Cascading Style Sheet Styling Issues for Punjabi Language

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

Master of Engineering
in
Computer Science and Engineering

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June 2011

CERTIFICATE

I hereby certify that the work which is being presented in the thesis entitled, "*Cascading Style Sheet Styling Issues for Punjabi Language*", in partial fulfillment of the requirements for the award of degree of *Master of Engineering in Computer Science and 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 Mr. Parteek Bhatia and refers other researcher's work which are duly listed in the reference section.

The matter presented in the thesis has not been submitted for award of any other degree of this or any other University.

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This is to certify that the above statement made by the candidate is correct and true to the best of my knowledge.

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Acknowledgement

First of all, I would like to express my gratitude towards **THAPAR UNIVERSITY,** for providing me a platform to do my thesis work at such an esteemed institute.

I wish to express my deep gratitude to Mr. Parteek Bhatia, Assistant Professor, Computer Science and Engineering Department, Thapar University, Patiala for his valuable advice and guidance in carrying out my thesis.

I would like to thank Dr. Maninder Singh, Head, Computer Science and Engineering Department, Thapar University, Patiala who has been a constant source of inspiration for me throughout this work.

I am also thankful to all the staff members of the Department for their full cooperation and help.

I am Thankful to my parents, brother and all my friends for their blessing and moral support. Thanks for boosting me with their constant encouragement, support and confidence.

Last but not the least, I am thankful to God for providing me with the strength and ability to complete my work.

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Abstract

Most of the websites today are multilingual. The information provided on the Internet is in local language. The fonts used for local languages are not compatible with the browsers. The websites make use of Cascading Style Sheets for styling. The effect of using CSS styles on local languages is not as good as it is for English language. There are many CSS styling issues in display of local languages.

W3C India has identified many CSS styling issues for Indic Scripts. In the work presented, CSS styling issues like, first-letter styling, underlining, over lining, line-through of characters, hyperlink display while mouse over, horizontal spacing, *etc.*, have been discussed for Punjabi language. These issues have been analyzed on six different browsers, namely, Google Chrome, Mozilla Firefox, Netscape Navigator, Safari, Internet Explorer and Opera. A comparative study of all these browsers has been carried out based on the CSS styling issues.

A number of Punjabi websites have been analyzed to find the problems in display. The websites use Unicode and non-Unicode *Gurmukhi* fonts for Punjabi content. There are problems in display of non-Unicode fonts.

A web application has been created that allows an end-user to apply different CSS styles on the Punjabi text. The effects of using these CSS styles can be uploaded by the end-user. The web portal for Punjabi language has also been created. This web portal presents the analysis of various CSS styling issues on different browsers. The analysis of *Gurmukhi* fonts used by the Punjabi websites is also presented in this web portal.

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Chapter 1
Introduction

Local newspapers, magazines and organizations provide information in their local language on the Internet. The transfer of each local language into cyberspace is a task with very high importance [1]. The websites make use of Cascading Style Sheets (CSS) for styling. CSS is a special purpose style sheet language and it helps in defining the format of presentation for any document that has been written in a markup language like HTML [2]. The effect of using CSS styles on local languages is not as good as it is for English language. There are many CSS styling issues in display of local languages.

The W3C is an international community where member organizations, a full-time staff, and the public work together to develop Web standards. The mission of W3C is to lead the web to its full potential by developing protocols and guidelines that ensure the long-term growth of the web. The main principle of W3C is Web for all and web on everything [3].

W3C India Office has been established under the aegis of "Technology Development for Indian Languages" at Department of Information Technology (DIT), Govt. of India. TDIL Programme is engaging itself actively since 2006 with all the stakeholders in the country to work towards internationalization of W3C Recommendations. The goal of W3C India is to enable all W3C Recommendations with 22 Indian languages. Some of the recommendations have been submitted to W3C corresponding Working Groups for possible consideration and deliberation by W3C. The main focus is on Web Internationalization and Standardization of all future web technology standards and ensuring proper and correct representations of Indian languages in W3C standards [4].

The World Wide Web Consortium (W3C) India has discussed many issues and harmonized the requirements from user communities and solutions from technological experts. The CSS Styling issues have been identified, regarding Punjabi language in this thesis work which will be applicable in all other Indian languages as well.

1.1 Introduction to CSS

The websites make use of CSS for styling the web content. A style sheet simply holds a collection of rules that we define to enable us to manipulate our web pages [5].CSS is a style sheet language used to describe the presentation semantics (the look and formatting) of a document written in a markup language. It's most common application is to style web pages written in HTML and XHTML [2].

CSS is designed primarily to enable the separation of document content (written in HTML or a similar markup language) from document presentation, including elements such as the layout, colors, and fonts [6].

1.1.1 Use of CSS

Prior to CSS, nearly all of the presentational attributes of HTML documents were contained within the HTML markup. All font colors, background styles, element alignments, borders and sizes had to be explicitly described, often repeatedly, within the HTML. CSS allows authors to move much of that information to a separate style sheet resulting in considerably simpler HTML markup.

In CSS, presentation is separated from structure. CSS can define color, font, text alignment, size, borders, spacing, layout and many other typographic characteristics. The W3C now considers the advantages of CSS for defining all aspects of the presentation of HTML pages to be superior to other methods [6].

1.1.2 History of CSS

Style sheets have existed in one form or another since the beginnings of SGML (Standard Generalized Markup Language) in the 1970s. Cascading Style Sheets were developed as a means for creating a consistent approach to providing style information for web documents.

As HTML grew, it came to encompass a wider variety of stylistic capabilities to meet the demands of web developers. To improve web presentation capabilities, nine different style sheet languages were proposed to the World Wide Web Consortium's (W3C) www-style mailing list. Of the nine proposals, two were chosen as the foundation for what became CSS: Cascading HTML Style Sheets (CHSS) and Stream-based Style Sheet

Proposal (SSP). CHSS, a language that has some resemblance to today's CSS, was proposed by Håkon Wium Lie in October 1994.

The CSS Working Group began tackling issues that had not been addressed with CSS level 1, resulting in the creation of CSS level 2 on November 4, 1997. It was published as a W3C Recommendation on May 12, 1998. CSS level 3, which started in 1998, is still under development as of 2009.

In 2005 the CSS Working Groups decided to enforce the requirements for standards more strictly. This meant that already published standards like CSS 2.1, CSS 3 Selectors and CSS 3 Text were pulled back from Candidate Recommendation to Working Draft level [6, 7].

1.1.3 CSS syntax

CSS has a simple syntax and uses a number of English keywords to specify the names of various style properties. A style sheet consists of a list of rules. Each rule or rule-set consists of one or more selectors and a declaration block. A declaration-block consists of a list of declarations in braces. Each declaration itself consists of a property, a colon (:), a value, then a semi-colon (;) [6].

An example is given in (1.1):

```
selector [, selector2, ...][:pseudo-class] {
property: value;
 [property2: value2;
  ...]
}
```
…(1.1)

1.1.4 CSS properties

Style sheets influence the presentation of documents by assigning values to style properties. This section lists the defined style properties, and their corresponding list of possible values [4].

- **Font properties**

Setting font properties will be among the most common uses of style sheets. CSS1 defines the properties 'font-family', 'font-style', 'font-variant' and 'font-weight', 'font-size', 'font' [8]. These have been discussed below.

font-family

This property sets the font family for the text. The value is a prioritized list of font family names and/or generic family names. Unlike most other CSS1 properties, values are separated by a comma to indicate that they are alternatives. An example of ‘font-family’ is given in (1.2).

BODY {font-family: gill, helvetica, sans-serif} …(1.2)

font-style

This property selects between normal, italic and oblique faces within a font family.

The values used in ‘fomt-style’ are given in (1.3).

Value: normal | italic | oblique …(1.3)

font-variant

The values that are user for ‘font-variant’ are given in (1.4).

Value: normal | small-caps …(1.4)

In a small-caps font the lower case letters look similar to the uppercase ones, but in a smaller size and with slightly different proportions. The 'font-variant' property selects that font. A value of 'normal' selects a font that is not a small-caps font, 'small-caps' selects a small-caps font.

font-weight

The 'font-weight' property selects the weight of the font. The values '100' to '900' form an ordered sequence, where each number indicates a weight that is at least as dark as its predecessor. The keyword 'normal' is synonymous with '400', and 'bold' is synonymous with '700'. Keywords other than 'normal' and 'bold' have been shown to be often confused with font names and a numerical scale was therefore chosen for the 9-value list. The values used in ‘font-weight’ are given in (1.5).

Value: normal | bold | bolder | lighter | 100 | 200 | 300 | 400 | 500 |
600 | 700 | 800 | 900 …(1.5)

font-size

This property selects the size of the font. The values for this property are given in (1.6).

Value: <absolute-size> | <relative-size> | <length> | <percentage> …(1.6)

An <absolute-size> keyword is an index to a table of font sizes computed. A <relative-size> keyword is interpreted relative to the table of font sizes and the font size of the parent element. Possible values are: [larger | smaller]. Length and percentage values

should not take the font size table into account when calculating the font size of the element. Negative values are not allowed.

font

The 'font' property is a shorthand property for setting 'font-style' 'font-variant' 'font-weight' 'font-size', 'line-height' and 'font-family' at the same place in the style sheet. The syntax of this property is based on a traditional typographical shorthand notation to set multiple properties related to fonts [8]. The values used are given in (1.7).

Value: [<font-style> || <font-variant> || <font-weight>]? <font-size> [/ <line-height>]? <font-family> …(1.7)

- **Text properties**

Some text properties used to style the text are given below.

word-spacing

This property provides space between words. The value used is given in (1.8).

Value: normal | <length> …(1.8)

The length unit indicates an addition to the default space between words. Values can be negative, but there may be implementation-specific limits.

letter-spacing

This property provides space between characters. The values used for ‘letter-spacing’ are given in (1.9).

Value: normal | <length> …(1.9)

The length unit indicates an addition to the default space between characters. Values can be negative, but there may be implementation-specific limits.

text-decoration

This property describes decorations that are added to the text of an element. If the element has no text (e.g. the 'IMG' element in HTML) or is an empty element (e.g. '<EM></EM>'), this property has no effect. A value of 'blink' causes the text to blink.

The values used are given in (1.10).

Value: none | [underline || overline || line-through || blink] …(1.10)

text-transform

The values used for ‘text-transform’ are given in (1.11).

Value: capitalize | uppercase | lowercase | none …(1.11)

The value ‘capitalize', uppercases the first character of each word. A value of 'uppercase'

causes uppercases all letters of the element, 'lowercase' changes lowercases all letters of the element and 'none' neutralizes inherited value. The actual transformation in each case is human language dependent.

text-align

This property describes how text is aligned within the element. The values used in this property are given in (1.12)

Value: left | right | center | justify …(1.12)

line-height

The property sets the distance between two adjacent lines' baselines. When a numerical value is specified, the line height is given by the font size of the current element multiplied with the numerical value. The value is given in (1.13).

Value: normal | <number> | <length> | <percentage> …(1.13)

border-top-width

This property sets the width of an element's top border. The values used are given in (1.14).

Value: thin | medium | thick | <length> …(1.14)

border-style

The 'border-style' property sets the style of the four borders. The value is given in (1.15).

Value: none | dotted | dashed | solid | double …(1.15)

The border styles none means no border is drawn, dotted means the border is a dotted line drawn on top of the background of the element. The dashed value means the border is a dashed line drawn on top of the background of the element. Solid means the border is a solid line. The double means the border is a double line drawn on top of the background of the element.

white-space

This property declares how whitespace inside the element is handled. The 'normal' is where whitespace is collapsed. The 'pre' behaves like the 'PRE' element in HTML and 'nowrap' is where wrapping is done only through BR elements [8]. The values are given in (1.16)

Value: normal | pre | nowrap …(1.16)

1.1.5 Difficulty with adoption

The CSS 1 specification was completed in 1996 and Microsoft's Internet Explorer 3 was released in that year featuring some limited support for CSS. It was more than three years before any web browser achieved near-full implementation of the specification. Internet Explorer 5.0 for the Macintosh, shipped in March 2000, was the first browser to have full (better than 99 percent) CSS 1 support, surpassing Opera, which had been the leader since its introduction of CSS support 15 months earlier. Other browsers followed soon afterwards, and many of them additionally implemented parts of CSS 2. As of August 2010, no (finished) browser has fully implemented CSS 2, with implementation levels varying.

Even though early browsers such as Internet Explorer 3 and 4, and Netscape 4.x had support for CSS, it was typically incomplete and afflicted with serious bugs. This was a serious obstacle for the adoption of CSS [9].

1.1.6 Variations of CSS

CSS has various levels and profiles. Each level of CSS builds upon the last, typically adding new features and typically denoted as CSS 1, CSS 2, and CSS 3. Profiles are typically a subset of one or more levels of CSS built for a particular device or user interface. Currently there are profiles for mobile devices, printers, and television sets. Profiles should not be confused with media types, which were added in CSS 2 [6, 10].

CSS 1

The first CSS specification to become an official W3C Recommendation is CSS level 1. It was published in December 1996. It had support for:

- Font properties such as typeface and emphasis
- Color of text, backgrounds, and other elements
- Text attributes such as spacing between words, letters, and lines of text
- Alignment of text, images, tables and other elements
- Margin, border, padding, and positioning for most elements
- Unique identification and generic classification of groups of attributes

The W3C no longer maintains the CSS1 Recommendation [6].

