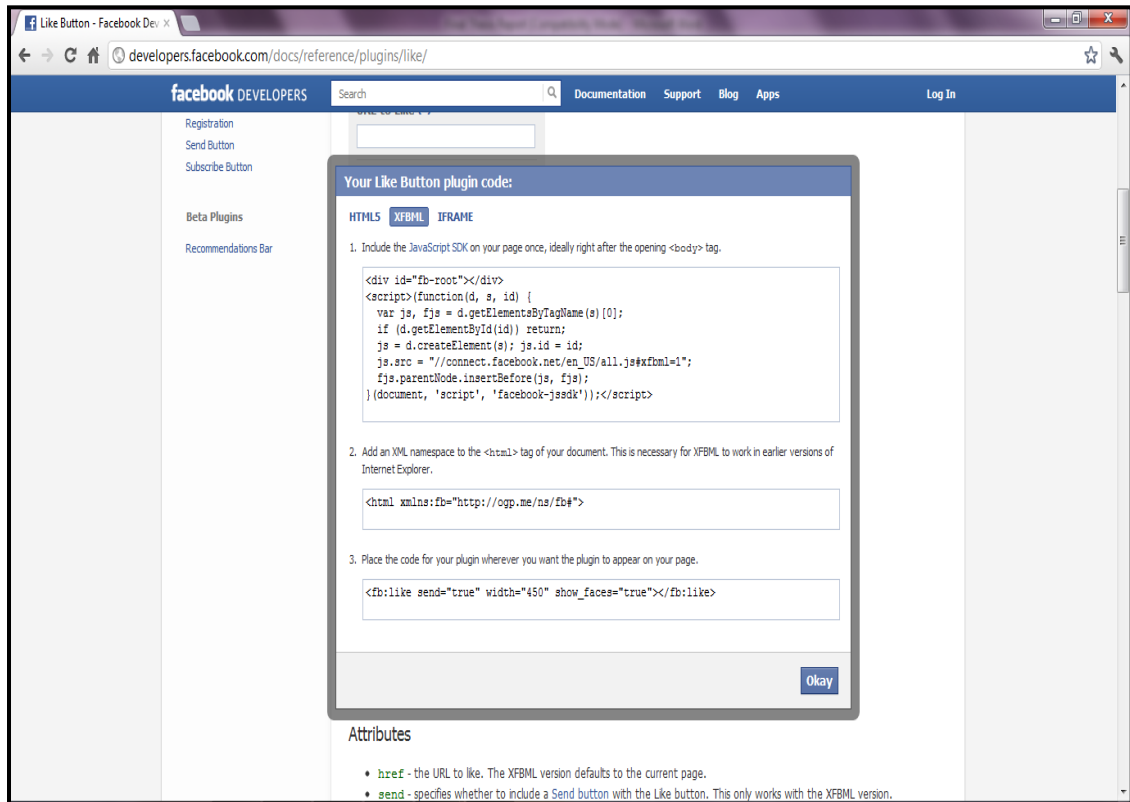


Figure 4.20 – Facebook Developers 'Like' button

On the web pages of the cultural portal, the code used for Like button is here.



The screenshot shows the Facebook Developers website with a modal window titled "Your Like Button plugin code:". The modal contains three tabs: "HTML5", "XFBML", and "IFRAME". The "XFBML" tab is selected, showing the following code:

```
<div id="fb-root"></div>
<script>(function(d, s, id) {
  var js, fjs = d.getElementsByTagName(s)[0];
  if (d.getElementById(id)) return;
  js = d.createElement(s); js.id = id;
  js.src = "//connect.facebook.net/en_US/all.js#xfbml=1";
  fjs.parentNode.insertBefore(js, fjs);
})(document, 'script', 'facebook-jssdk')</script>
```

Below the code, there are three numbered instructions:

1. Include the JavaScript SDK on your page once, ideally right after the opening <body> tag.
2. Add an XML namespace to the <html> tag of your document. This is necessary for XFBML to work in earlier versions of Internet Explorer.
3. Place the code for your plugin wherever you want the plugin to appear on your page.

The modal also shows the following code for the XFBML version:

```
<html xmlns:fb="http://ogp.me/ns/fb#">
```

```
<fb:like send="true" width="450" show_faces="true"></fb:like>
```

At the bottom of the modal, there is an "Okay" button. Below the modal, the "Attributes" section is visible, listing the following attributes:

- **href** - the URL to like. The XFBML version defaults to the current page.
- **send** - specifies whether to include a **Send button** with the Like button. This only works with the XFBML version.

Figure 4.21 – Like Button Code for Portal

### Increasing Efficiency of Cultural Portal

---

As discussed in the previous chapter, digitization of the Ancient Scriptures related to Sikhism is done using CAPTCHAs. Also, the search feature is provided on the portal for getting the relevant results for any information searched, as well as the searching metadata feature.

This chapter discusses that how the efficiency of cultural portal is taken under consideration while providing these features.

#### 5.1 Digitization of Ancient Scriptures related to Sikhism

The rare collection of these scriptures will be lost, if not attended and preserved for future generations. The ancient scriptures of Sikhism are available both in printed and handwritten form. Digitization of these scriptures using CAPTCHAs will be a great help in preserving these scriptures as well as in providing security simultaneously.

CAPTCHA stands for “Completely Automated Public Turing test to tell Computers and Humans Apart”. It is kind of Challenge - Response test used in computing, so as to ensure that the response is generated by a person. It prevents automated software from filling out the form. These are designed so as to keep away malicious computer "bots" and other automated programs, from using Web forms. CAPTCHAs are used for security purpose on the website. Several companies like Yahoo, Google, Microsoft, etc. offer free email services. CAPTCHAS prevent these email services from a specific type of attack "bots" - automated computer programs create a large number of email accounts.

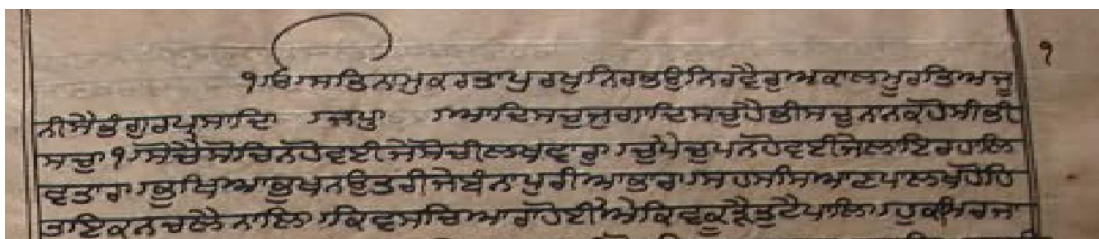


Figure 5.1 – Handwritten Text from Sikh Scripture (Sri Guru Granth Sahib)

CAPTCHA is somewhat like a challenge – response test. Example – password authentication system. The CAPTCHA challenges the user to type letters or digits appearing in the distorted image that are not understandable by computer programs. Two different approaches are used for digitizing the handwritten as well as printed Sikh Scriptures, in Login Process for members of cultural portal. The members will have to enter the code as visible in the CAPTCHA image and click on ‘Login’ button. Each CAPTCHA will be visible only once to every user of the cultural portal. The Login Process completes only after entering the CAPTCHA code.

