12. VL2: Building a Search Engine for Democracy

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Abstract

The ability to find a name in the electoral rolls is a very important requirement in a election. Unfortunately, no automated search engine was deployed on a significant scale till recently for the world's biggest democracy, India.

VL2, described in this paper, is an automated, web-based search engine developed for searching through the electoral rolls. It includes features like phonetic matching (in Indian languages) and multilingual interfaces for maximum usability and accessibility. Many measures are also taken to ensure VL2 usability on machines that may not support multilingual software.

VL2 is fully-functional, and has been tested with real data. These tests have shown VL2 to be remarkably fast, accurate and relevant. Currently, VL2 fulfills the need of voters to find information about their voting booth, its address and so on. It is envisioned that VL2 may also be used in the future for a completely automated search-assisted voter registration system.

VL2 was deployed as pilot case, on suggestion of Election Commissionfor for Chief Electoral Officer, Maharashtra as a online application for searching voterlist as well as an application for helplines set up by district collectors of Mumbai main, Mumbai suburbs and Thane districts for the Assembly Elections held in October 2004.

- Introduction

In the last Lok Sabha elections (held in April 2004), a large number of voters found their names missing, and were left without any recourse to remedy their situation. The primary cause of this was the inability to locate their names in the voter list.

Clearly, computers can be used to help solve this problem. In this paper is described VL2, a fully-functional, working search engine for the Electoral Rolls, purpose-built to help solve this problem.

VL2 is standards-based, works with the standard electoral data as in the format with the Election Commission (with automatic conversions wherever needed), and provides a Web-based interface to the voter list data.

- Initiation

The idea of a search-engine like interface to the voterlist data was originally conceived by Prof. Jitendra Shah, at that time with VJTI . He was also responsible for proving that the concept works by producing the initial version of the software. He then assigned the task of building a fullfledged solution after receiving request from the Election Office.

- Challenges

The electoral rolls present several challenges to anybody working on a search engine for it. The most important among these are summarized below:

- Multilingual Data: Data in the Electoral database is in the local language.

For example, Marathi in Maharashtra, Kannada in Karnataka, and so on. For a search engine to be truly national, it must be able to handle data in all of these languages.

- Spellings: The primary search keys are names and addresses. This is the biggest stumbling block to accurate results. Consider what happens when, say a Christian name or a South Indian name is written in Marathi. In fact, even local names have considerable variation in spellings in the database. In a quick test across a single constituency (about 3 lakh voters), we have found that a name is usually spelt on average in 3 different ways!
- Multi String names: The style of naming differs from region to region. The concept of first name, surname and use of suffixes as part of name or separate etc differ from person to person.
- Scale of data: The scale of the data, evaluated per city, is on average with most large databases. For example, a city like Pune contains about 50-60 lakh people on its electoral rolls. Mumbai (Main and Suburb together had 1.25 crore of voters data.
- Duplicates: Since the registration is so far done without the aid of a search engine, there are duplicate names in the list. There is no obvious way to find whioch one is correct and which not, except by the Election Office records.

- Speed and Relevancy: Given the scale of the data, and the imperfections in spelling; the search engine must be fast and produce relevant results. This will enhance user experience, as well as enable deployment of the software in time-sensitive environments like that of a helpline/ call-center.
- Legacy data formats: The database is usually in the FoxPro.dbf format.

Hence a conversion process that converts this data to the more modern SQL based databases is required.

In addition to the above challenges, the software must, of course, be easy to use. In an ideal scenario, the software should be usable across the Web by any person, and should be just like any other search engine!

- Current Approach

Most state governments today do use IT for enhancing the electoral process. In fact, most governments have put up the electoral rolls on the Internet. Unfortunately, the approach used for locating a name is not very different from the existing manual process.

Usually, the user is taken to a website which first requires geographic details such as city/district, assembly constituency, etc. Once such information has been obtained (it is assumed that the user knows such information - which is not true all the time), a list of voters in that area is provided on a web page. The user is then expected to look through the list to find his/her name.

Clearly, this does not work if the name is not found. Either the user must repeat the process with different details, or give up. With most web users pampered by Google, it is not difficult to see how effective this approach is for the most important case - when the name is not found.

- Our Approach

Most approaches today are data-driven, in that the user is secondary to the format of the data. The approach used by VL2 is user-driven, the user specifies what to search for. In this sense, VL2 is a true search engine for the electoral data.