CSS 2

CSS level 2 was developed by the W3C and published as a Recommendation in May 1998. A superset of CSS1, CSS2 includes a number of new capabilities like absolute, relative, and fixed positioning of elements and z-index, the concept of media types, support for aural style sheets and bidirectional text, and new font properties such as shadows. The W3C maintains the CSS2 Recommendation.

CSS level 2 revision 1 or CSS 2.1 fixes errors in CSS2, removes poorly-supported features and adds already-implemented browser extensions to the specification. While it was a Candidate Recommendation for several months, on June 15, 2005 it was reverted to a working draft for further review. It was returned to Candidate Recommendation status on 19 July 2007 [6, 10].

CSS 3

CSS level 3 has been under development since December 15, 2005. The W3C maintains a CSS3 progress report. CSS3 is modularized and consists of several separate recommendations [6].

1.1.7 Browser support

All browsers do not comply identically with CSS code. A coding technique known as a CSS filter can be used to show or hide parts of the CSS to different browsers, either by exploiting CSS-handling quirks or bugs in the browser, or by taking advantage of lack of support for parts of the CSS specifications. Because very early web browsers were either completely incapable of handling CSS, or render CSS very poorly, designers today often routinely use CSS filters that completely prevent these browsers from accessing any of the CSS. Internet Explorer support for CSS began with IE 3.0 and increased progressively with each version. By 2008, the first Beta of Internet Explorer 8 offered support for CSS 2.1 in its best web standards mode.

An example of a well-known CSS browser bug is the Internet Explorer box model bug, where box widths are interpreted incorrectly in several versions of the browser, resulting in blocks that are too narrow when viewed in Internet Explorer, but correct in standards-compliant browsers. The bug can be avoided in Internet Explorer 6 by using the correct doctype in (X)HTML documents [9].

1.2 Thesis outline

The thesis is divided into following six chapters. Chapter 1, covers the introduction to W3C and Cascading Style Sheets. In Chapter 2, *i.e.*, Literature Review details of CSS Styling Issues and *Gurmukhi* fonts used in websites have been discussed. After going through literature review, the problem statement has been identified and defined in Chapter 3.The Objectives and methodology used to solve the problem is discussed. The Chapter 4, provides the implementation details of CSS styling issues for Punjabi language tested on different browsers. The implementation of web portal for Punjabi is also discussed in this chapter. The results of our analysis are discussed in this Chapter 5. The conclusion of the work done and scope for future work is proposed in Chapter 6.

Chapter 2

Literature Review

The CSS Styling issues identified by W3C India are describes in section 2.1. These issues have been identified and tested on different browsers. The Unicode Gurmukhi fonts are discussed in section 2.2.

2.1 CSS styling issues

The following CSS styling issues have been identified for Indian languages bye W3C.

2.1.1 Styling of first-letter pseudo-element

The first-letter pseudo-element represents the first-letter of the first line of a block, if it is not preceded by any other content (such as images or inline tables) on its line. It allows that first-letter to be styled individually, without markup. It may be used for "initial caps" and "drop caps", which are common typographical effects in text in Latin script [1].

When some styling feature is applied to the starting character, then it should be applied to either single character, conjunct character or a syllable. Figure 2.1 and Figure 2.2, shows styling and Initial caps applied to starting character in Hindi Language respectively.

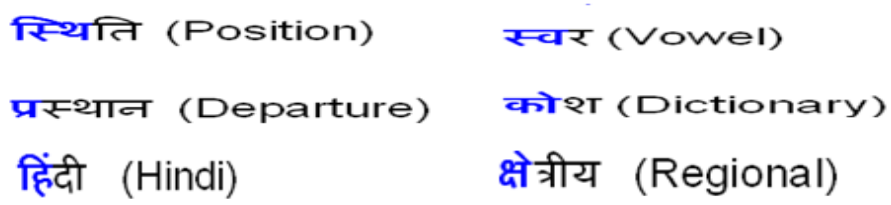


Figure 2.1: Styling starting character in Hindi language [1]

Figure 2.2: Initial caps applied to starting characters in Hindi language [1]

Indic script behavior relates to syllables, rather than individual letter forms. In the Hindi word स्थिति ('sthiti') the sequence of characters in the first syllable is given in Figure 2.3.

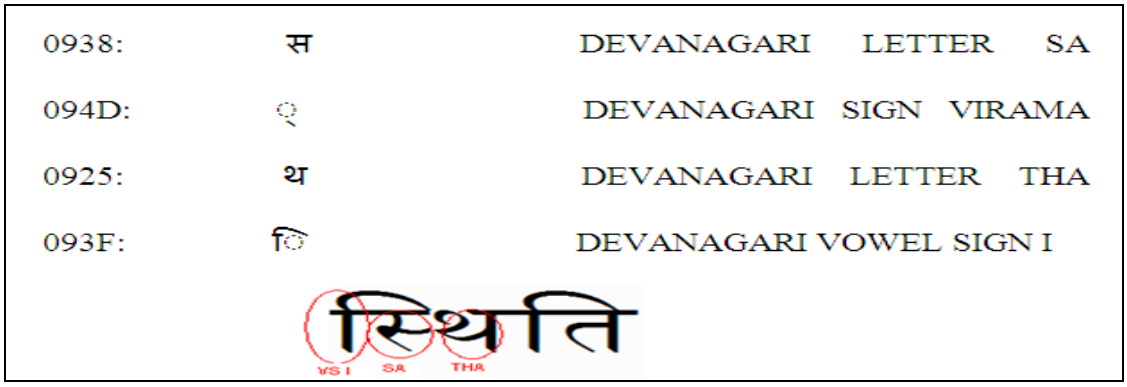


Figure 2.3: Sequence of characters in the first syllable [1]

Figure 2.3, shows that the vowel sign appears to the left of the first character, not the third.

2.1.2 Drop initial overview

Drop initial is a typographic effect emphasizing the initial letter(s) of a block element with a presentation similar to a 'floated' element.

Figure 2.4, shows a simple case of a three line drop initial and a case of a two line drop initial but with a three line size initial letter.

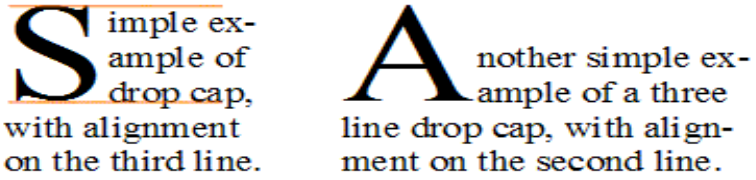


Figure 2.4: Drop initial [1]

Figure 2.4, show a predominance of styling similar to what would be called 'drop letter' in English. Where a character is enlarged in a script has a headstroke, the height of the headstroke in the large text and the regular text is typically approximately on the same level, but commonly does not join.

The drop initial effect may also be used for writing systems which use different alignment strategies. For example, in *Devanagari* the hanging baseline may be preferred. In that case the primary connection point connects the text-after-edge of the initial letter with the text-after-edge of the nth line, but the secondary connection point connects the hanging baselines of the initial letter and the initial line [1]. This is shown in Figure 2.5.

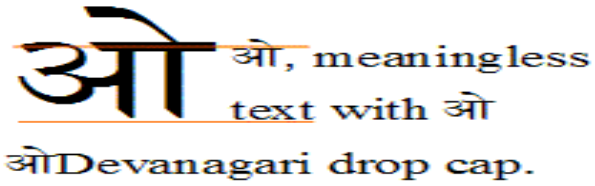


Figure 2.5: Drop initial in *Devanagri* [1]

2.1.3 Bullets and Numbers

Number schemes/ bulleting needs to be supported in Indian languages as well. Some standards however need to be provided to those developing CSS so that by default user could have the facility to use bulleting in his own Indic languages. The current bulleting order even in popular DTP (Desktop Publishing) applications such as Microsoft Word is not suitable for user. The word processors are sometimes used by the user to develop pages for the web. Therefore standards are must. In most application *Devanagari* order is followed for languages sharing the script, which unfortunately is not the correct thing while deciding on sorting/collation for Indic languages [5]. Number schemes to be supported in Indian languages also, as shown in Figure 2.6.

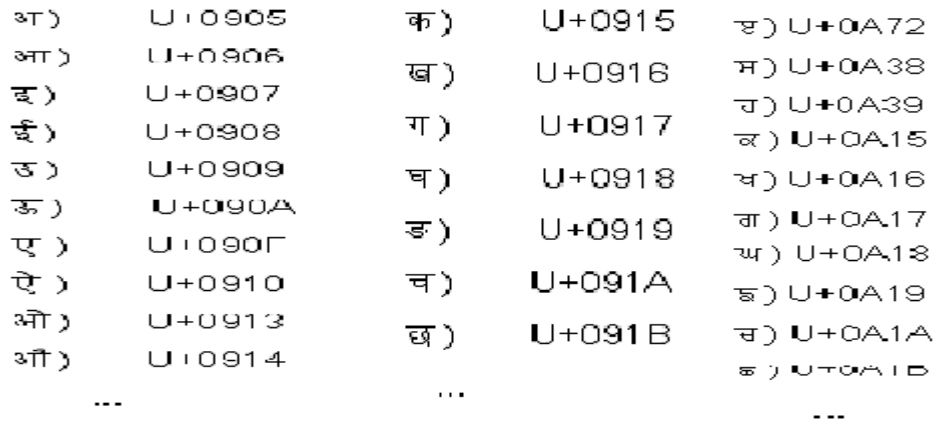


Figure 2.6: Numbering in *Devanagari* [5]

2.1.4 Vertical arrangements of characters

If some string is written in vertical mode, then writing each character on a new line may not be suitable. [5, 11]. Figure 2.7, shows the vertical arrangement of *Devanagari* text in different ways.

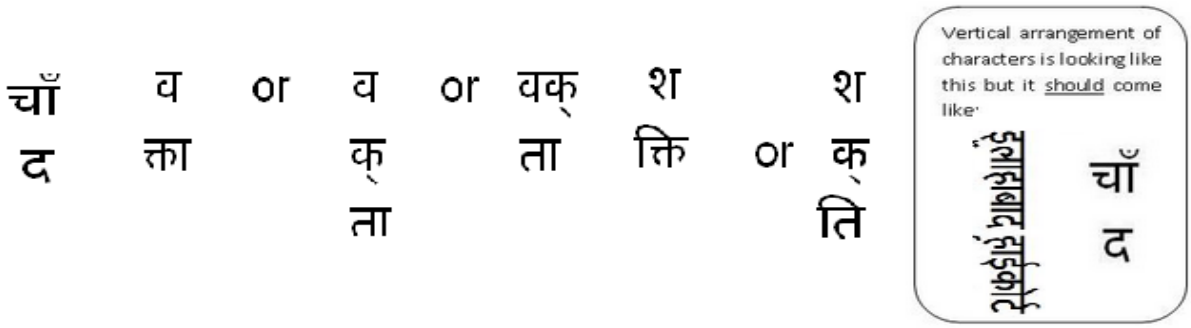


Figure 2.7: Vertical arrangement of characters [5]

2.1.5 Horizontal spacing

Styling issues like the Horizontal spacing between characters like C E R T I F I C A T E, the space is given between the every character in case of English [1]. But in case of Indian language, the space may not be given in every character but after some portion of the character sequence as in Figure 2.8.

Figure 2.8: Horizontal spacing

2.1.6 Underlining of the characters

There is some examples of Indian languages in which *matra*'s are not readable due to underlining of characters.

Hindi अन्य भाषाओं में भी अनुवाद

Punjabi ਗੁਰੂ → ***Matra*'s are not readable**

When we see these pages on internet, the information is not clearly readable because if we hyperlink the text in Indian languages some *matras* are cut and in Punjabi the underline matches few *matras* like '◌ੁ' *Aunkar* and '◌ੂ' *Dulanukar*. It can create problem in reading the information correctly. Therefore some changes may be required to be implemented in CSS standards developed by W3C with respect to Indian languages [1].

2.1.7 Over lining of the characters

Whenever we use special characters in Hindi and applying text decoration as over line there are some issues in almost every India language where any special characters are

used. Issues found in language like Hindi, Bangla, Tamil, Gujrati, Marathi, Punjabi, Malayalam and Kannada are shown in Figure 2.9.