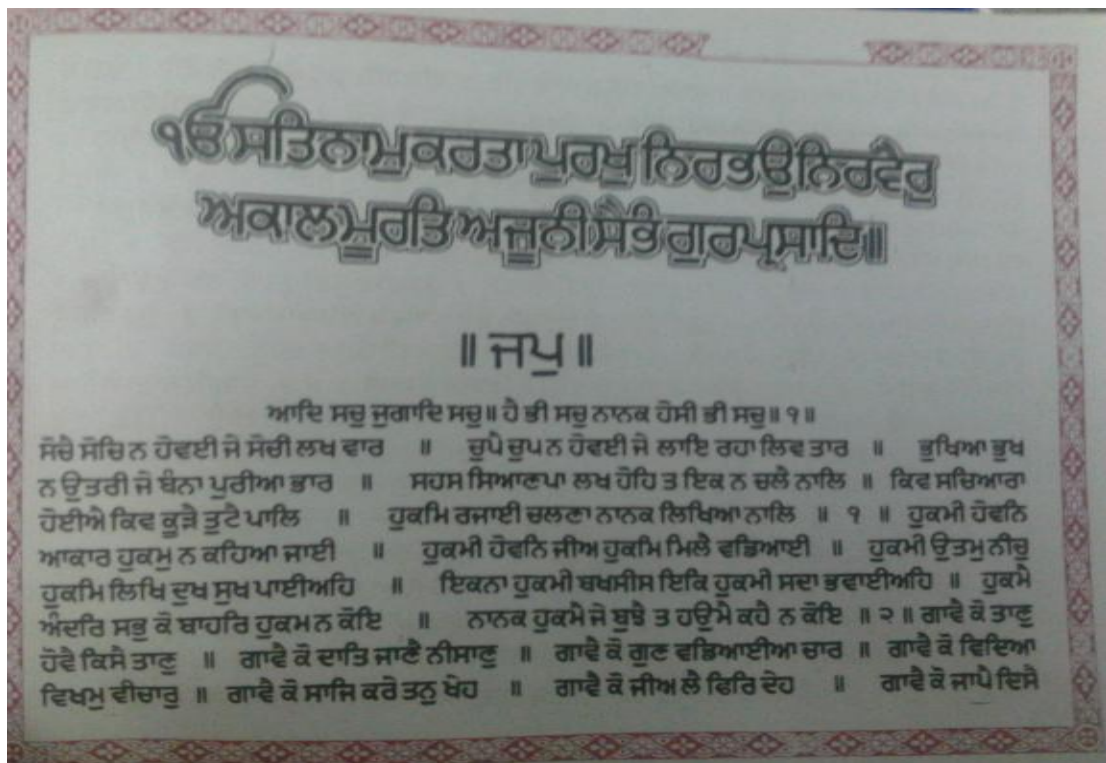


Figure 5.2 – Printed Text from Sikh Scripture (Sri Guru Granth Sahib)

### 5.1.1 Digitization of Printed Sikh Scriptures

In this thesis, I have implemented the digitization of one page of printed Sikh scripture, Sri Guru Granth Sahib (SGGS). One page of this scripture gets digitized in 154 executions of the code, used for the purpose. The processing of printed CAPTCHA is shown in Figures 5.3, Figure 5.4 and Figure 5.5. The dynamic generation of CAPTCHA (word by word in page wise sequence), is shown in Figure 5.3.

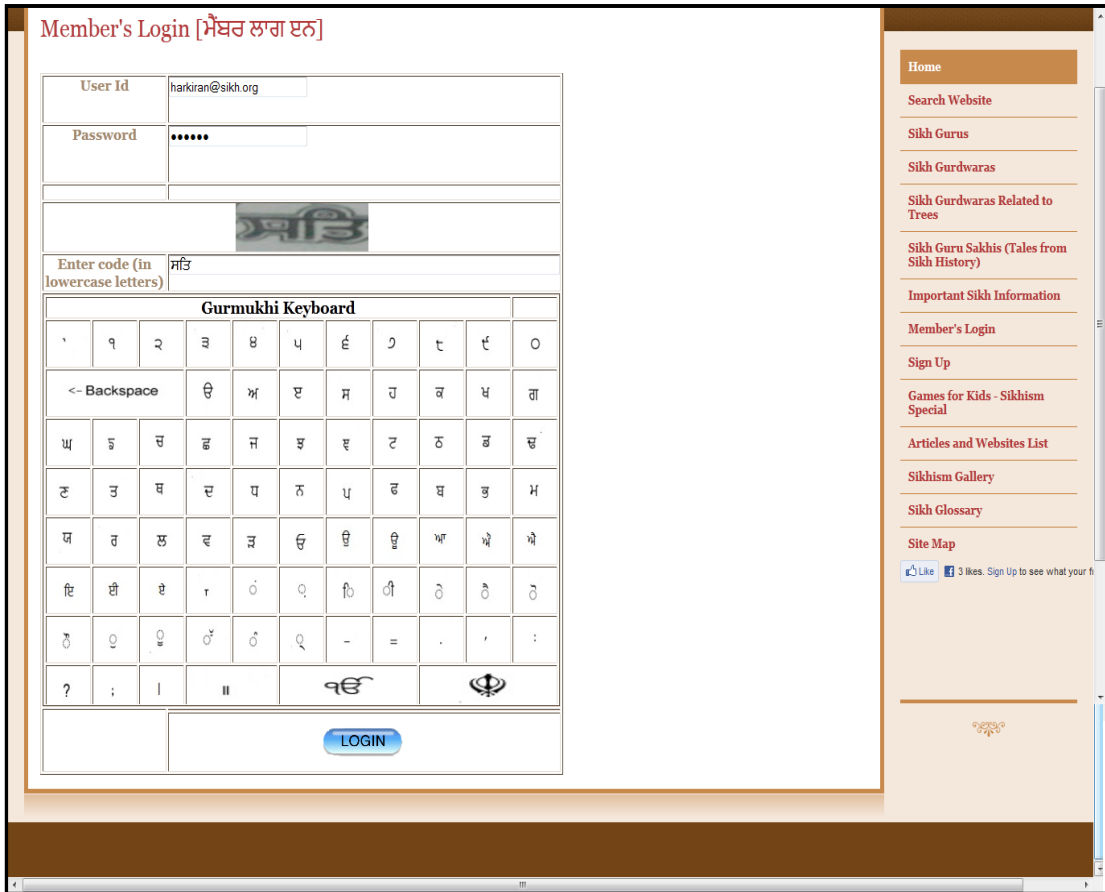


Figure 5.3 – Dynamic CAPTCHA generation (from printed SGGS scripture) on Login Page

After each CAPTCHA is processed, it will get digitized (saved in a folder). This way the whole scripture can be digitized and be preserved for future generations.

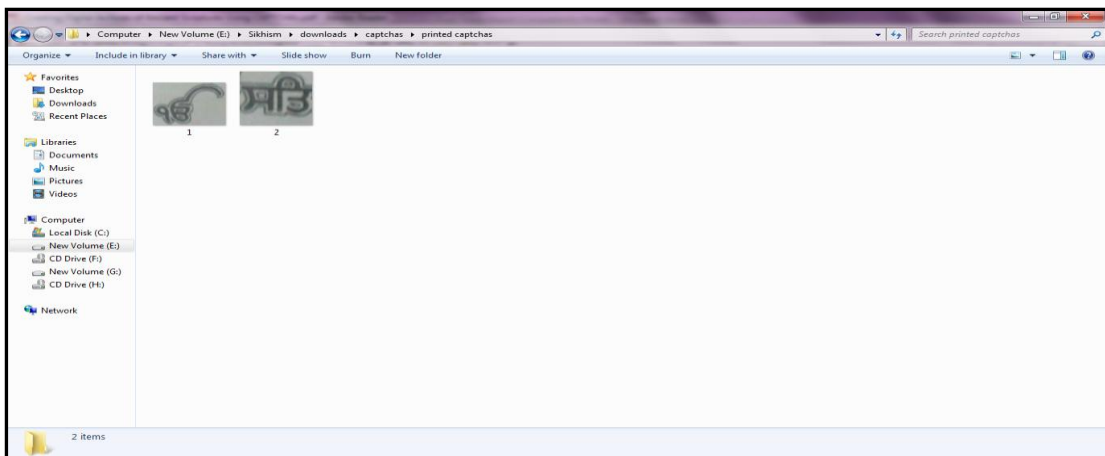


Figure 5.4 – Digitized CAPTCHAs of SGGS Scripture (Printed)

If the user enters wrong code, then the message appears ‘Code Entered Incorrectly’. Then, user will again have to enter the code and press ‘Login’ button.