The only information the user must provide is his name and surname. VL2 requires no other data. Of course, it can also use information such as address (building name, etc.), and assembly constituency to deliver more specific results, in the case of very common names.

The Main Search Application

Before going to the main search page, user is asked to select the option for viewing Indian language text (in this case Marathi) depending on which of the option is best visible on his/her screen. The options are provided in the form of a chart with text written in Marathi using each of the available technologies (i.e. Unicode, static font, Dynamic font etc.). User is then asked to select one option which he/she can view best on his/her computer. On clicking the option user is taken to appropriate main page. This takes care of selecting right kind of environment for each of the client-side machine without bothering the user about technological details.(see selection screen snapshot)

The main search engine interface is carefully built to resemble most contemporary search engines, so that adoption by users is not hampered by a steep learning curve. The interface is available in Marathi as well as English(see main screen snapshot).

Once a search has been carried out, the results are shown ordered by relevancy. Once the name has been found, a user clicking on it is led to a page giving voter details, such as booth number, booth address, etc.(see booth details snapshot).

Most of the challenges mentioned in Section 3 have been tackled, as outlined in the following sections.

- Multilingual Issues:

Tackling multilinguality is not very difficult in theory. As per best practices today, the software is based entirely on Unicode. This means that all input, output, and storage is Unicode-based. The conversion process automatically converts the ISCIIbased electoral data to Unicode.

On Unicode-based client operating systems like GNU/ Linux, Windows XP, Windows 2000, etc., the search engine can accept input in Unicode as well display output in Unicode (which is also font-independent).

Non-Unicode operating systems do pose input/output problems, which have been solved using the following features:

1. Input in ITRANS: The ITRANS[1] transliteration standard provides a common way to input Indian languages using the English alphabet only. So for systems that do not support Unicode-based keyboards like INSCRIPT, the users can use ordinary keyboards for typing in the local languages. ITRANS is then converted to the Unicode.

   The ITRANS input feature is also convenient for users who are not conversant with local language keyboards, but who otherwise have Unicode-supporting systems.

2. Output in Legacy ASCII-based fonts: The software can automatically convert all Unicode output to a legacy ASCII font encoding like Shusha, ISFOC, etc. This enables users on legacy operating systems (like Windows 9x) to view the data in the local script limited only by the particular font chosen.

3. Output in Dynamic Font: With this option, the data is showed on user's machine in a dynamic font. This font gets automatically installed on user's machine when he/she opens the first page, thus eliminating the need for installing the font. The dynamic font file is downloaded once for the entire session and pages in Marathi can use this file till the user is online.

4. Output in Roman script: Since fonts for native scripts may not be available always, or it may not be feasible to install them, the software also provides output in the Roman script. One may argue that having a dynamic font, and another installable font for Marathi eliminates need for any other option. But this is not always true. For example Mozilla browser doesnot suport dynamic font and installable font may not be useful for users who donot have enough privilages to install a font on the computer they are using (This is typically the case with Cybercafe users). This causes all local language Unicode output to be Romanized using a slightly modified variant of the ITRANS transliteration standard. This feature can also be used by users who may not be comfortable with the script of the local language.

- Phonetic Name/Address matching (SouIndics)

To solve the problem of variations in spellings across the languages, it is evident we need to use approximate matching techniques. Since the data being searched is names, it is clear that a phonetic matching technique be used. Such a technique would allow matches based on how a name sounds, rather than how it is written.

Phonetic matching algorithms for the Indian languages, unfortunately, do not exist. This led to the development of SouIndics, a phonetic matching algorithm for Indian languages. Like existing phonetic matching techniques for the English language (SoundEx and Metaphone), SouIndics returns a code for a given name. If the codes for two names match, the two names are identical phonetically.

The SouIndics algorithm developed for this search engine is in conformance with recommendations in Unicode Technical Report on Character Folding (UTR# 30). We have defined "equivalence classes" for Devanagari letters (consonants, independent vowels and dependent vowels). These equivalence classes are based on "Pronunciation" i.e. On the sound associated with them, hence the name "SouIndics". Each of this equivalence class is mapped to its equivalent letter in Roman script. e.g. Ka and Kha form a equivalence class which is mapped to roman "K" , Ga and Gha are mapped to roman "G" and so on. We have discarded dependent vowels while calculating SouIndics. We are using dependent vowels in our ranking function which is explained in next section. Once we get roman phonetic code for the search term, some extra rules are applied to normalize the SouIndics code further. This includes folding same letter appearing consecutively to single instance and similar techniques.