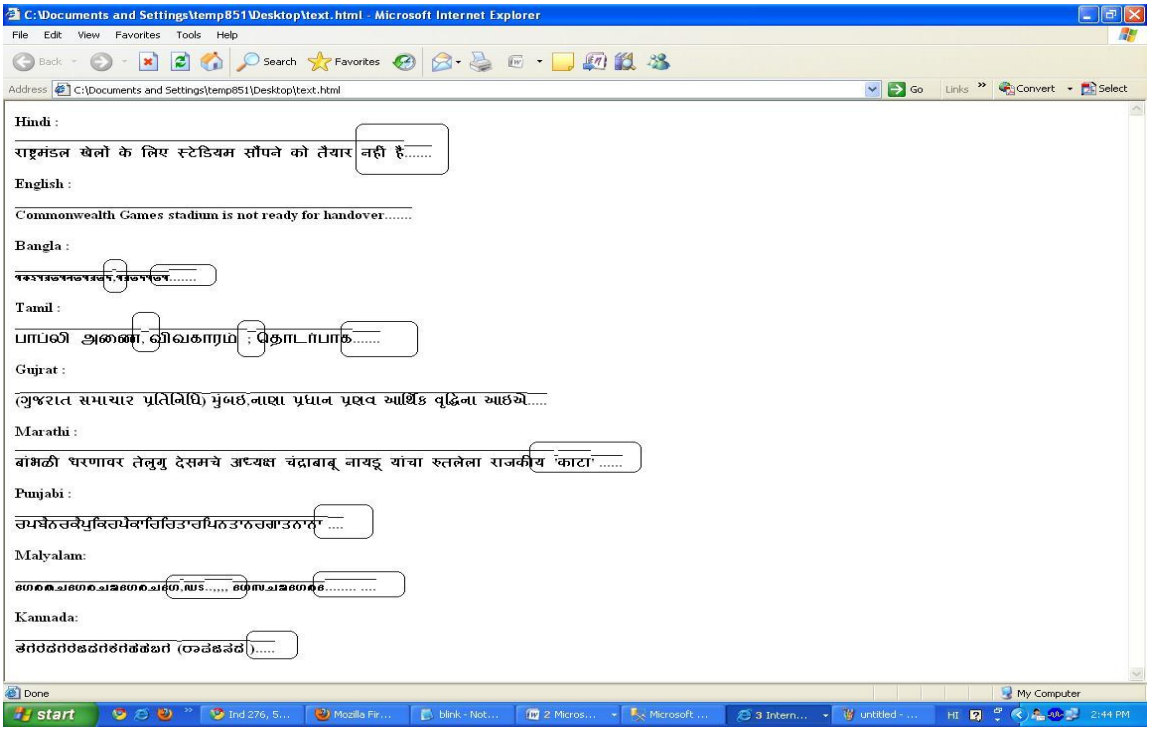


Figure 2.9: Over lining of characters [1]

2.1.8 Line-through of the characters

Whenever text decoration as line-through is applied on special characters, there are some issues in the India language. The line is coming in bottom of the characters but it should come in between the characters horizontally. Issues found in language like Hindi, Bangla, Tamil, Gujrati, Marathi, Punjabi, Malayalam and Kannada is shown in Figure 2.9.

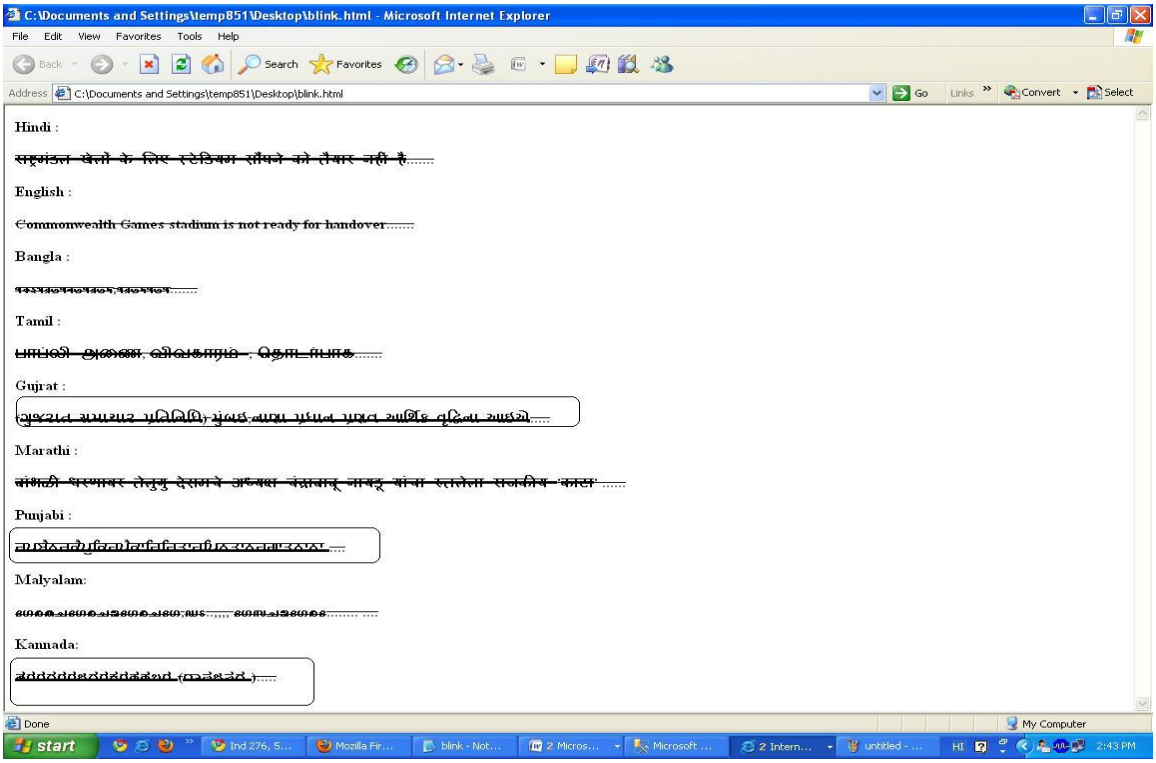


Figure 2.10: Line-through of characters [1]

2.2 Unicode and non-Unicode *Gurmukhi* fonts used for Punjabi language

The Unicode Consortium is a non-profit organization founded to develop, extend and promote use of the Unicode Standard, which specifies the representation of text in modern software products and standards [12]. Unicode is the accepted international standard that includes support for all major scripts of the World and is adopted by all current major computer operating systems. This is a 16 bit standard that allows use of more than 65000 characters in one font. It has support for major Indic (Indian) scripts that include *Devanagari* (*Hindi, Marathi, Sanskrit*), *Bengali* (*Bengali, Assamese*), *Gurmukhi* (Punjabi), *Gujarati, Oriya, Tamil, Telugu, Kannada and Malayalam*. Microsoft Windows XP/ Vista has full support for Indic scripts, including *Gurmukhi* [13].

2.2.1 Unicode Gurmukhi fonts

The Gurumukhi script is a North Indian script historically derived from an older script called *Lahnda*. It is closely related to *Devanagari* structurally [14]. *Gurmukhi* has been presented in Unicode since version 1.1. The Unicode block for *Gurmukhi* is U+0A00–

U+0A7F. The Unicode 4.0 adds U+0A01 (*Adak Bindi*) and U+0A03 (*Visarga*).The Unicode 5.1 adds U+0A51 (*Udaat*) and U+0A75 (*Yakash*) [15]. The chart for Unicode *Gurmukhi* code is given in Figure 2.11.

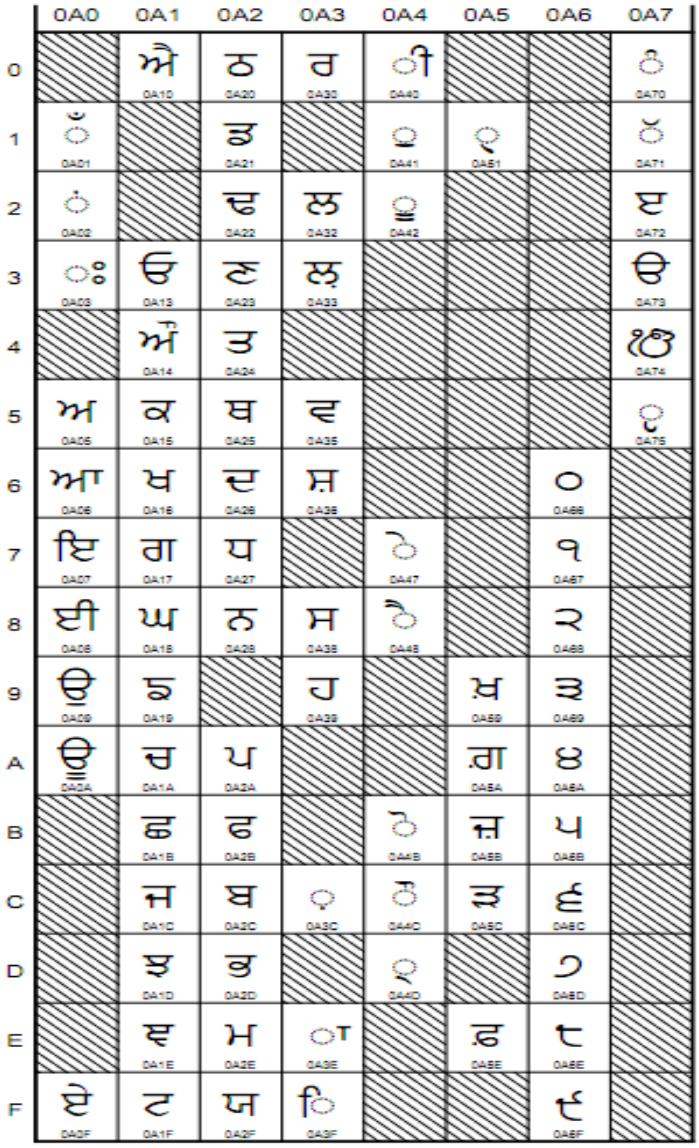


Figure 2.11: Chart for Unicode Gurmukhi code [15]

The current version of the *Gurmukhi* Unicode standard does not have support for some special characters that are used in *Gurbani*/ old *Gurmukhi* [13]. Figure 2.12, gives an example of few special characters that are not supported by *Gurmukhi* fonts. These are *Paireen* characters (subjoined forms) used in *Gurbani* (Sri Guru Granth Sahib).

Figure 2.12: Special characters used in *Gurmukhi* and *Gurbani* [13]

The default *Gurmukhi* font that comes with Windows XP/ Vista is *Raavi*. An alternate font in Windows XP/ Vista for typing *Gurmukhi* is *Arial Unicode MS*. *Tahoma* is another font from Microsoft that has *Gurmukhi* characters [16, 17]. Few *Gurmukhi* fonts are discussed below.

- *Saab* is the first ever freely available, Unicode 4.0 compliant, OpenType, *Gurmukhi* font. The creation of this font was a combined effort by Bhupinder Singh and Sukhjinder Sidhu to help encourage the use of Punjabi online [17].
- *AnmolUni* and *AnmolUniBani* are a set of fonts developed by Dr. Thind as eventual replacements for the proprietary encoded *AnmolLipi* fonts. AnmolUni is fully compliant with Unicode 4.0. *AnmolUniBani* incorporates all features of Unicode 4.0 but also includes additional characters required for older *Gurmukhi*. They are both identical typefaces [13, 17].
- *Lohit* Punjabi is a font developed in conjunction with Red Hat to help increase Indic support on Linux [17, 18].
- *Raavi* is arguably the best quality commercial *Gurmukhi* font available. It is a general purpose font and is suited for web page and application use [18].
- The non-Unicode *Gurmukhi* fonts are available in market like *Satluj, DRChatrikWeb, GurbaniAkar, GurbaniWebThick, Prabhki, Rupe, GHWAdhiapak, GHWDukandar, Punjabi Tpewriter, GurbaniLipi, AmritLipi etc.*, are not supported by browsers [19] .

2.2.2 Advantages of Unicode relating to Gurmukhi script

Migration to Unicode may not be painless as one has to adapt to new ways and for editing purposes, one has to have a software that has support for Unicode. There are many advantages in using Unicode text.

i. **Viewing Documents:** Documents or web pages made with Unicode text, when viewed with an appropriate program or web browser on a computer that has support for Unicode, will always be viewed in the right script even if the font in which the documents or web pages are made is not installed into the system. Just as English text is always in English, even if the font in which it is made is missing.
ii. **Permanence:** This is the international standard and will remain so for the future perhaps as long as humanity lives. The standard may improve with some additions and adjustments, but there will be no drastic changes to disable the standard that is already developed. Thus, any work that is done in Unicode fonts today, will not require any significant modification in the future.
iii. **Searching:** On the internet, only the information prepared with Unicode fonts will be properly analyzed by the search engines. Thus it will be possible to search the internet in Punjabi, if the information uses Unicode standard [13].

2.2.3 Disadvantages of using Unicode for Gurmukhi

Although Unicode is a good solution for *Gurmukhi*, some minor disadvantages are as follows.

i. People with older computers may not take full advantage of this new international standard.
ii. Not all features of *Gurmukhi* (particularly the older *Gurmukhi* used in the *Guru Granth Sahib*) can be represented yet. However, this is not a problem for modern Punjabi.
iii. Using Unicode *Gurmukhi* requires some readjustment in the way it is approached in comparison to font-based *Gurmukhi*. For example, you may have to use a different keyboard layout [20, 21].

Chapter 3

Problem Statement

Most of the content on web today is multilingual. Creating and maintaining websites with multiple languages is a challenging task [22]. Website developers use different fonts which may not be compatible with end-user's operating systems and browsers. Since, the standards were initially designed for English language, all other languages have issues in its display on browsers. It has been observed that Punjabi text is not properly displayed and stored in websites. When CSS styles are applied to Punjabi text various styling issues can be seen like styling of first-letter; underlining, over lining, line-through of characters; hyperlink display while mouse over; horizontal spacing, *etc.* It is important to analyze these issues on different browsers.