**Member's Login [ਮੈਂਬਰ ਲਾਗ ਦਨ]**

User Id: harkiran@sikh.org

Password: [Redacted]

Enter code (in lowercase letters): ਨਾਮ

**Gurmukhi Keyboard**

,	ੴ	ੲ	ੳ	ੴ	ੵ	੶	੷	੸	੹	੺	੻	੼	੽	੾	੿
<- Backspace			ੴ	ਅ	ੲ	ਸ	ਹ	ਕ	ਖ	ਗ					
ਘ	ਙ	ਚ	ਛ	ਜ	ਝ	ਞ	ਟ	ਠ	ਡ	ਢ					
ਣ	ਤ	ਥ	ਦ	ਧ	ਨ	ਪ	ਫ	ਬ	ਭ	ਮ					
ਯ	ਰ	ਲ	ਵ	ਸ਼	ਰ਼	ਲ਼	ਲ਼	ਅ਼	ਐ	ਓ					
ੲ	ੳ	ੴ	ੵ	੶	੷	੸	੹	੺	੻	੼	੽	੾	੿		
ੴ	ੵ	੶	੷	੸	੹	੺	੻	੼	੽	੾	੿				
?	:		=	ੴ				ੵ							

**Code Entered Incorrectly!**

**LOGIN**

Figure 5.5 – Validation Process of Printed CAPTCHA

**Flowchart depicting processing of printed CAPTCHA**

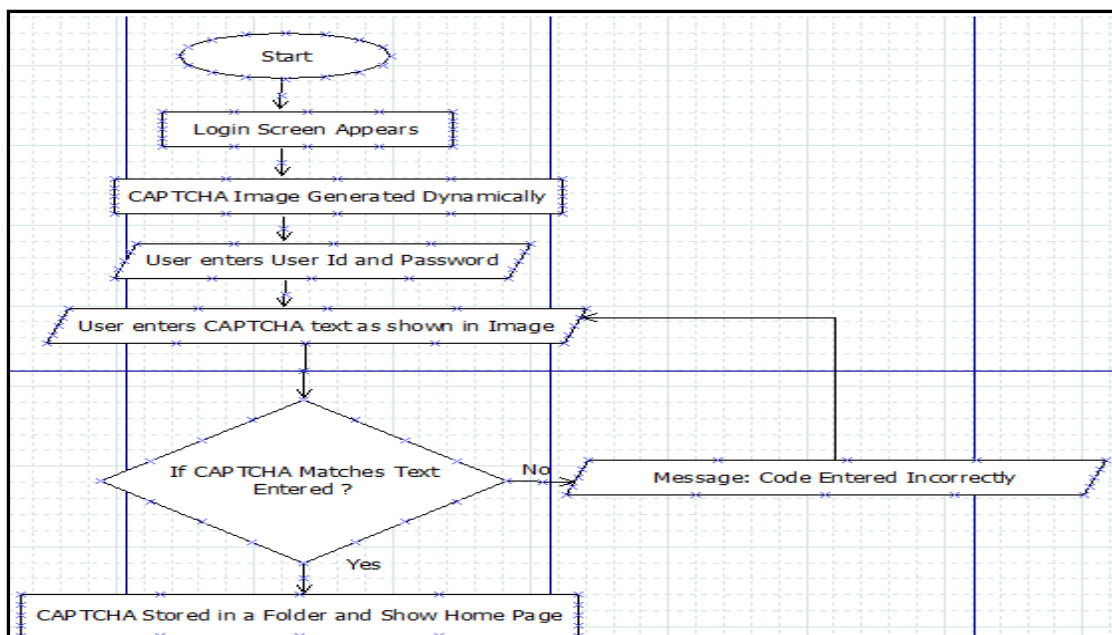


Figure 5.6 – Flowchart depicting processing of Printed CAPTCHA

### 5.1.2 Digitization of Handwritten Sikh Scriptures

The handwritten Sikh scriptures are deteriorating, day by day. In order to preserve these ancient scriptures, and make them available for our future generations; they need to be digitized. After the user enters his/her user id and password, a screen appears, asking the user to enter the code as shown in CAPTCHA image. Each CAPTCHA of the scripture is visible only once to every user of the cultural portal. The Login Process is completed only after entering the CAPTCHA code. This way, a repository of the words of manuscript will be formed and scripture would be digitized.

The screenshot shows a login interface. At the top, there is a CAPTCHA image displaying the handwritten Gurmukhi text 'ਕਰਤਾ'. Below this is a 'Gurmukhi Keyboard' with the following layout:

Gurmukhi Keyboard										
,	ੴ	ੲ	ੳ	ੴ	ੵ	੶	੷	੸	੹	੺
<- Backspace		ੴ	ਅ	ੲ	ਸ	ਹ	ਕ	ਖ	ਗ	
ਘ	ਙ	ਚ	ਛ	ਜ	ਝ	ਞ	ਟ	ਠ	ਡ	ਢ
ਲ	ਤ	ਥ	ਦ	ਧ	ਨ	ਪ	ਫ	ਬ	ਭ	ਮ
ਯ	ਰ	ਲ	ਵ	ੜ	ੴ	ੴ	ੴ	ਆ	ਐ	ਐ
ਇ	ਈ	ਏ	ੴ	ੴ	ੴ	ੴ	ੀ	ੇ	ੈ	ੴ
ੴ	ੴ	ੴ	ੴ	ੴ	ੴ	-	=	.	,	:
?	;			ੴ			ੴ			

Below the keyboard, there is a text input field with the label 'Enter code (in lowercase letters)'. The field contains the text 'ਕਰਤਾ'. Below the input field is a blue 'LOGIN' button.

Figure 5.7 – Dynamic CAPTCHA generation (from handwritten SGGS scripture) on Login

The code information (if entered wrong) by the user while solving the CAPTCHA is stored in the database. This code will be verified by the administrator of the database. Administrator will observe if many of the users are experiencing errors while entering a particular CAPTCHA; then he will make changes in that very CAPTCHA to solve the visibility issue.