With proper integration of SouIndics into the database, searches using SouIndics include almost all variants of the names. The results of this wide search are then reordered using a stricter variant of SouIndics, called SouIndicsV , before display.Thus, exact spellings of names are not required, a spelling that approximates

the sound well is good enough.(see SouIndics capability snapshot)

- Platform and Performance

For maximum flexibility and performance-cost ratio, the software has been completely built using Free/ Open Source components. The components are:

1. Operating System: GNU/Linux
2. Database Server: PostgreSQL 7.4 with tsearch2
3. Programming Language: PHP/4.3
4. Web server: Apache 2.0

The search engine is fast. Tests on searches with any combination of name/address across six constituencies of Pune (~25 lakh records), return relevant results in less than 1 second. In all tests so far, including one conducted by C-DAC, the software has never failed to return a result, unless of course the name does not exist in the database.

In recently concluded Assembly Elections in Maharashtra, more than 120 million voters' data was hosted on the web with this search engine. More than 700000 hits were recieved by the search engine during the last 10 days. <to be added ?>

- Future Directions: Although the software is fully functional, many features are planned to enhance the user experience:
- Multilingual Input: Since most languages in India are phonetically similar, it is possible to allow a user to enter his name in his native language (say Gujarati), when searching across a Marathi database.
- Phonetic Signature for more intuitive ranking: Although SouIndicsV does a good job of differentiating words with same SouIndics, it does fail in some very close cases. To overcome this we are working on using a more authentic identity of word to rank the search results. While SouIndics is appropriate for throwing the net wide (i.e. For covering wider variety while searching), we need to focus on smmaller portion while ranking the results. For this we can use what we call "Phonetic Signature" which is nothing but a numeric string obtained by replacing all distinct letters of a word by a number as defined by some sequence. Phonetic Signature being the true measure of all the different sounds which are associated with each of the components of the word, it can differentiate between Hrasva I and Dirgh I, and so on. Phonetic Signature can also be tuned according to a particular sort order. This sort order may be different in case of, for example Marathi and Hindi although both use same script i.e. Devanagari.
- Integration into registration process: As the core of the software is independent of the current web interface, it becomes possible to integrate the search engine into any other software that may require such capability. Top among these is an search-assisted registration system, that would considerably improve the current manual process.

  Indeed, even in its current form, the current software is suitable for use in the registration process, to prevent multiple registrations and other such errors.

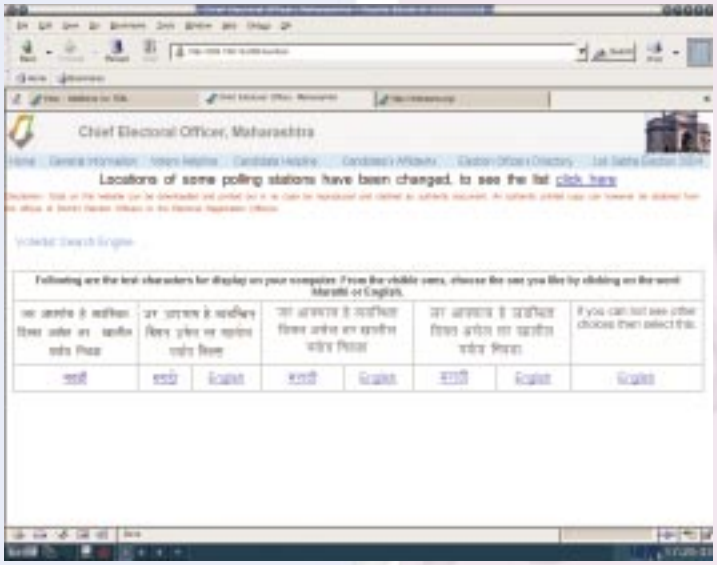
- Conclusion

  As with all software created to solve a problem for the first time, there is very little awareness on the possibilities of VL2. Although it was created to solve the "find your name in the voterlist" problem efficiently, it can be applied to other processes that require search capabilities as well. Paramount among these is the voter registration process, which requires a check of whether the name already exists in the rolls or not, currently a tedious manual process.