3.1 Problem statement

The CSS styling issues have been widely tested and analyzed for Hindi language on different browsers. CDAC (Centre for Development of Advanced Computing) has also developed a portal for Gujarati, Kashmiri, Konkani, Marathi, Sindhi and Urdu to investigate issues of display of Indian language content and effects of various CSS style on it [23, 24]. There is an immense need for such research and study for Punjabi language. No such research or study has been available for Punjabi language. For the testing and reporting of any CSS styling issue by an end-user there is a need to develop a web portal for Punjabi language. This study has motivated us to develop a web portal that analyzes CSS styling issues for Punjabi language.

3.2 Objectives

The main objectives of this work are:

- To analyze the CSS styling issues for Punjabi language on different browsers. We have analyzed the CSS styling issues on six browsers, namely, Google Chrome, Mozilla Firefox, Netscape Navigator, Safari, Internet Explorer and Opera.

- To analyze the Punjabi news and magazine websites to find out the CSS styling issues fonts used by Punjabi websites.
- To develop a web application that implements various CSS styles on Punjabi text. It allows an end-user to select the style of their choice on Punjabi text, test it on different browsers and provide feedback of their findings.
- To develop a web portal for Punjabi language that will include the results of analysis of CSS styling issues for Punjabi language on different browsers. The findings about CSS issues for Punjabi language will be helpful to W3C India for improvements in CSS standards related to Indian languages.

3.3 Methodology

To achieve the objectives discussed in section 3.2, a step-by-step methodology has been followed. The detail of this is given below.

i. W3C India has carried out a study of CSS styling issues for Indian languages. By referring to this study, an analysis has been carried out for Punjabi language.
ii. Study of Unicode standards and fonts used for Punjabi language has been carried out.
iii. The analysis of Punjabi news and magazine websites to find out various CSS styling issues has been performed.
iv. The analysis of CSS styling issues on different web browsers namely Google Chrome, Netscape Navigator, Mozilla Firefox, Internet Explorer, Safari and Opera has been performed.
v. Comparative study of these issues for Punjabi Language relative to the web browsers has been carried out.
vi. A web application that allows the end-user to select the various CSS styles, apply it on Punjabi text has been created. It can be tested on different browsers and errors in display of text are provided by the user as feedback.
vii. A web portal which contains the complete result of analysis process with the facility to upload the result of findings by any end-user on any web browser and operating system has been created.

Chapter 4

Analysis of CSS Styling Issues for Punjabi Language and Its Implementation

The power of the web is in its ability to reach people of different countries, culture and languages. Correspondingly, websites often provide the same information in multiple languages [25]. The websites make use of CSS styles for styling the web content. The text is not displayed properly and there are issues in use of CSS styling. The Punjab websites also use many Unicode and non-Unicode *Gurmukhi* fonts. The non- Unicode fonts are not compatible with the browsers and are not displayed properly. Our focus here is to analyze the fonts commonly used and CSS styling issues in display of Punjabi language on web. A Web Portal has been designed that implements various CSS styles on Punjabi language and presents the analysis of different styling issues and fonts on different browsers.

4.1 CSS styling issues for Punjabi language

The different CSS styling issues for Punjabi language like first-letter styling, underlining, over lining, line-through of characters, hyperlink display when mouse over, horizontal spacing, *etc.,* has been discussed in Chapter 2. These CSS Styles have been applied on Punjabi text and tested in six browsers, namely, Google Chrome, Mozilla Firefox, Netscape Navigator, Safari, Internet Explorer and Opera. This section describes the CSS styling issues for Punjabi and its output on different browsers.

4.1.1 Styling of first-letter

The CSS coding used to analyze the first-letter styling is given in (4.1).

```
p.introduction:first-letter {
font-size : 300%;
font-weight : bold;
float : left;
width : 1em;
color : #c00; }
```
…(4.1)

The effect of first-letter styling for Punjabi Language on six different browsers is given in Table 4.1.

Table 4.1: Styling of first-letter

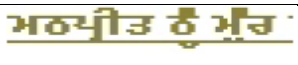
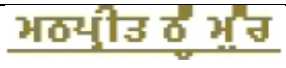
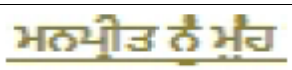
Name of Browser	Effect of Styling	Remarks
Google Chrome		*Matra* separated form first-letter
Mozilla Firefox		No Error
Netscape Navigator		*Matra* separated form first-letter
Safari		*Matra* separated form first-letter
Internet Explorer		*Matra* separated form first-letter
Opera		*Matra* separated form first-letter

It is evident from Table 4.1, that only Mozilla Firefox displayed the correct output and applies the styling to conjunct characters. All other browsers only applied the styling to single character.

4.1.2 Underlining of characters

During underlining of characters in a Punjabi website, the *matras* like '◌ੁ' *Aunkar* and '◌ੂ' *Dulanukar* become unreadable due to its overlap with the underline. It creates problem in reading the information correctly. Table 4.2, shows the underlining issue for all browsers considered in this study.

Table 4.2: Underlining of characters

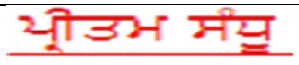
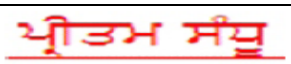
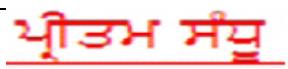
Name of Browser	Effect of Styling	Remarks
Google Chrome		*Matra* overlap with underline
Mozilla Firefox		*Matra* overlap with underline
Netscape Navigator		*Matra* overlap with underline
Safari		*Matra* overlap with underline
Internet Explorer		*Matra* overlap with underline
Opera		*Matra* overlap with underline

It is clear from Table 4.2, that all the browsers have the problem in reading *matras* due to overlap of *matras* with underline.

4.1.3 Hyperlink display while mouse over

When we use Punjabi text in hyperlink, the *matras* overlap with underlining as shown in Table 4.3.

Table 4.3: Hyperlink display while mouse over

Name of Browser	Effect of Styling	Remarks
Google Chrome		*Matra* overlap with underline
Mozilla Firefox		*Matra* touches the underline
Netscape Navigator		*Matra* touches the underline
Safari		*Matra* overlap with underline
Internet Explorer		*Matra* touches the underline
Opera		*Matra* overlap with underline

It is evident from Table 4.3, that the problem with hyperlink display over mouse over of Punjabi text is present in all the six browsers.

4.1.4 Over lining of the characters

The Punjabi websites generally do not make use of over lining feature for styling. To analyze this issue we created our own HTML content for Punjabi language. The CSS code for over lining is given in (4.2).

p {text-decoration: overline; font-size:15px;} …(4.2)

When we use the CSS text decoration for over lining, the line overlaps the *matras* like '*sia(h)ri*, '*bia(h)ri*, '*la(n)*, '*Dulai(n)*, '*HoRa* and '*kAnauRa* in Punjabi language. Table 4.4, gives the effect of over lining on various browsers.

Table 4.4: Over lining of character

Name of Browser	Effect of Styling	Remarks
Google Chrome	ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ)	Line overlaps with the *matras*
Mozilla Firefox	ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ)	Line touches the *matras*
Netscape Navigator	ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ)	Spacing is proper
Safari	ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ)	Line overlaps with the *matras*
Internet Explorer	ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ)	Distorted line where digits or special chatacters are present
Opera	ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ)	Line touches the *matras*

It is evident form Table 4.4, that in case of over lining the line either overlaps or touches the *matras*. For Netscape Navigator the spacing between line and *matra* is proper. The line is distorted where digits or special characters are present in case of Internet Explorer.

4.1.5 Line-through of characters

Most Punjabi websites do not use line-through feature. So this feature has been analyzed by creating our own HTML content for Punjabi language. The result of findings on different browsers is shown in Table 4.5.

Table 4.5: Line-through of character

Name of Browser	Effect of Styling	Remarks
Google Chrome	~~ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ).~~	No error
Mozilla Firefox	~~ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ).~~	The line is not in the center
Netscape Navigator	~~ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ).~~	No error
Safari	~~ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ).~~	No error
Internet Explorer	~~ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ).~~	The line is thicker and reduces the clarity of letters
Opera	~~ਚੇਨਈ, 28 ਅਗਸਤ (ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ).~~	No error

It is clear form Table 4.5, that in Mozilla the line is not exactly in the center and for Internet Explorer the line is thicker than in other browser, thus reducing the readability of letters.

4.1.6 Horizontal spacing

In case of Punjabi language when letter-spacing is applied to text, the spacing should be given after conjunct letter, *i.e.,* the letter and the *matra*. The CSS coding used for horizontal spacing is given in (4.3).

H2 {letter-spacing: 10px;} …(4.3)

Table 4.6, shows the effect of horizontal spacing applied to Punjabi text for each browser.

Table 4.6: Horizontal spacing

Name of Browser	Effect of Styling	Remarks
Google Chrome	ਚ ੜ੍ ਦ ਾ ਕ ਲ ਾ ਿ ਨ ਊ ਜ਼ ਸ ਰ ਿ ਵ ਸ	*Matras* are separated from the letter

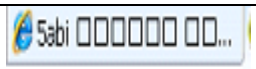
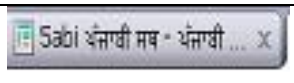
Mozilla Firefox	ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ	No error, Space is given after comlete letter
Netscape Navigator	ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ	*Matras* are separated from the letter
Safari	ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ	*Matras* are separated from the letter
Internet Explorer	ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ	Few *Matras* are separated from the letter
Opera	ਚੜ੍ਹਦੀਕਲਾ ਨਿਊਜ਼ ਸਰਵਿਸ	*Matras* are separated from the letter

It is evident from Table 4.6, that for most browsers the *matra* gets separated from the letter. The horizontal spacing was better in Internet Explorer and the best in case of Mozilla Firefox.

4.1.7 Title bar display for Punjabi letters

If a Punjabi website has a title in Punjabi it should be displayed properly in a web browser. But it has been found that, few browsers do not support this feature as indicated in Table 4.7.

Table 4.7: Title bar display

Name of Browser	Effect of Styling	Remarks
Google Chrome		Punjabi font is not recoganized
Mozilla Firefox		No error
Netscape Navigator		No error
Safari		No error
Internet Explorer		Punjabi font is not recoganized
Opera		No error

It is evident from Table 4.7, that for Google Chrome and Internet Explorer the title bar has error in display of Punjabi letters.

4.2 Comparative study of browsers

Seven CSS styling issues have been analyzed for Punjabi language. The result of our analysis for six browsers is given in Table 4.8. Here, "ERROR" indicates that the corresponding issue has a display problem with corresponding browser and "NO ERROR" indicates that the issue is not having any display problem with the mentioned browser.

Table 4.8: Comparative study of CSS styling issue for each web browser

Issues Vs. Web browsers	Google Chrome	Mozilla Firefox	Netscape Navigator	Safari	Internet Explorer 7.0 or above	Opera
Styling of First-letter	ERROR	NO ERROR	ERROR	ERROR	ERROR	ERROR
Underlining of Character	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
Link while mouse over	ERROR	NO ERROR	NO ERROR	ERROR	NO ERROR	ERROR
Over lining of Characters	NO ERROR	NO ERROR	NO ERROR	NO ERROR	ERROR	NO ERROR
Line through Characters	NO ERROR	ERROR	NO ERROR	NO ERROR	ERROR	NO ERROR
Horizontal spacing	ERROR	NO ERROR	ERROR	ERROR	ERROR	ERROR
Title bar display for Punjabi letters	ERROR	NO ERROR	NO ERROR	NO ERROR	ERROR	NO ERROR

It is evident form Table 4.8, that the problem of underlining of characters is present in all the browsers. The minimum error have been found in Mozilla Firefox and the maximum in Internet Explorer.

4.3 Fonts used for Punjabi language

The Unicode and non-Unicode fonts have been used in Punjabi websites. These fonts have already been discussed in Chapter 2. Generally web-browsers have support for

Unicode. The web-pages made with Unicode text, will always be viewed in the right script even if the font in which the web-pages are made is not installed into the system. We have analyzed about seventy, Punjabi news, magazines and other websites have been analyzed to find out the fonts used by these websites. It has been analyzed that, the fonts like *Arial Unicode MS, Tahoma, Raavi, Mangal, Saab, AmbarKalmi, ChatrikUni, Akaash, and AnmolUni* are Unicode *Gurmukhi* fonts and are compatible with the system. If a Punjabi website makes use of these fonts then there is no problem in display of Punjabi text on browsers. The non-Unicode fonts like *Satluj, DRchatrikWeb, WebAkharThick, GurbaniWebThick, DespardesEngland, etc.*, are not supported by the browsers and have to be downloaded in order to read the Punjabi text properly.