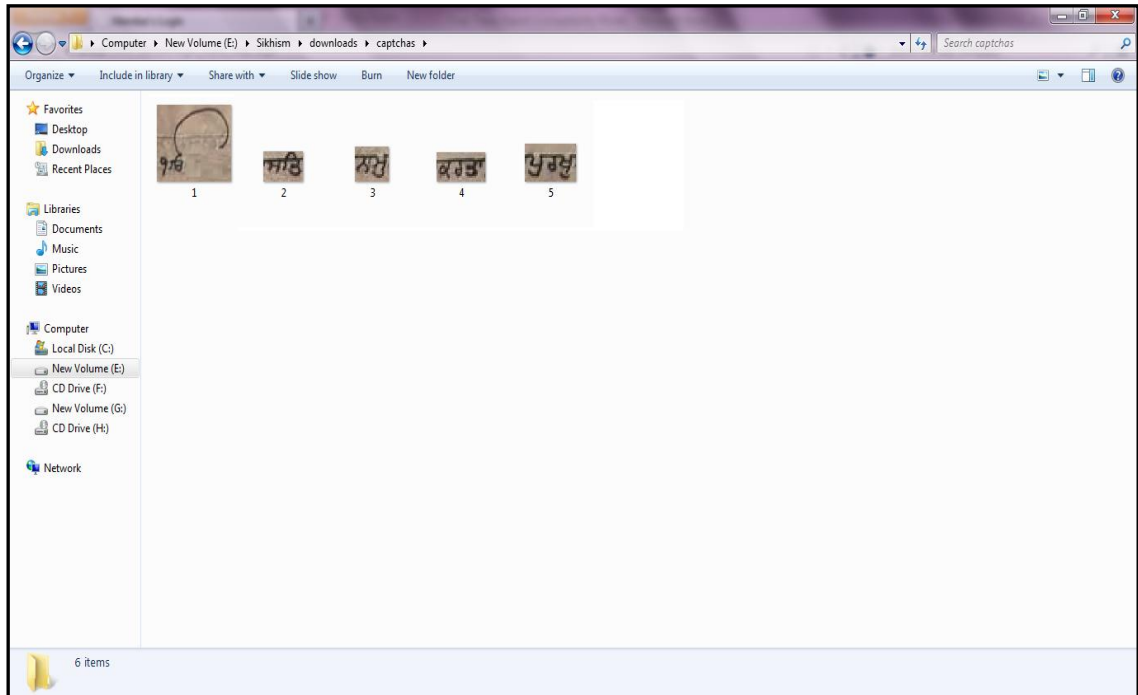


Figure 5.8 - Digitized CAPTCHAs of SGGS Scripture (Handwritten)

CAPTCHAs add to the security feature of the cultural portal. The cultural portal will be prevented from an attack called bots. CAPTCHA will confirm that the user trying to login or create a new user account is a human, not an automated program. One page of this copy of the handwritten Sikh scripture, SGGS is digitized in 253 executions of the code for this purpose.

If the user enters the code wrong, then a message appears ‘Code Entered incorrectly’. When user clicks on ‘Go Back’ button, then new CAPTCHA image will be generated on the screen, to be entered by the user. The user is given three chances, to enter the code correctly.

If the user enters the wrong code third time, page will redirect to login screen.



Figure 5.9 – Validation Process of Handwritten CAPTCHA

## Flowchart depicting processing of Handwritten CAPTCHA

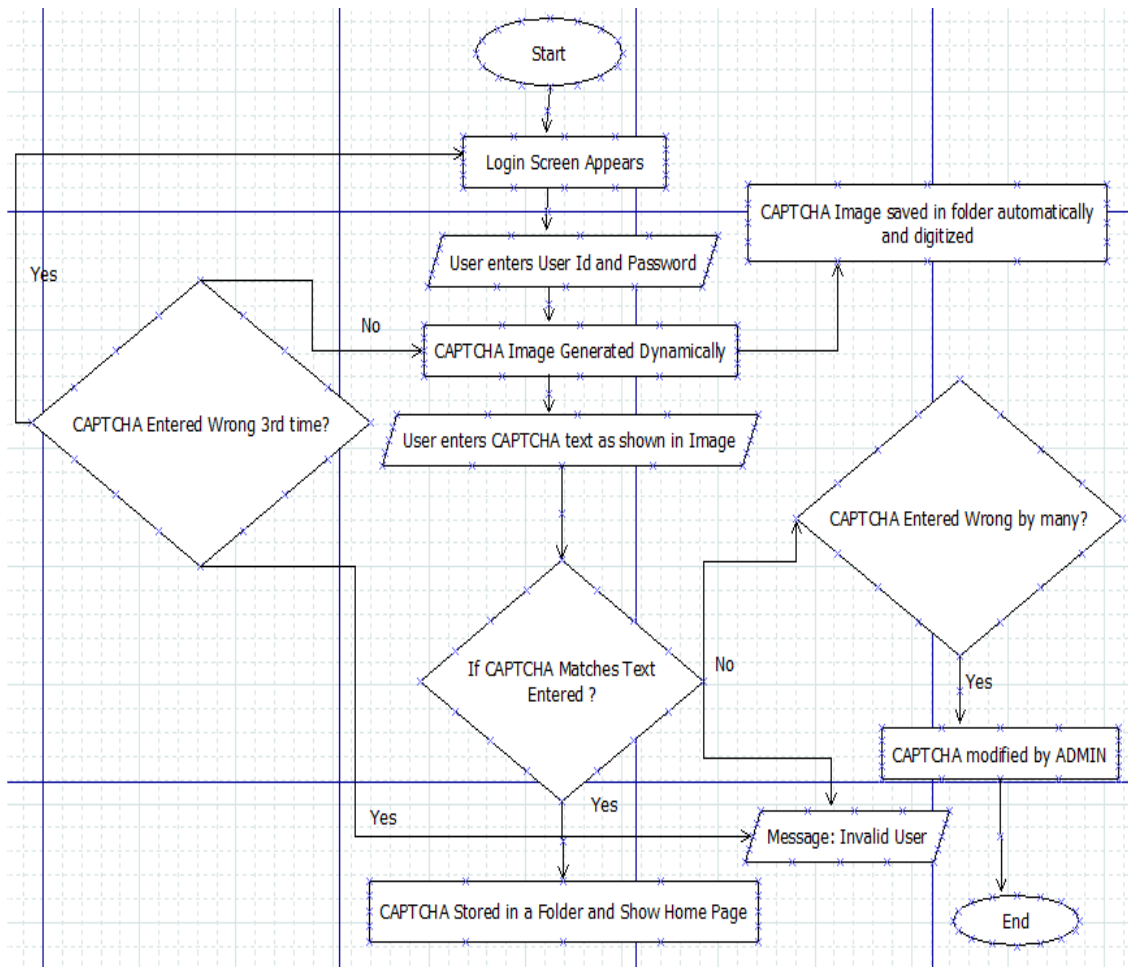


Figure 5.10 – Flowchart depicting processing of Handwritten CAPTCHA

## 5.2 Semantic Search on the Cultural Portal

Semantic Relatedness focuses on the likeness of meaning of the words in consideration. If the two words have same meaning, then on searching about any of the two should produce same results. Otherwise, if a user searches one word or the other, the system will produce different results, hindering the search mechanism. Using Semantic relatedness for word search has various applications. The Semantics are well understood by humans, than computers.

So, to make the computers understand the semantics, some of the approaches are being introduced in this thesis. It is kind of artificial intelligence system, to make the system intelligent enough to understand the meanings of words. Semantic relatedness of words is helpful in determining the page rank (for the desired information). A set of words can be represented or written in many ways.

### **5.2.1. Implementation of Semantic Relatedness on Cultural Portal**

Example – A user searches for ‘five takhats of Sikhs’ on the cultural portal. This can be searched by user by writing any of the following group of words:

five takhats

5 takhts

5 takhats

panj takhat (Panj means 5)

five takhats of Sikhs,

punj takhat

takhats of Sikhs, and many more.

Search words can be different in orientation of words, spellings or the language difference that introduces different way of representing it. The system should be made intelligent enough to understand that - any of these, means the same thing. The difference among all the words in example above (1-7) is very minor. These words differ from each other, just in case of spellings and orientation of words. Also, ‘5’ is represented as ‘panj/punj’ in Punjabi and ‘takhat’ can be written both ways, that is, ‘takht/takhats’.

Example – ‘panj pyare’ is a word in Punjabi which can be written in roman like this. But, in English, it is interpreted as ‘five beloved ones’. This is the different way to represent ‘panj pyare’ rather than a small difference in the spellings.

To understand the meaning of the word searched by the user, options of words searched are stored as a repository. If the user searches for any of the words like these options, then the relevant results are shown, Page Rank Wise.

## 5.2.2 Page Rank in Searching

System produces relevant results Page rank wise. This means, the most relevant result at the first position, then the next near relevant result and so on. Page rank determines the relative importance of a page in a set of search results.