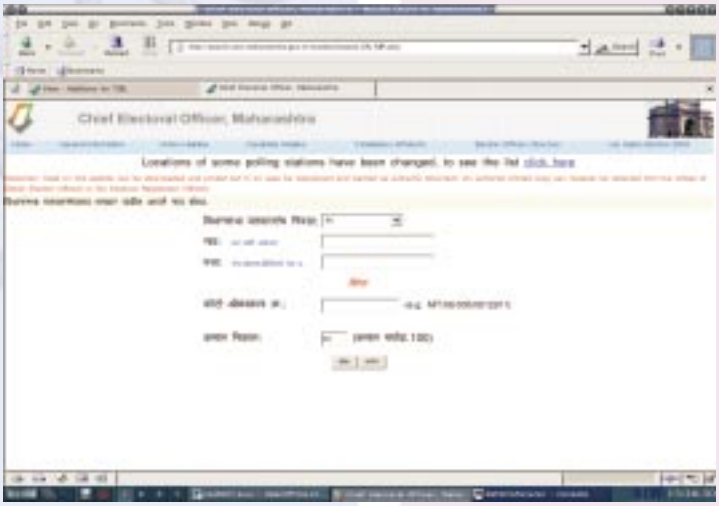
  Any tool that makes the electoral rolls more accessible makes democracy more accessible. Clearly, VL2 is such a tool. With VL2, problems of missing names may soon become a thing of the past.

Snapshots

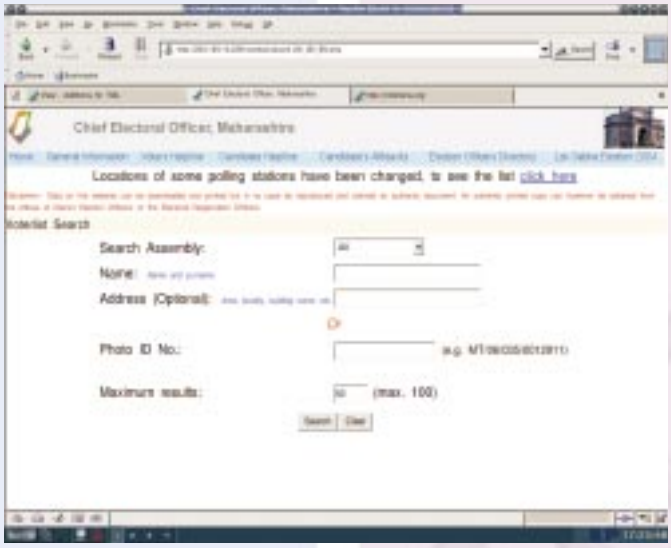
Selection Screen:



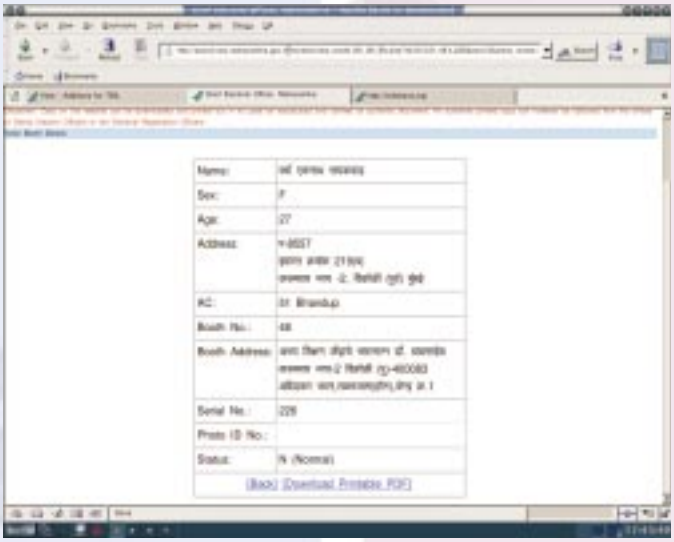
Main Screen (Marathi):



Main Screen (English):



Booth Details Page:



- References
- Chopde, Avinash. ITRANS - Indian Language Transliteration Package.
  http://www.aczone.org/itrans/
- The Indictrans Website.
  http://www.indictrans.org
- The Voterlist page at Indictrans.org.
  http://www.indictrans.org/voterlist/English/voter.php
- Voterlist search engine page at CEO Mahrashtra website.
  http://search.ceo.maharshtra.gov.in
- Unicode Consortium, The Unicode Standard, Version 4.0 , Boston, MA, AddisonWesley, 2003.
  http://www.unicode.org
- Freytag, Asmus. Draft Unicode Technical Report on “Character Folding”.
  http://www.unicode.org/reports/tr30/