The analysis of Punjabi websites is given in Table 4.9. The first column of table give the link of website tested, the second column gives the detail that whether the site makes use of CSS or not. Third and fourth column respectively contain information about the font used by the website and whether font is Unicode or non-Unicode. The fifth column provides comments relevant to our study for that website

Table 4.9: Analysis of Punjabi Websites

Website URL	Use CSS (Yes /No)	Font used	Unicode/ Non-Unicode	Comments
http://www.5abi.com/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display.
http://ajdiawaaz.com/	Yes	Arial	Unicode	It is a Punjabi news website. No error has been found in display.
http://ajitweekly.com/	Yes	Arial	Unicode	It is a Punjabi news website. No error has been found in display.
http://www.apnaorg.com/sanjh/	Yes	Verdana	Unicode	It is a Punjabi website. No error has been found in display.
http://www.badhni.com	Yes	Arial, Tahoma	Unicode	It is a Punjabi news website. No error has been found in display.

http://www.bahujanexpress.com	Yes	AmritLipi	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available.
http://charchapunjab.com/	Yes	dRChatrik Web	Non-Unicode	It is a Punjabi website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi.
http://www.charhdikala.com/web/	Yes	Mangal	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available.
http://dailyaashiana.com/newspaper/	Yes	Satluj, Arial	Non-Unicode	It is a Punjabi news website. No error has been found in display.
http://www.ajitjalandhar.com/	Yes	Satluj	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available.
http://www.dailyakalipatrika.com	No	Satluj	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi.
http://dailypehredar.com/	Yes	Satluj	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available.
http://www.deshsewak.com/	Yes	DRChatrik Web	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi.

http://www.deshvideshtimes.com/	Yes	Satluj	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi.
http://www.despardesweekly.co.uk/	Yes	DespardesEngland	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. Most of the content is in English language.
http://www.doabaheadlines.co.in/	Yes	Ravvi	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available.
http://europesamachar.com/	Yes	Tahoma, Arial	Unicode	It is a Punjabi news website. No error has been found in display.
http://www.europevichpunjabi.com/	Yes	Gurmukhi, Arial	Unicode	It is a Punjabi news website. No error has been found in display. English is also used in the website.
http://hamdardweekly.com	Yes	Arial, Tahoma	Unicode	It is a Punjabi news website. No error has been found in display.
http://hindustanpost.ca/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display. English text is also used.
http://onlineindian.net/	Yes	Raavi, Mangal	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available.
http://indocanadiantimes.com/	No	NA	Unicode	It is a Punjabi website. No error has been found in display. The website makes use images for displaying Punjabi content.

http://www.jagbani.com/	Yes	Mangal, Tahoma, Arial	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available.
http://janchetna.net/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display.
http://khabarnama.com/	Yes	DRChatrik Web, AmritLipi	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available.
http://khulisoch.com	Yes	AmritLipi, Satluj	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available.
http://lalparcham.org/	Yes	AmritLipi	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available. English text is also used.
http://nawanzamana.in/nz/index.php	Yes	Satluj	Non-Unicode	It is a Punjabi website. The Punjabi text is displayed as images. e-Paper of the website is available.
http://www.nisot.com	Yes	DRChatrik Web	Non-Unicode	It is a Punjabi magazine website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi.

http://pardestimes.com/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available. English text is also used.
http://www.parvasi.com/	Yes	Arial	Unicode	It is a Punjabi news website. No error has been found in display.
http://punjabheadlines.com	Yes	Raavi	Unicode	It is a Punjabi website. No error has been found in display. English text is also used.
http://punjabmonitor.com/	Yes	Raavi	Unicode	It is an online Punjabi magazine. No error has been found in display.
http://www.5abnews.com/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available.
http://punjabpost.ca/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display.
http://punjabspectrum.com	Yes	Arial,	Unicode	The website is available in English and Punjabi. No error has been found in display.
http://punjabtimes.in/	Yes	Satluj	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi.
http://punjabidaily.com	Yes	Trebuchet MS	Unicode	It is a Punjabi news website. Punjabi text is displayed as images. English text is used.
http://www.punjabidunia.com/	Yes	Satluj	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available. English text is also used.
http://punjabinewsonl	Yes	Raavi	Unicode	It is a Punjabi news website.

ine.com/				No error has been found in display.
http://www.punjabiwebhouse.com/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display.
http://wn.com/punjabi	Yes	Tahoma	Unicode	It is a Punjabi news website. Error has been found in some part of text.
http://punjabibooks.com/	Yes	Satluj, Trebuchet MS	Unicode	It is a Punjabi website. No error has been found in display.
http://www.quamiekta.com/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display.
http://www.rozanaspokesman.com/	Yes	Satluj	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available.
http://www.sahitkar.com	Yes	AmbarKalmi, Times New Roman	Unicode	It is a Punjabi online magazine website. No error has been found in display.
http://www.sangeetdarpan.com	Yes	Satluj	Non-Unicode	It is a Punjabi monthly magazine. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available. English text is also included.
www.sanjhsavera.com	Yes	DRChatrik Web	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi.
http://www.seerat.ca	Yes	Tahoma	Unicode	It is an online Punjabi magazine. No error has been

				found in display.
http://shanpanjabdee.com	Yes	Satluj	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available.
http://sher-e-panjab.com/	Yes	Tahoma	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available.
http://sikhmarg.com	Yes	Tahoma	Unicode	It is a Punjabi website. No error has been found in display.
http://sikhshahadat.com/	Yes	Satluj, GurbaniLipi	Non-Unicode	It is a Punjabi monthly magazine. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. English text is included.
http://www.sikhvirsa.com/	Yes	Raavi	Unicode	It is a Punjabi monthly magazine. No error has been found in display. English text is also used.
http://skyhawktimes.com	Yes	Arial	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available. English text is also used.
http://www.sridasam.org	Yes	AnmolDevanSpl	Unicode	It is a Punjabi news website. No error has been found in display. English text is also used.
http://www.gurugranthdarpan.com/	Yes	Tahoma, WebAkharThick, SplAnmol, GuruDevan	Non-Unicode	It is a Punjabi website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi.

				English text is also used.
http://granthsahib.com/	Yes	GurbaniWebThick	Non-Unicode	It is a Punjabi website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is also available. English text is also used.
http://tarksheel.com/	Yes	DRChatrikWeb	Non-Unicode	It is a Punjabi news website. The font used by the website is incompatible with the system. So there are issues in display of Punjabi. e-Paper of the website is available. English text is also used.
http://tasveer.co.nz/	Yes	DRChatrikWeb, Arial, Helvetica, sans-serif	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is also available.
http://www.rajnimagazine.blogspot.com/	Yes	Arial	Unicode	Punjabi Monthly Magazine; English text included; contains image of all pages of magazine.
http://www.epaper.thetimesofpunjab.com	Yes	AmritLipi	Unicode	It is a Punjabi news website. No error has been found in display. e-Paper of the website is available.
http://thetimesofpunjab.com/punjabi-main-news.aspx	Yes	AmritLipi, Satluj	Unicode	It is a Punjabi news website. No error has been found in display.
http://punjabitribuneonline.com/	Yes	Raavi	Unicode	It is a Punjabi news website. No error has been found in display.
http://www.vishawkarma.com/creature-of-universe.html	Yes	Raavi, Amritlipi	Unicode	It is a Punjabi website. No error has been found in display.
http://wakeupkhalsa.com/	Yes	Raavi, Tahoma	Unicode	It is a Punjabi news website. No error has been found in

				display.
http://wichaar.com/news/130/	Yes	AnmolUni	Unicode	It is a Punjabi news website. No error has been found in display.

It is evident from Table 4.9, that all seventy Punjabi websites make use of CSS for styling the content. Out of these analyzed Punjabi websites, about 68% Punjabi website use Unicode *Gurmukhi* fonts and 32% Punjabi websites use non-Unicode *Gurmukhi* fonts for Punjabi text. The most commonly used *Gurmukhi* fonts for Punjabi websites are *AmritLipi, Arial, dRChatrikWeb, Mangal, Raavi, Satluj* and *Tahoma*. The non-Unicode fonts like *Satluj* and *dRChatrikWeb* are not compatible with the system and hence, there is an error in display of Punjabi text. The Unicode *Gurmukhi* fonts like *AmritLipi*, *Arial*, *Mangal*, *Tahoma* and *Raavi* are compatible with the browsers and no error has been found in display of Punjabi content.

4.4 Web application to test CSS styling issues for Punjabi language

CSS styling issues for Punjabi language have already been discussed in section 4.1. To analyze these CSS styling issues for Punjabi language, we have developed a web application. The main features of this web application have been discussed below.

4.4.1 Dynamic CSS

The web application implements a numbers of CSS styles. The end-user has the facility to enter their Punjabi text and apply CSS styles on it on different browsers. To apply styling, the end-user has to select the CSS style from the options available to them in this web application. The effects of CSS styles applied on end-users text is displayed on the output window. The screenshot of the "*Dynamic CSS*" is given in Figure 4.1.

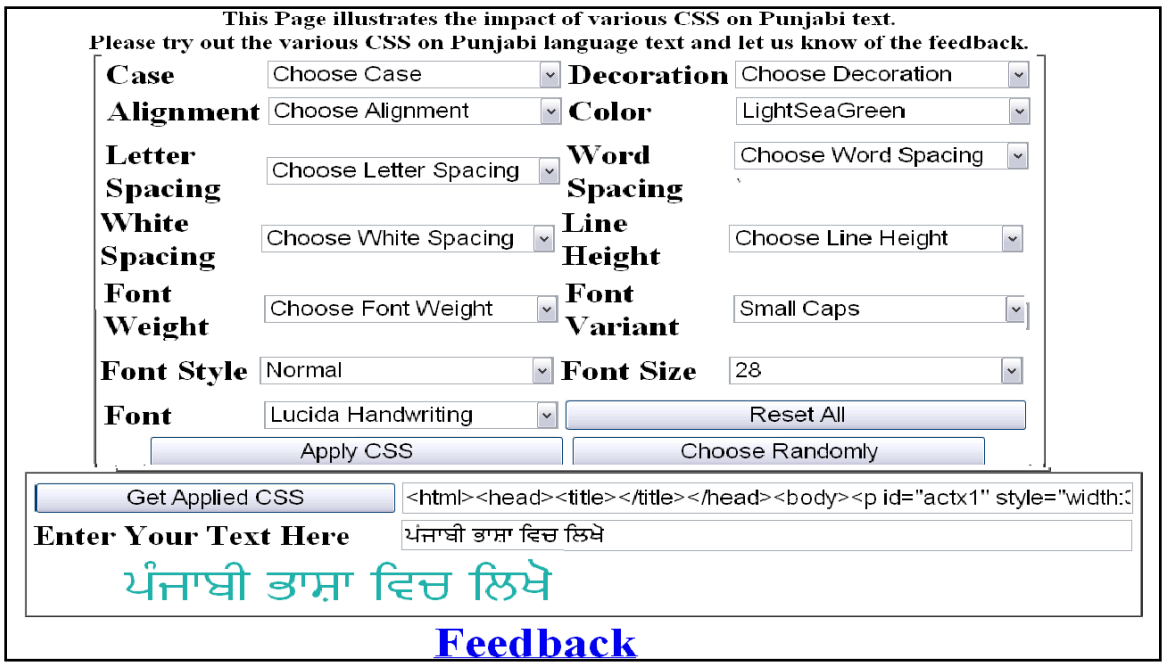


Figure 4.1: Screenshot of "*Dynamic CSS*" web application

Figure 4.1, shows the effect of CSS styles applied to Punjabi text. The CSS Styles used in the web application are described below.

1. **Case-** It applies text-transformation like upper case, lower case and capitalize on the text. The code used for 'case' is given in (4.4).

```
<select id="changedcase1" style="width:120pt">
    <option value=";text-transform: none" selected="selected">Choose Case</option>
    <option value=";text-transform: none">None</option>
   <option value=";text-transform: uppercase">Upper Case</option>
   <option value=";text-transform: lowercase">Lower Case</option>
   <option value=";text-transform: capitalize">Capitalize</option>
</select>                                                                    …(4.4)
```

2. **Decoration-** It applies text-decoration like underline, overline, line-through and blink. The code used to provide decoration style is given in (4.5).

```
<select  id="changeddeco1" style="width:120pt">
    <option value=";text-decoration: none" selected="selected">Choose Decoration</option>
    <option value=";text-decoration: none">None</option>
    <option value=";text-decoration: underline">Underlined</option>
    <option value=";text-decoration: overline">Overline</option>
    <option value=";text-decoration: line-through">Line Through</option>
    <option value=";text-decoration: blink">Blink</option>
```

```
</select>
```
…(4.5)

3.**Alignment-** It applies text-align like center, left and right alignment on text. The code used is given in (4.6).

```
<select  id="changedalign1" style="width:120pt">
    <option value=";text-align: left" selected="selected">Choose Alignment</option>
    <option value=";text-align: center">Center</option>
    <option value=";text-align: left">Left</option>
    <option value=";text-align: right">Right</option>
</select>
```
…(4.6)

4.**Color-** A color can be applied to text. The code used is given in (4.7)

```
<select  id="changedcolor1" style="width:120pt">
    <option value=";color: rgb(0,0,0)" selected="selected">Choose Color</option>
    <option value=";color: rgb(240,248,255)">AliceBlue</option>
    <option value=";color: rgb(250,235,215)">AntiqueWhite</option>
    <option value=";color: rgb(0,255,255)">Aqua</option>
</select>
```
…(4.7)

5.**Letter Spacing-** It applies letter-spacing on characters with different values. The code that is used to provide color to the text is given in (4.8).

```
<select  id="changedletterspace1" style="width:120pt">
    <option value=";letter-spacing: 0px" selected="selected">Choose Letter Spacing</option>
    <option value=";letter-spacing: 1px">1px</option>
    <option value=";letter-spacing: 2px">2px</option>
    <option value=";letter-spacing: 3px">3px</option>
    <option value=";letter-spacing: 5px">5px</option>
    <option value=";letter-spacing: 10px">10px</option>
    <option value=";letter-spacing: 20px">20px</option>
</select>
```
…(4.8)