Column Name	Data Type	Allow Nulls
word1	varchar(500)	<input checked="" type="checkbox"/>
word2	varchar(500)	<input checked="" type="checkbox"/>
word3	varchar(500)	<input checked="" type="checkbox"/>
word4	varchar(500)	<input checked="" type="checkbox"/>
word5	varchar(500)	<input checked="" type="checkbox"/>
word6	varchar(500)	<input checked="" type="checkbox"/>
word7	varchar(500)	<input checked="" type="checkbox"/>
word8	varchar(500)	<input checked="" type="checkbox"/>
word9	varchar(500)	<input checked="" type="checkbox"/>
word10	varchar(500)	<input checked="" type="checkbox"/>
link1	varchar(500)	<input checked="" type="checkbox"/>
link2	varchar(500)	<input checked="" type="checkbox"/>
link3	varchar(500)	<input checked="" type="checkbox"/>
link4	varchar(500)	<input checked="" type="checkbox"/>
link5	varchar(500)	<input checked="" type="checkbox"/>
link6	varchar(500)	<input checked="" type="checkbox"/>
link7	varchar(500)	<input checked="" type="checkbox"/>
link8	varchar(500)	<input checked="" type="checkbox"/>
link9	varchar(500)	<input checked="" type="checkbox"/>

Column Name	Data Type	Allow Nulls
link10	varchar(500)	<input checked="" type="checkbox"/>
title1	varchar(500)	<input checked="" type="checkbox"/>
title2	varchar(500)	<input checked="" type="checkbox"/>
title3	varchar(500)	<input checked="" type="checkbox"/>
title4	varchar(500)	<input checked="" type="checkbox"/>
title5	varchar(500)	<input checked="" type="checkbox"/>
title6	varchar(500)	<input checked="" type="checkbox"/>
title7	varchar(500)	<input checked="" type="checkbox"/>
title8	varchar(500)	<input checked="" type="checkbox"/>
title9	varchar(500)	<input checked="" type="checkbox"/>
title10	varchar(500)	<input checked="" type="checkbox"/>
word11	varchar(500)	<input checked="" type="checkbox"/>
word12	varchar(500)	<input checked="" type="checkbox"/>
word13	varchar(500)	<input checked="" type="checkbox"/>
word14	varchar(500)	<input checked="" type="checkbox"/>
word15	varchar(500)	<input checked="" type="checkbox"/>
word16	varchar(500)	<input checked="" type="checkbox"/>
word17	varchar(500)	<input checked="" type="checkbox"/>
word18	varchar(500)	<input checked="" type="checkbox"/>

word19	varchar(500)	<input checked="" type="checkbox"/>
word20	varchar(500)	<input checked="" type="checkbox"/>
word21	varchar(500)	<input checked="" type="checkbox"/>
word22	varchar(500)	<input checked="" type="checkbox"/>
word23	varchar(500)	<input checked="" type="checkbox"/>
word24	varchar(500)	<input checked="" type="checkbox"/>
word25	varchar(500)	<input checked="" type="checkbox"/>
word26	varchar(500)	<input checked="" type="checkbox"/>
word27	varchar(500)	<input checked="" type="checkbox"/>
word28	varchar(500)	<input checked="" type="checkbox"/>
word29	varchar(500)	<input checked="" type="checkbox"/>
word30	varchar(500)	<input checked="" type="checkbox"/>

Figure 5.11 – Semantics Repository Metadata

word1	word2	word3	word4	word5	word6	word7	word8	word9	word10	link
guru	sikh gurus	10 gurus in sikh...	10 sikh gurus	ten gurus	ten sikh gurus	das guru sahiban	das patshahian	ten patshahian	10 patshahian	sikh
5 pyaras	5 beloved ones	five beloved ones	5 piyaras	five pyara	five pyare	panj pyare	punj pyare	five pyaras	khalsa panth	pa
path	prayers	banis	sikh banis	sikh prayers	gurbani	sikh sangeet	hymns	holy hymns	paath	ba
guru nanak	guru nanak dev ji	pehli patshahi	pehli patshahi ...	nanak	patshahi pehli	founder of sikhi...	first guru of sikhs	1st guru of sikhs	NULL	sikh
gurdwaras	gurudwaras	sikh shrines	sikh gurdwaras	historical sikh g...	historical gurud...	historical sikh g...	historical sikh g...	sikh gurudwaras	NULL	gu
zafarnama	letter of victory	zaffarnama	zaffarnamah	zaffar nama	zaffar namah	zafar nama	guru gobind si...	NULL	NULL	za
dasam pita	guru gobind si...	tenth guru of si...	bajan wale	dasmi patshahi	dasvin patshahi	dasvi patshahi	guru gobind si...	guru gobind si...	waho waho go...	gu
chali mukte	40 muktas	40 liberated ones	40 muktae	40 mukte	chaali mukte	mukte	40 muktee	chali muktee	NULL	40
karah parshad	kada prashad	karah prashad	kada prasad	karah prasad	sacred pudding	sacred pudding...	karah parsad	karah prasad	karah parshad	gu
guru angad dev ji	duji patshahi	dosri patshahi	doosri patshahi	bhai lehna ji	2nd nanak	angad	guru angad	second nanak	dooji patshahi	gu
guru amar das ...	guru amar das ji	guru amardas s...	guru amardas ji	third nanak	3rd nanak	amar das	amardas	teesri patshahi	tiji patshahi	gu
guru ram das s...	guru ramdas sa...	guru ram das ji	guru ramdas ji	fourth nanak	4th nanak	chothi patshahi	chauthi patshahi	bhai jetha	bhai jetha ji	gu
guru arjan dev ji	guru arjan	arjan	fifth nanak	5th nanak	5th patshahi	panjvi patshahi	panjvin patshahi	fifth guru of sik...	5th guru of sikhs	gu
sikh martyrs	sikh shaheed	shaheed	martyrdom in s...	NULL	NULL	NULL	NULL	NULL	NULL	sikh
guru hargobind...	guru har gobin...	guru hargobind ji	guru har gobin...	6th nanak	sixth nanak	miri piri de maa...	miri piri de malak	sixth guru of sik...	patshahi chevin	gu
5 takhts	5 takhtas	five takhtas	five takhts	five takhtas	takhtas of sikhs	sikh takhtas	panj takhat	punj takhat	five takhtas of s...	5_
anand karaj	sikh marriage	marriage cerem...	marriage cerem...	sikh marriage c...	anand kaaraj	anand kaaraj ce...	laavan	4 laavan	four laavan in si...	an
ardas	sikh supplication	sikh invocation	sikh ardaas	sikh prayer	prayer of sikhs	ardaas	sikh ardas	NULL	NULL	an
guru har rai sah...	7th nanak	seventh nanak	seventh guru of...	7th guru of sikhs	seventh patshahi	7th patshahi	guru har rai ji	har rai	patshahi satvi	gu
guru har krisha...	8th nanak	eighth nanak	eighth guru of...	8th guru of sikhs	eighth patshahi	guru harkrishan ji	eighth patshahi	harkrishan	har krishan	gu
guru teg bahad...	guru teg bahad...	teg bahadur	9th nanak	ninth nanak	9th guru of sikhs	ninth guru of si...	ninth patshahi	9th patshahi	patshahi ninth	gu
four sahibzade	4 sahibzade	guru gobind si...	dasvin patshahi...	dasvin patshahi...	guru sahib de s...	4 princes of gur...	four princes of ...	sons of guru go...	sons of guru go...	li

Figure 5.12 – Semantics Repository

## Search by Relevance on the Cultural Portal

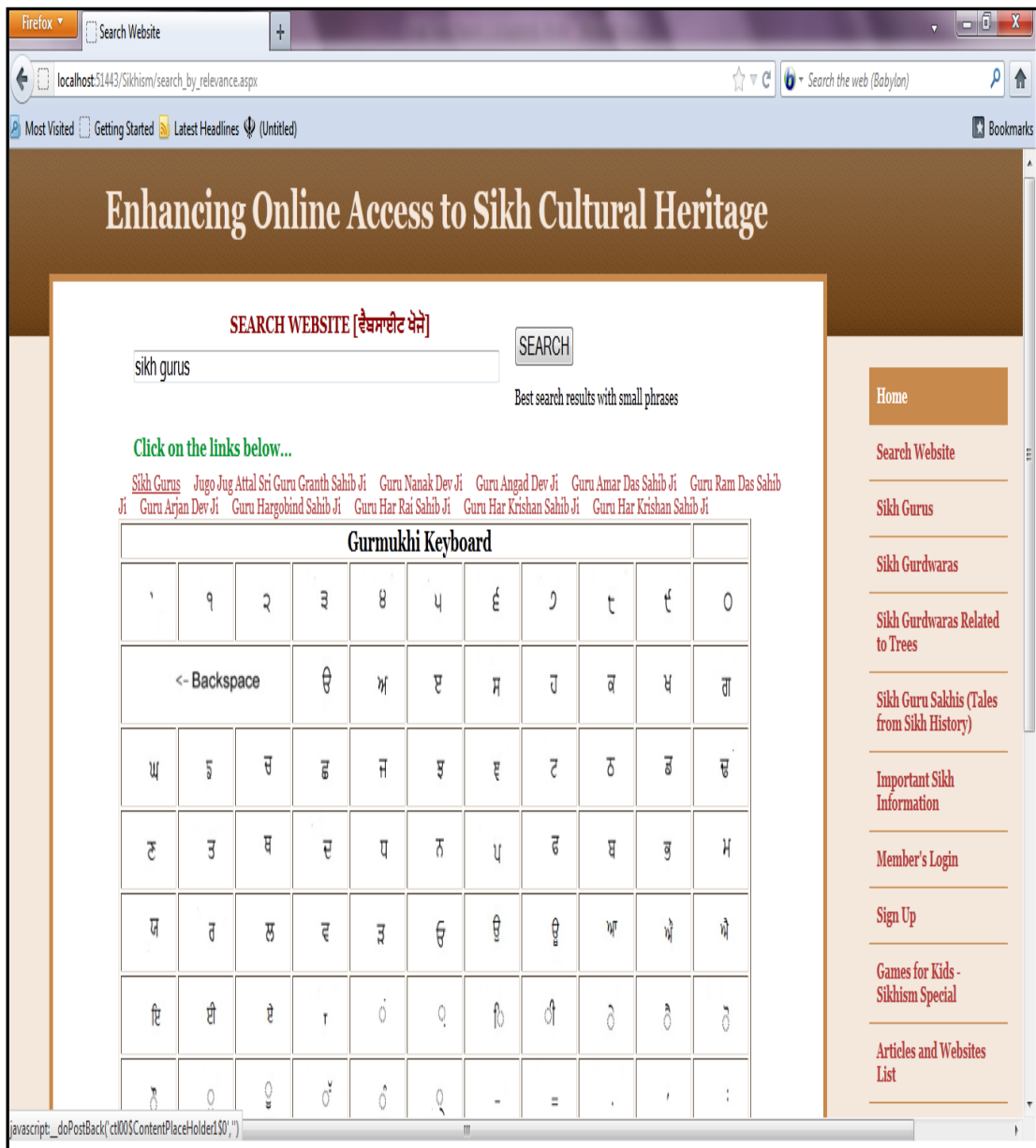


Figure 5.13 – Search by Relevance Working

### Creating Repository of Searches by user

User's search cannot be determined completely beforehand. For this, the words searched by user are recorded in the repository. This way, these words can be added to the options of words in semantics repository, by the administrator. This will make the search even better, every time the user searches for some information.

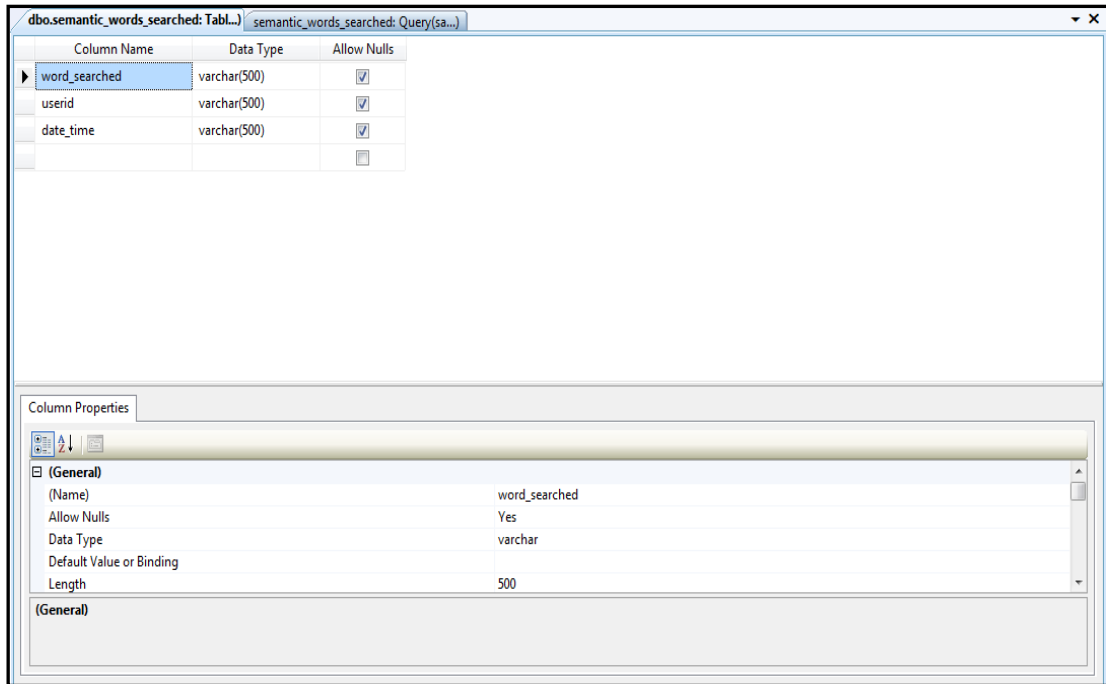


Figure 5.14 – Semantics words searched Repository Metadata

word_searched	userid	date_time
amar	none	11-04-2012 09:4...
amamr das	none	11-04-2012 09:4...
gurus	none	11-04-2012 10:0...
guru	none	11-04-2012 10:0...
sri guru granth ...	none	11-04-2012 10:2...
guru granth sa...	none	11-04-2012 10:2...
sri guru granth ...	none	11-04-2012 10:2...
sri guru granth ...	none	11-04-2012 10:2...
sri guru granth ...	none	11-04-2012 10:2...
sikh martyr	none	11-04-2012 16:1...
sikh martyr	none	11-04-2012 16:1...
ardaas	none	16-04-2012 10:5...
ardaas	none	16-04-2012 10:5...
ardaas	none	16-04-2012 10:5...
ardaas	none	16-04-2012 10:5...
ardaas	none	16-04-2012 10:5...
5 kakkar	none	16-04-2012 11:1...
prayer of sikhs	none	16-04-2012 18:1...
prayers of sikhs	none	16-04-2012 18:1...
member account	none	16-04-2012 18:1...
guru	none	30-04-2012 22:1...
guru gobind	none	30-04-2012 22:1...
guru gobind si...	none	30-04-2012 22:1...