6.**Word Spacing-** It applies word-spacing on words in text. The code used to inster space between words is given in (4.9).

```
<select  id="changedletterspace1" style="width:120pt">
    <option value=";word-spacing: 0px" selected="selected">Choose Word Spacing</option>
    <option value=";word-spacing: 1px">1px</option>
    <option value=";word -spacing: 2px">2px</option>
    <option value=";word -spacing: 3px">3px</option>
    <option value=";word -spacing: 5px">5px</option>
```

```
<option value=";word -spacing: 10px">10px</option>
<option value=";word -spacing: 20px">20px</option>
</select>
```
…(4.9)

7. **White Spacing-** It applies white-space like Normal, Pre and nowrap on the text. The code used is given in (4.10).

```
<select  id="changedwhitespace1" style="width:120pt">
<option value=";white-space: normal" selected="selected">Choose White Spacing</option>
<option value=";white-space: normal">Normal</option>
<option value=";white-space: pre">Pre</option>
<option value=";white-space: nowrap">No Wrap</option>
</select>
```
…(4.10)

8. **Line Height-** It allows line-height with different values on the text. The code used for line-height is given in (4.11).

```
<select  id="changedlineheight1" style="width:120pt">
<option value=";line-height: 120%" selected="selected">Choose Line Height</option>
<option value=";line-height: 10%">10 %</option>
<option value=";line-height: 25%">25 %</option>
<option value=";line-height: 50%">50 %</option>
<option value=";line-height: 75%">75 %</option>
<option value=";line-height: 100%">100 %</option>
<option value=";line-height: 125%">125 %</option>
</select>
```
…(4.11)

9. **Font Weight-** It applies font-weight like normal, bold, lighter, *etc.*, on the text. The code used is given in (4.12).

```
<select  id="changedfontweight1" style="width:120pt">
<option value=";font-weight: normal" selected="selected">Choose Font Weight</option>
<option value=";font-weight: lighter">Lighter</option>
<option value=";font-weight: normal">Normal</option>
<option value=";font-weight: bold">Bold</option>
<option value=";font-weight: bolder">Bolder</option>
<option value=";font-weight: 100">100</option>
<option value=";font-weight: 200">200</option>
<option value=";font-weight: 300">300</option>
<option value=";font-weight: 400">400</option>
<option value=";font-weight: 500">500</option>
<option value=";font-weight: 600">600</option>
```

```
<option value=";font-weight: 700">700</option>
<option value=";font-weight: 800">800</option>
<option value=";font-weight: 900">900</option>
</select>
```
…(4.12)

10. **Font Variant-** It applies font-variant like normal and small-caps style on text. The code used for font variant is given in (4.13).

```
<select  id="changedfontvariant1" style="width:120pt">
<option value=";font-variant: normal" selected="selected">Choose Font Variant</option>
<option value=";font-variant: normal">Normal</option>
<option value=";font-variant: small-caps">Small Caps</option>
</select>
```
…(4.13)

11. **Font Style-** It applies font-style for normal, italics and oblique on the text. The code used for styling the text is given in (4.14).

```
<select  id="changedfontstyle1" style="width:120pt">
<option value=";font-style: normal" selected="selected">Choose Font Style</option>
<option value=";font-style: normal">Normal</option>
<option value=";font-style: italic">Italic</option>
<option value=";font-style: oblique">Oblique</option>
</select>
```
…(4.14)

12. **Font Size-** It applies font-size with different values on text. The code used is given in (4.15).

```
<select  id="changedfontsize1" style="width:120pt">
<option value=";font-size: medium" selected="selected">Choose Font Size</option>
<option value=";font-size: xx-small">xx-Small</option>
<option value=";font-size: x-small">x-Small</option>
<option value=";font-size: small">Small</option>
<option value=";font-size: medium">Medium</option>
<option value=";font-size: large">Large</option>
<option value=";font-size: 8px">8</option>
<option value=";font-size: 9px">9</option>
<option value=";font-size: 10px">10</option>
<option value=";font-size: 11px">11</option>
<option value=";font-size: 12px">12</option>
<option value=";font-size: 14px">14</option>
<option value=";font-size: 16px">16</option>
<option value=";font-size: 18px">18</option>
```

```
<option value=";font-size: 20px">20</option>
<option value=";font-size: 22px">22</option>
<option value=";font-size: 24px">24</option>
<option value=";font-size: 26px">26</option>
<option value=";font-size: 28px">28</option>
<option value=";font-size: 36px">36</option>
<option value=";font-size: 48px">48</option>
<option value=";font-size: 72px">72</option>
</select>
```
…(4.15)

13. **Font-** It applies font-family with different value of fonts on the text. The code used to change font-family is given in (4.16).

```
<select id="changedfontfamily1" style="width:120pt">
<option value=";font-family: 'Courier New', Courier, monospace" selected="selected">Choose Font</option>
<option value=";font-family: Arial, Helvetica, sans-serif">Arial</option>
<option value=";font-family: 'Arial Black', Gadget, sans-serif">Arial Black</option>
<option value=";font-family: 'Comic Sans MS', cursive">Comic Sans MS</option>
<option value=";font-family: Courier, monospace">Courier</option>
<option value=";font-family: 'Courier New', Courier, monospace">Courier New</option>
<option value=";font-family: Garamond, serif">Garamond</option>
<option value=";font-family: Georgia, serif">Georgia</option>
<option value=";font-family: Impact, Charcoal, sans-serif">Impact</option>
<option value=";font-family: 'Lucida Console', Monaco, monospace">Lucida Console</option>
<option value=";font-family: 'Lucida Sans Unicode', 'Lucida Grande', sans-serif">Lucida Sans Unicode</option>
<option value=";font-family: 'MS Sans Serif', Geneva, sans-serif">MS Sans Serif</option>
<option value=";font-family: 'MS Serif', 'New York', sans-serif">MS Serif</option>
<option value=";font-family: 'Palatino Linotype', 'Book Antiqua', Palatino, serif">Palatino Linotype</option>
<option value=";font-family: Symbol, sans-serif">Symbol</option>
<option value=";font-family: Tahoma, Geneva, sans-serif">Tahoma</option>
<option value=";font-family: 'Times New Roman', Times, serif">Times New Roman</option>
<option value=";font-family: 'Trebuchet MS', Helvetica, sans-serif">Trebuchet MS</option>
<option value=";font-family: Verdana, Geneva, sans-serif">Verdana</option>
<option value=";font-family: Webdings, sans-serif">Webdings</option>
</select>
```
…(4.16)

4.4.2 CSS styles on Punjabi text

A web application has been developed to test the CSS styling issues for Punjabi language. Different CSS style like first-letter, bold, italics, underline, marquee, blink, line-through, over lining, direction, border, font-size, font-weight, font-variant, letter-spacing, word-spacing, *etc*., has been applied on Punjabi text. These are tested by end-user using different browsers. The screenshot of error in these pages can be uploaded by end-user. Figure 4.2, shows the screenshot for CSS styles applied to Punjabi text.

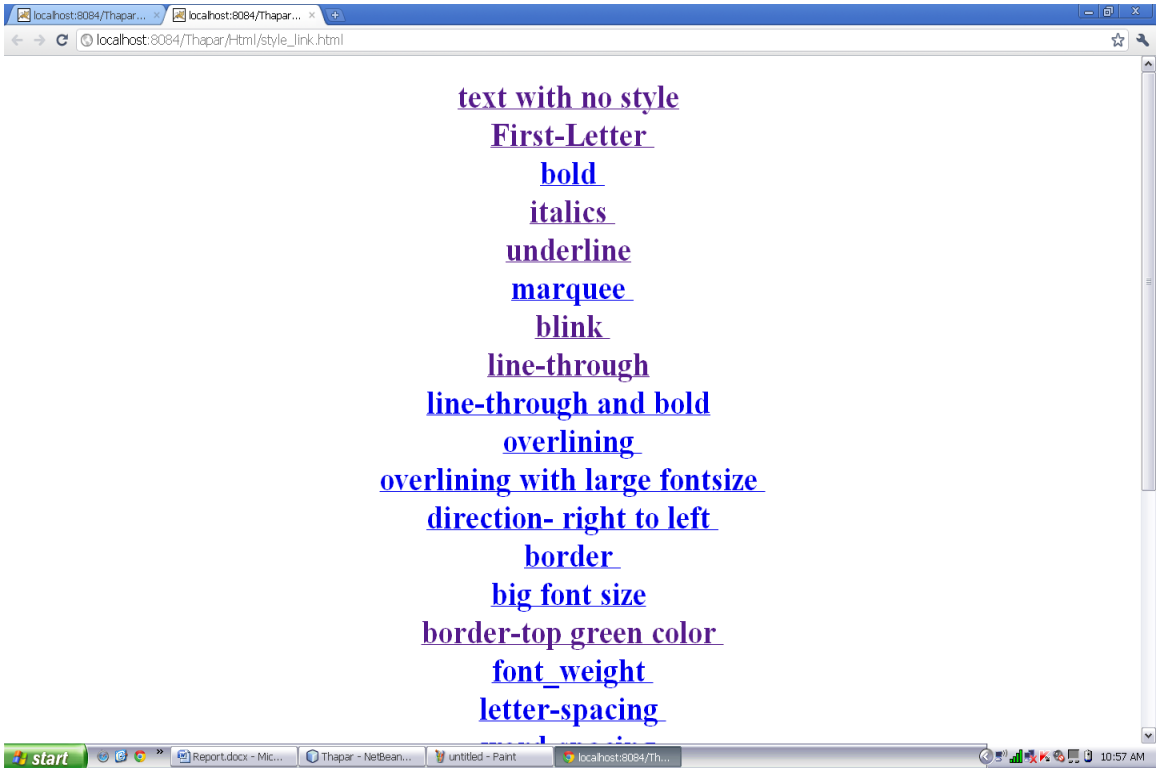


Figure 4.2: Screenshot for CSS styles to be applied on Punjabi text

Figure 4.2, shows the links to the web-pages on which the CSS style is applied on Punjabi text. For example, the link "*letter-spacing*" when tested on Internet Explorer has issues in its display. The screenshot for the same is given in Figure 4.3.

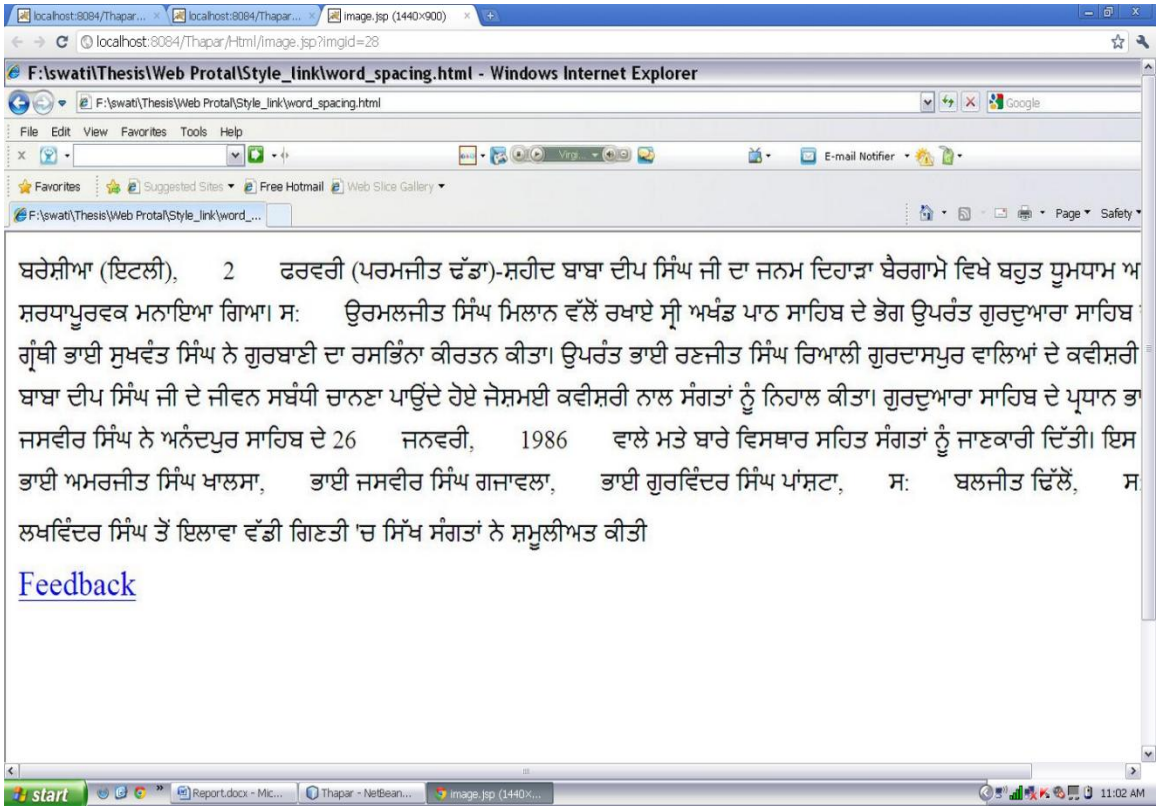


Figure 4.3: Screenshot of page tested on Internet Explorer

It is evident form Figure 4.8, that when letter-spacing is applied on Punjabi text, it is not properly displayed in Internet Explorer. The screenshot of this error page can be reported by clicking on "*Feedback*" link.