Figure 5.15 – Semantics words searched Repository

### 5.2.3 Search by Relevance in Punjabi Language

To promote Punjabi language (an important language in Sikhism) search facility is also provided in Punjabi, using Gurmukhi Keyboard. On clicking the buttons of the Gurmukhi letters, the character clicked by user gets typed in the textbox (besides the ‘SEARCH’ button).

A number of options of different phrases are used to produce desired search results by the user. After completing the phrase user clicks the search button. The page is redirected to the desired page.

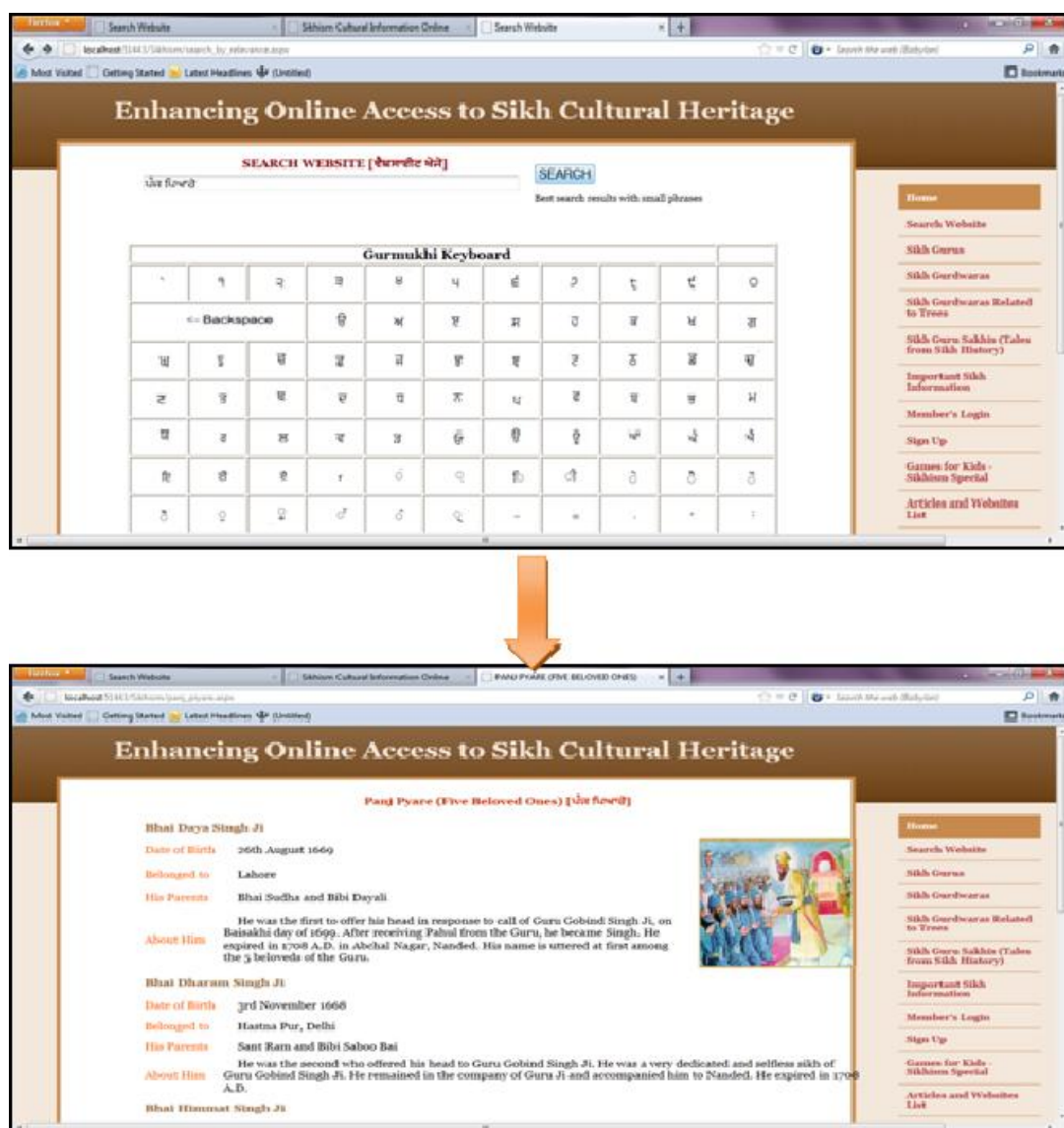


Figure 5.16 – Search in Punjabi Language

## 5.2.4 Searching Metadata of Tables used for Cultural Portal

If anyone wants to contribute some information about Sikhism to this portal, he or she can request to search metadata of the tables containing such information. If that information is not available on the cultural portal, the user can add that information, and content of the portal can be enhanced.