4.4.3 Feedback

The web application is used by the end-user with different browsers to view the effect of CSS styles on Punjabi text. If any error is found in the display of Punjabi text after applying CSS styles, then the end-user can capture the screenshot and can report the error on proposed web application. For this purpose we have designed a "*Feedback Form*" that has to be filled by the end-user. Figure 4.4, shows the screenshot of this "F*eedback Form*".

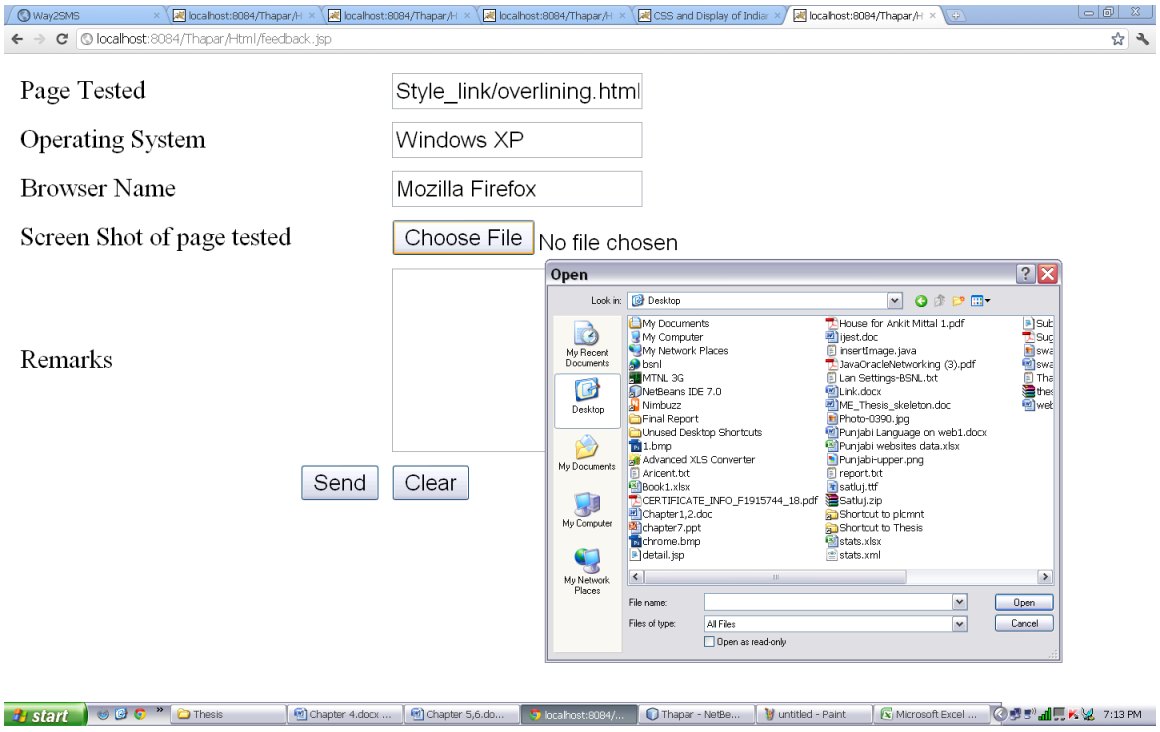


Figure 4.4: Screenshot of "*Feedback Form*"

Figure 4.4, shows screenshot of "*Feedback Form*" which is filled by the end-user to report errors in the tested page. The end-user fills the details about the error page like link of the page, operating system, browser on which the page was tested, the screenshot of the page tested and remarks. This feedback can be saved in the database which can be viewed by other user as well.

4.7 Web portal for Punjabi language

The proposed web portal contains the complete study of CSS styling issues for Punjabi, the analysis of Unicode and non-Unicode *Gurmukhi* fonts and Web application for Punjabi. The feedback uploaded by the end-user is stored in a database. The information stored in the database can be viewed by any user of the application.

The web portal has been developed using NetBeans IDE 7.0 in which we have used HTML pages and JSP files to create a web application. At the back-end we have used MySQL database to store the results of our findings.

The screenshot of the "*Welcome page*" of the web portal is given in Figure 4.5.

Figure 4.5: Screenshot of the "*Welcome page*"

When user clicks on the hyperlink "*Click Here*" on the "*Welcome page*" shown in Figure 4.5, it navigates user to the "*Home page*" of the web portal. The screenshot of the "*Home page*" is given in Figure 4.6.

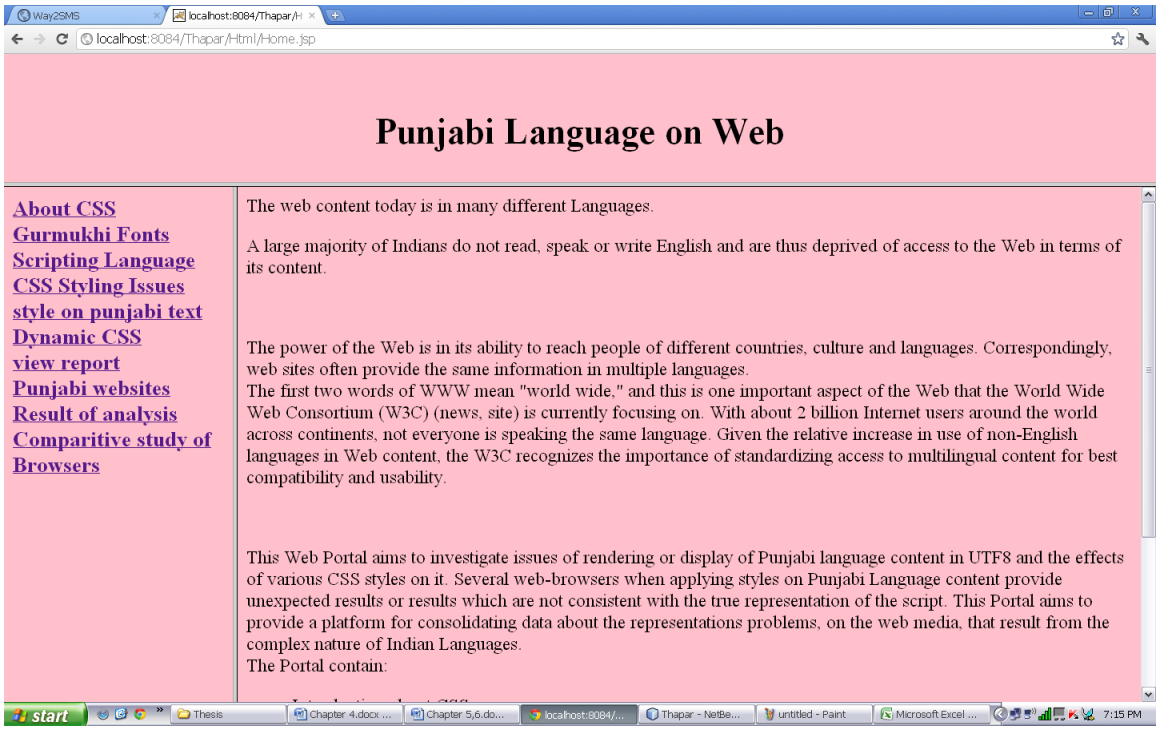


Figure 4.6: Screenshot of the "*Home page*"

It is clear from Figure 4.6, that the "*Home page*" gives brief introduction about out portal and describes the aim of the web portal. On the left side there are several links which gives details about our study. These have been described below.

i. **About CSS-** It contains the introduction to Cascading Style Sheets, its use, history and various CSS versions.

ii. **Gurmukhi Fonts-** It describes the various Unicode and non-Unicode *Gurmukhi* fonts, the advantage and disadvantage of using these fonts.

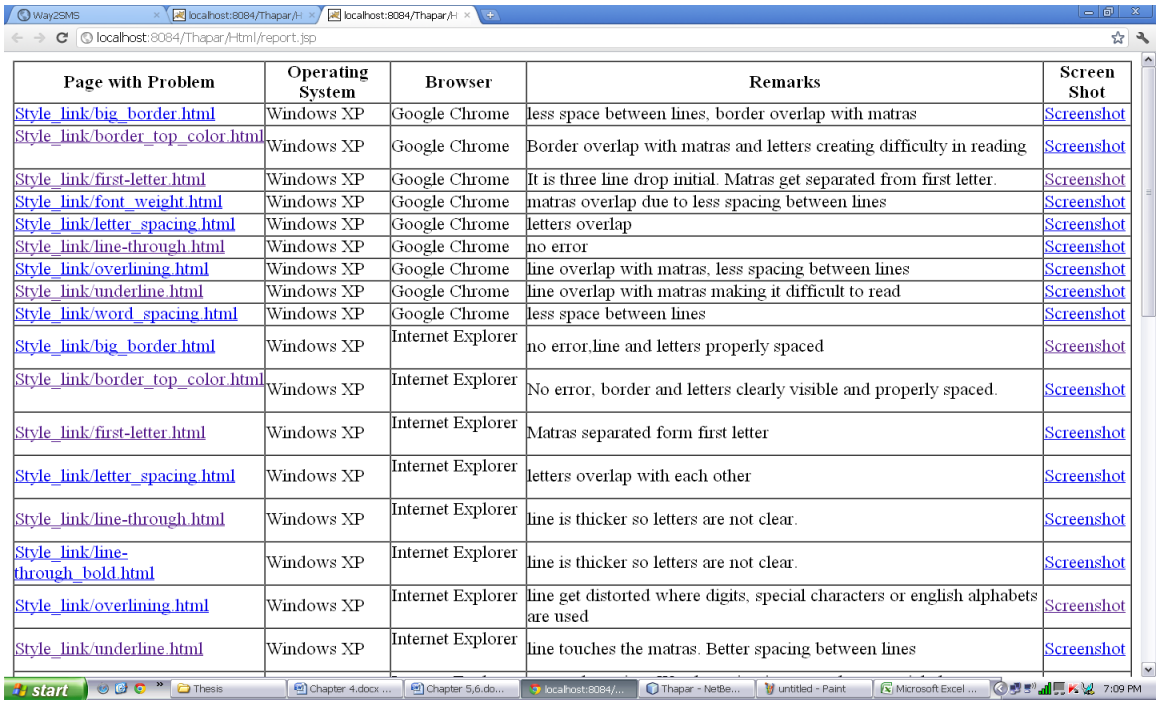
iii. **Scripting Language-** It contains introduction to *Devanagari*, *Gurmukhi* and *Shahmukhi* Scripts.

iv. **CSS styling issues-** It describes various CSS styling issues for Punjabi language.

v. **Styles on Punjabi text-** It implements different CSS styles on Punjabi text, allows end-user to test it on different browsers and provide their feedback.

vi. **Dynamic CSS-** It contains our web application in which end-user can select different styles, apply it on Punjabi text and view the effect of these styles.

vii. **View report-** It contains the report of error pages that are stored in database. It also includes the feedback given by the end-user. The screenshot of the "View report page" is given in Figure 4.7.



Page with Problem	Operating System	Browser	Remarks	Screen Shot
Style_link/big_border.html	Windows XP	Google Chrome	less space between lines, border overlap with matras	Screenshot
Style_link/border_top_color.html	Windows XP	Google Chrome	Border overlap with matras and letters creating difficulty in reading	Screenshot
Style_link/first-letter.html	Windows XP	Google Chrome	It is three line drop initial. Matras get separated from first letter.	Screenshot
Style_link/font_weight.html	Windows XP	Google Chrome	matras overlap due to less spacing between lines	Screenshot
Style_link/letter_spacing.html	Windows XP	Google Chrome	letters overlap	Screenshot
Style_link/line-through.html	Windows XP	Google Chrome	no error	Screenshot
Style_link/overlining.html	Windows XP	Google Chrome	line overlap with matras, less spacing between lines	Screenshot
Style_link/underline.html	Windows XP	Google Chrome	line overlap with matras making it difficult to read	Screenshot
Style_link/word_spacing.html	Windows XP	Google Chrome	less space between lines	Screenshot
Style_link/big_border.html	Windows XP	Internet Explorer	no error,line and letters properly spaced	Screenshot
Style_link/border_top_color.html	Windows XP	Internet Explorer	No error, border and letters clearly visible and properly spaced.	Screenshot
Style_link/first-letter.html	Windows XP	Internet Explorer	Matras separated form first letter	Screenshot
Style_link/letter_spacing.html	Windows XP	Internet Explorer	letters overlap with each other	Screenshot
Style_link/line-through.html	Windows XP	Internet Explorer	line is thicker so letters are not clear.	Screenshot
Style_link/line-through_bold.html	Windows XP	Internet Explorer	line is thicker so letters are not clear.	Screenshot
Style_link/overlining.html	Windows XP	Internet Explorer	line get distorted where digits, special characters or english alphabets are used	Screenshot
Style_link/underline.html	Windows XP	Internet Explorer	line touches the matras. Better spacing between lines	Screenshot

Figure 4.7: Screenshot of the "View Report page"

viii. **Punjabi Websites-** It contains details of all Punjabi website analyzed by us. It also provides the facility to end-user to add details of other Punjabi website which are not present in the list.

ix. **Results of Analysis-** It contains the results and findings of our analysis for CSS styling issues for Punjabi on different browsers and the analysis of Unicode and non-Unicode *Gurmukhi* Fonts.

x. **Comparative Study of Browsers-** It gives the result of comparative study of CSS styling issues on different browsers. The performance of different browsers for Punjabi language has been compared and documented in this link.