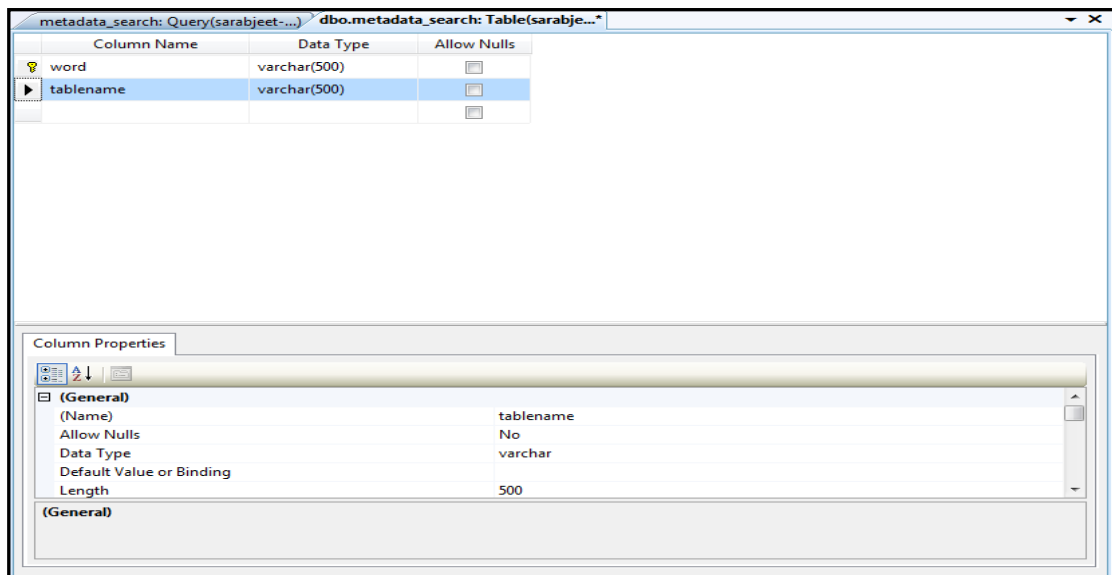


Figure 5.17 – Searching Table Metadata

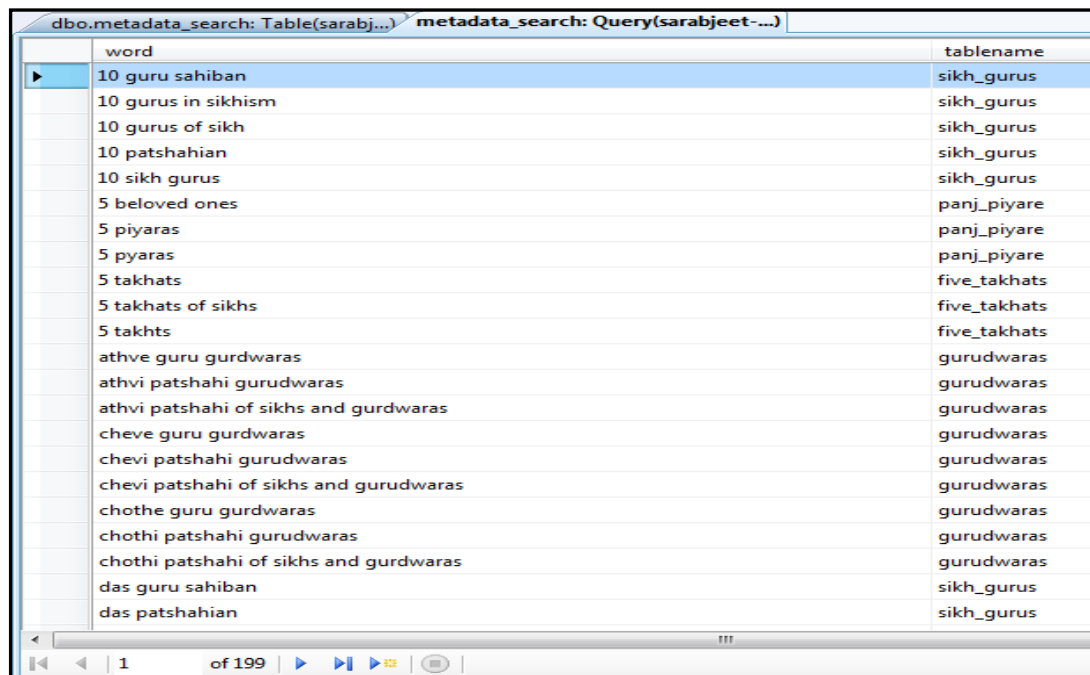


Figure 5.18 – Searching Table Metadata (Repository)

**SEARCH WEBSITE METADATA [ਮੈਟਾਡਾਟਾ ਖੋਜੋ]**

five takhats of sikhs

TABLE_NAME	COLUMN_NAME	DATA_TYPE	CHARACTER_MAXIMUM_LENGTH	NUMERIC_PRECISION
five_takhats	takht	varchar	500	
five_takhats	itihis	varchar	8000	
five_takhats	image	varchar	500	

takht	itihis	image
Takhat Sri Akal Takhat Sahib, Amritsar (Punjab)	This Gurdwara is situated on the front side of Sri Harmandir Sahib Takhat Sri Darbar Sahib Akal Takhat means the seat (throne) of the timeless one or seat (throne) of God. This Gurdwara is located in the Golden Temple complex in Amritsar. This was initially built by Guru Hargobind Sahib Ji (6th Guru of Sikhs), as a symbol for political sovereignty of Sikhs. It	~/img/5 takhats/Akal Takhat Sahib, Amritsar.jpg

Figure 5.19 – Searching Tables (for websites) Metadata Working

#### 6.1 Conclusion

In this thesis, a cultural portal has been developed. This portal supports the digitization of ancient scriptures related to Sikhism, by the use of CAPTCHAs, and providing the security simultaneously. Digitization of a page from Sikh scripture ‘Sri Guru Granth Sahib’ (both handwritten and printed) has been done. Every user sees each word of this scripture once, in the form of CAPTCHA and system challenges the user to enter the text shown in the CAPTCHA, with the help of ‘Gurmukhi Keyboard’ made available on the login page. As each word of scripture is processed, it gets stored in a folder. This way, after all of the words are processed once, scripture will get digitized.

The cultural portal also provides another important feature ‘search website’. This feature is offered in two kinds namely, Search by Relevance (Page Rank Wise) and Searching Metadata of tables. Search by Relevance feature provides the most relevant results (page rank wise) depending upon the words searched. This feature uses the concept of semantic relatedness. Searching Metadata feature is also available after the user sends request to search metadata. This feature helps the user know the exact cultural information available on the portal and contribute new information to this portal.

As the level of understanding of different persons is different; depending upon the type of user and his/her age, users are assigned separate permissions to access different features of the portal. Every new user has to enter his/her date of birth at the time of sign up. The system calculates user’s age. Also, user has to enter his/her type (Example – beginner/learner, kid, expert and others). If the user is beginner/learner or kid, then he/she can play Games like KBC, Pehchan Kaun and Tic – Tac – Toe (Sikhism Special). These games help the users to learn about Sikh culture easily in play – way style. If the user is Expert, that is, he/she has much of knowledge about Sikh culture, so he/she can access different research papers, Articles and websites on Sikhism. These will add to their knowledge about Sikh culture. Links to these articles,

research papers and websites are being provided under ‘Articles and Websites List’ menu of the portal.

This cultural portal is integrated with facebook, so that the promotion of culture amongst the youth gives the desired results. The similar effort can give best possible outcomes if used with more of the social networking websites.

## **6.2 Future Work**

The future scope of this work is:

- i. Digitization of complete scriptures using latest computing trends.
- ii. Audio CAPTCHAs of Sri Guru Granth Sahib (helpful to physically challenged people, as well as acting as Guide to read Sri Guru Granth Sahib).
- iii. Integration of the cultural portal with more of the popular Social Networking websites will act as a fruitful milestone in the journey of Cultural Computing.
- iv. Use of Semantic Web components for understanding the user’s requirements more efficiently than proposed in this thesis.
- v. Use of Punjabi language, to represent the cultural contents, so as to make the contents useful for people knowing only Punjabi.
- vi. Use of Augmented Reality (AR) and Virtual Reality (VR) concepts to represent cultural information in a more effective way.
- vii. Creating Virtual Gurdwara (Sikh Shrines) videos, presenting every room of Gurdwara, as for real.

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<http://www.freepatentsonline.com/article/Abhigyan/206056229.html>.
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<http://www.sikhreview.org/pdf/january2005/pdf-files/moral5.pdf>.

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## Appendix – A

### List of Websites Visited for Survey

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1. [www.sikhnet.com](http://www.sikhnet.com)
2. <http://guruarjandev.com>
3. [www.allaboutsikhs.com](http://www.allaboutsikhs.com)
4. <http://www.hemkunt.in>
5. [www.sikhpoint.com](http://www.sikhpoint.com)
6. <http://www.sikhcoins.in/>
7. [www.gurugranthdarpan.com](http://www.gurugranthdarpan.com)

## Appendix – B

### List of Sikhism Research Papers Reviewed

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1. “Dhur Ki Bani: What does it mean?” at  
<http://www.iuscanada.com-www.iuscanada.com/journal/archives/2009/j1101p24.pdf>
2. “Aad Guru Granth Sahib”, at  
<http://www.iuscanada.com/journal/archives/2000/j0201p03.pdf>
3. “Akhand Paath In Sikhism” at  
<http://www.iuscanada.com-www.iuscanada.com/journal/archives/2001/j0301p34.pdf>
4. “Ethics of The Sikhs” available at  
<http://www.iuscanada.com-www.iuscanada.com/journal/archives/2005/j0701p35.pdf>
5. “Guru Nanak’s Concept of God (Absolute Reality)” at  
<http://www.iuscanada.com/journal/archives/2011/j1312p73.pdf>
6. “Art Work in Historic Sikh Shrines: Need for Documentation and Conservation” at  
<http://cipa.icomos.org/fileadmin/template/doc/ATHENS/FP132.pdf>
7. “Position of Women in Sikh Society” at  
<http://aygrt.net/August/2011/August/Rajan.pdf>
8. “Sikh Coinage - Symbol of Sikh Sovereignty” at  
<http://www.sikhreview.org/pdf/december2004/pdf-files/book.pdf>
9. “Origin of Nishan Sahib: The Sikh Banner” at  
<http://www.sikhreview.org/pdf/january2005/pdf-files/moral5.pdf>

## **LIST OF PUBLICATION**

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1. Harkiran Kaur, Seema Bawa, *Creating Digital Archives of Ancient Scriptures Using CAPTCHAs*, Information and Computation Elsevier (communicated).
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