Chapter 5

Results of Analysis

The contents in websites are often in multiple languages and images. Almost all websites make use of Cascading Style Sheets (CSS) of styling the content. There are number of CSS styling issues like styling of first letter; underlining, over lining, line-through of characters; hyperlink display; and horizontal spacing for Punjabi language. These CSS styling issues has been tested on six different web browsers, namely, Google Chrome, Mozilla Firefox, Netscape Navigator, Safari, Internet Explorer and Opera. By referring to Table 4.8, it has been calculated that, the problem of underlining of characters is present in all the browsers. The problem of first-letter styling and horizontal spacing is found in 83.3 percent of the browsers. The problem of over lining is present only in Internet Explorer. The result of testing the CSS styling issues for Punjabi language on different browsers is given in Figure 5.1.

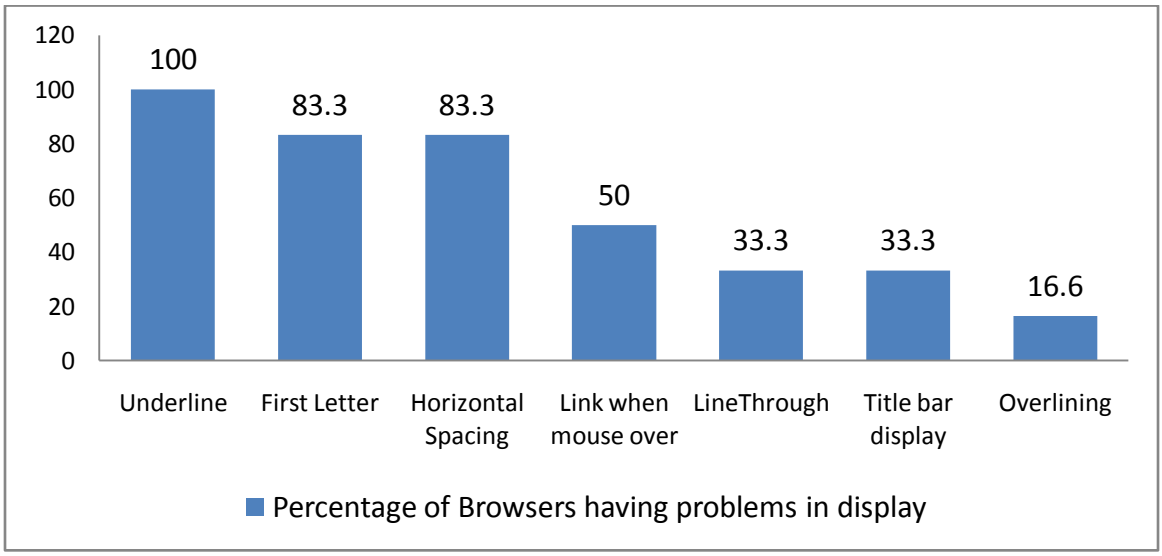


Figure 5.1: Bar graph for styling issues problems v/s the percentage of browsers having that problem

The bar graph in Figure 5.1, shows the CSS styling issues for Punjabi language with respect to percentage of browsers in which there is problem in display.

Based on the analysis given in Table 4.8, it has been identifed, that Mozilla Firefox supports the maximum number of CSS styling properties for Punjabi language display.

The percentage of CSS styling issue problems for Punjabi language in each browser is given in Figure 5.2.

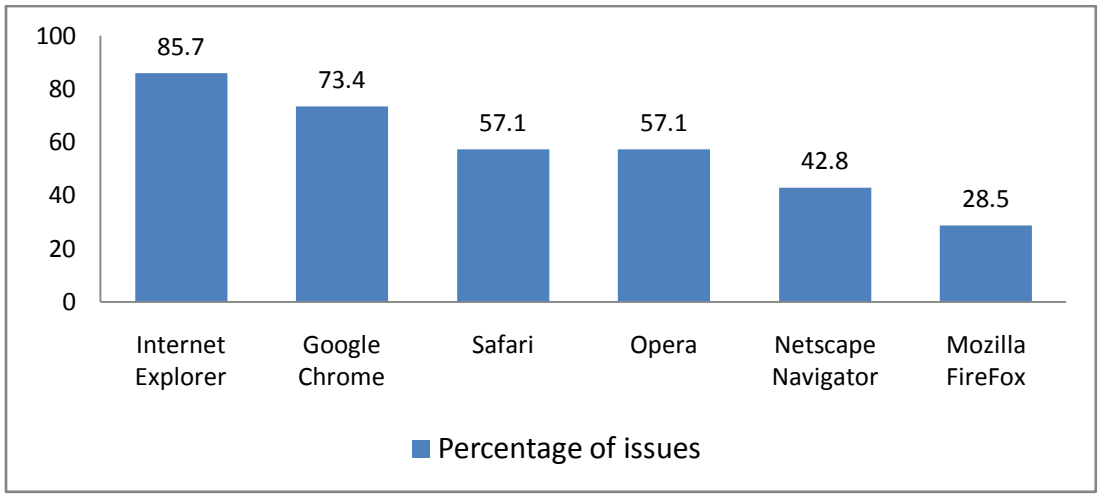


Figure 5.2: Bar graph to indicate the percentage of styling issue problems in each browser

It is evident from Figure 5.2, that Mozilla Firefox has only 28.5 percent of issues in display. Internet Explorer has the maximum, *i.e.*, 85.7 percent of problem in display. Thus we find that Mozilla Firefox is probably the browser that we should use for browsing Punjabi websites and Internet Explorer has the least performance, for browsing Punjabi websites.

Based on analysis given in Table 4.9, it has been found, that most of the Punjabi news websites also provide e-paper of their newspaper. The Punjabi websites also contain text in English and in form of images. The Unicode *Gurmukhi* fonts like *AmritLipi, Arial Unicode MS, Saab, Mangal, Raavi, Tahoma, etc.*, are compatible with the operating system and browsers with support for Unicode. The non-Unicode *Gurmukhi* fonts like *Satluj, dRChatrikWeb, WebAkhaThich, GurbaniWebThich, etc.*, are not compatible with the system unless installed. The percentage of Punjabi websites using Unicode and non-Unicode *Gurmukhi* font is represented with the help of pie-chat in Figure 5.3.

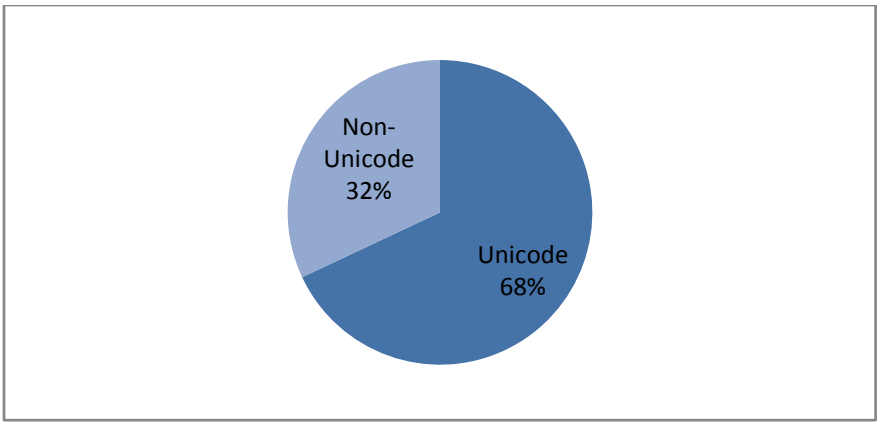


Figure 5.3: Pie-chart indicating the percentage of Punjabi websites using Unicode and non-Unicode *Gurmukhi* fonts

It is clear from Figure 5.3, that 68 percent of Punjabi website use Unicode *Gurmukhi* fonts and 32 percent of Punjabi websites use non-Unicode *Gurmukhi* fonts.

Based on the Table 4.9, it has been analyzed that the most commonly used Unicode *Gurmukhi* fonts for Punjabi websites are *AmritLipi*, *Arial*, *Mangal*, *Tahoma* and *Raavi*; and non-Unicode *Gurmukhi* fonts are *Satluj* and *dRChatrikWeb*. The approximate percentage of Punjabi websites using these fonts is given in Figure 5.4.

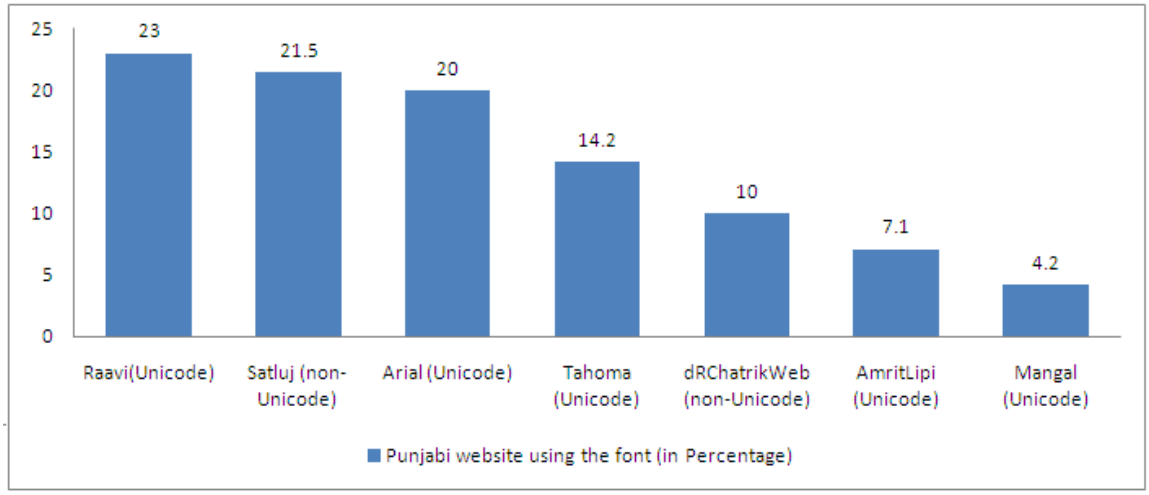


Figure 5.4: Bar Graph to indicate the percentage of Punjabi websites using a particular *Gurmukhi* font

It is clear from Figure 5.4, that the Unicode *Gurmukhi* font, *Raavi* is used by 23 percent of Punjabi websites. The non-Unicode fonts like *Satluj* and *dRChatrikWeb* are used by 25.9 percent and 12 percent Punjabi websites respectively.

Chapter 6

Conclusion and Future Scope

6.1 Conclusion

Cascading style sheets are used for styling the text in websites. Most of the Punjabi websites generally has underlining, hyperlink while mouse over and title bar display problems. To identify more styling issues on different browsers HTML content for Punjabi using CSS has been created. It was thus found that, the problem of underlining of characters is present in all the browsers. First-letter styling and horizontal spacing is found is 83.3 percent of browsers. The problem of over lining is present only in Internet Explorer.

Mozilla Firefox is the best for browsing Punjabi websites. It supports the maximum number of CSS styling properties for Punjabi language display with only 28.5 percent of the display issues. Internet Explorer has the maximum problems in display of Punjabi Language.

The Punjabi websites make use of both Unicode and non-Unicode *Gurmukhi* fonts for Punjabi content. The Unicode *Gurmukhi* fonts are compatible with system but, non-Unicode *Gurmukhi* fonts need to be installed on the system to read the Punjabi text. The Unicode Gurmukhi fonts, *Arial* and *Raavi* are used by 23 percent and 20 percent of the Punjabi websites respectively. The non-Unicode *Gurmukhi* font *Satluj* is used by 21.5 percent of the Punjabi websites

6.2 Future scope

There are various other CSS styling issues for Punjabi language like bullets and numbering which need to be identified. At present the number schemes/ bulleting is not supported in Indian languages. CSS standards need to be developed so that, by default the user could have the facility to use bulleting in his own Indic languages.

In our study we have tested the CSS styling issues on six web browsers. The performance of many other browsers like K-Meleno, OmniWeb, Camino, iCab, Konqueror, Epiphany,

RockMelt, *etc.*, need to be tested. The effects of CSS styling for Punjabi still need to be explored on mobile devices.

At present Punjabi website make use of both Unicode and non-Unicode *Gurmukhi* fonts. There is a need to convert the non-Unicode fonts to the Unicode fonts. The results of our findings for Punjabi language are applicable to other Indic languages as well. The results can be used for comparison of issues in other languages with Punjabi language. This study can be of help to W3C India for further analysis and recommendations for improvement in CSS standards.

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- Swati Mittal, R.K. Sharma, Parteek Bhatia, "Cascading Style Sheet Styling Issues in Punjabi Languages", Published in "Information Systems for Indian Languages International Conference, ICISIL 2011, Communications in Computer and Information Science, 2011" Vol. 139, pp. 242-245.

Research Paper Communicated

- Swati Mittal, Parteek Bhatia, "Web Application for analysis of CSS Styling Issues and Gurmukhi fonts for Punjabi websites", Communicated to IETE Technical Review