Alipi: A framework for re-narrating web pages

T B Dinesh
Janastu
Bangalore, India

S Uskudarli
Department of Computer Engineering
Bogazici University
Istanbul, Turkey

Subramanya Sastry
Minneapolis, USA

Deepti Aggarwal
International Institute of Information Technology
Hyderabad, India

Venkatesh Choppella
International Institute of Information Technology
Hyderabad, India

ABSTRACT

We propose Alipi, a distributed and participatory approach for re-narrating web pages for the purpose of rendering the content more accessible. This model supports alternative descriptions for a web page or parts of it via rewriting or *re-narration* for a given target audience by volunteers. The goal is to render the Web accessible to people across varied abilities, age, economic situation, language and geographic locations. We present the motivation, architecture and prototype implementation of Alipi.

Categories and Subject Descriptors

H.4.2 [**Computers and Society**]: Social Issues, Assistive technologies for persons with disabilities—*non-literacy*; H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces—*Collaborative computing, Computer-supported cooperative work*

General Terms

Human Factors, Languages

Keywords

Accessibility, Inclusion, Collaborative narration, Localization, Social Semantic Web

1. INTRODUCTION

Despite the phenomenal growth of the Internet, major population groups of the world remain outside its influence. Worldwide penetration is still only 32%[3]. Poor accessibility of current Web resources contributes significantly to this problem. The barriers to accessibility range from limited Internet connectivity, to physical impairment, linguistic differences, and also social, cultural and economic factors.

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The overwhelming fraction of Web content today is in languages that are inaccessible to large populations of the world. For example, as of December 2011, no Indian or native African vernacular comprises of even 0.1% of the total number of Web pages[1]. About only 10% of India's approximately 880 million literate persons speak English[2, 4], implying that for nearly 800 million literate persons in India, the majority of Web content is inaccessible. This form of inaccessibility, where a literate person finds herself unable to utilize the Web in a meaningful way, remains a serious challenge. We call this *print illiteracy* and distinguish it from traditional illiteracy. Thus while impairments and disability or poor cognitive skills can each lead to print illiteracy, it is clear that social and cultural contexts could play a large role.

Traditional approaches to solving the accessibility problem due to print illiteracy consist of automatic translation for cross-linguistic information retrieval approaches, e.g., online translation services. More recently, social collaboration based on creation of content, translation of web pages, audio rendition by humans has emerged as an interesting and popular alternative (e.g, social collaboration sites like Wikipedia). Under the rubric of *social accessibility*, these approaches rely on the power of individual users to improve web page accessibility in a decentralised manner[11]. However "social" in this context refers largely to the process in which content is created and managed by humans. There is, however, another aspect of social accessibility which concerns itself with the issue of the socio-cultural background of the content consumer. Each of the approaches mentioned above are important, but they do not adequately address the second aspect of social accessibility issue since they are unaware of or miss the specific socio-cultural context of the reader.

The WWW becomes a much more effective medium of knowledge when users and information consumers have access to interpretations, or *re-narrations* of content. Several rudimentary forms of re-narrations already exist today on the web as blogs, annotations on pages, bookmark recommendations, tagging, etc. Little support, however, seems to exist in the meta-data frameworks of web pages that allows a re-narrator to target a specific group of readers, based for example, on language, location, etc. Likewise, the current architectures of the web do not explicitly support the user's preferences for a particular set of re-narrations to be automatically retrieved.

In this paper, we propose *Alipi*[1] as a social collaboration framework for authoring, targeting and accessing re-narrations of web pages. The components of the Alipi framework consist of a predefined set of web element attributes, a browser plugin for creating re-narrations at the re-narrator's end and for generating the re-narrated page at the reader's end. Alipi supports an architecture where semantic attributes derived from the content of the page may be drawn from arbitrary ontologies and mixed and matched with the semantic attributes of a particular reader (group). Additionally, re-narration applies to elements of the page. The combination of these two features makes Alipi, initially designed to address print illiteracy, usable in much more general contexts. For example, using Alipi, it is possible to combine selective translation of a page with splicing of locally relevant images in order to make information accessible in a broader sense. (See Figures 4 and 5 for examples.)

The rest of the paper consists of a comparison with background and related work (Section 2), an exposition of the approach and architecture of the Alipi system (Section 3), a prototype implementation of Alipi (Section 4) a roadmap for future work and conclusions (Section 5).

2. RELATED WORK

Various approaches have been proposed for addressing accessibility issues for the World Wide Web and standard guidelines for web accessibility are actively being worked out. We present a brief survey of work in the area of accessibility focusing on work that is closely related to the Alipi approach.

There are already several examples of community-sourced initiatives for subtitling and other needs for creating metadata [10, 12].

The work closest to the Alipi approach, however, is that of Takagi et al. [11]. Their approach works within the framework of WAI guidelines, i.e., given a page without appropriate accessibility tags, it uses social collaboration to generate a new page by adding metadata to various sections of the page (alt text for images, headings, etc.). The notable part of this work is the use of social collaboration where a group of supporters fill in missing metadata whenever a report of inacessibility comes in, bypassing the page author completely. The modified page is stored on a centralised server which then makes the new page accessible to anyone else who visits original page. All these services – reporting inaccessibility, generation of metadata by supporters, as well as identifying existing re-narrations – are provided by a set of client-side tools that interact with the server via a set of APIs.

The Alipi approach is in the spirit of Takagi et al., but our approach is somewhat broader. We rely on browser plugins — similar to the approach by Mirri et al. [7] — website-toolbars, and decentralized servers for generating renarrations of pages. The re-narrations may be done with WAI-inaccessibility issues but also goes beyond it. described earlier, we are interested in re-narrations, not just filling in missing metadata. So, given a page multiple re-narrations of it can exist. Each such renarration can range from a simple metadata-completion as above, or can be a translation into another language, or an audio narration. In Alipi, the re-narration could be motivated by other semantic concerns. This conforms to the need for a generous interpretation of accessibility as proposed by Kelly et al.[6].

[1]alipi means print illiterate in Kannada and several other languages of the Indian subcontinent.

3. APPROACH AND ARCHITECTURE OF ALIPI

This section describes the motivation and architecture of the Alipi framework. The architecture is designed with the objective of enabling one set of web users, the *re-narrators* to re-narrate any web page or its element, and a second (possibly overlapping) set of users who consume the web resource appropriately re-narrated to them.

3.1 Approach: restructuring via re-narration

Re-narration of a web page is at the heart of the Alipi framework. From a DOM perspective, re-narration is a syntactic restructuring of the DOM structure of the document. Most common accessibility issues are currently handled by DOM restructuring. Examples of these include reading alternate text for images with the `alt` tag, video captioning, and systematic replacement of colour in the document to make a document accessible to a person with colour blindness.

The traditional solutions for accessibility demand that the author of the page take responsibility for ensuring that the page is accessible. This is usually done by the author specifying a rewriting rule usually fixed as a standard across all pages (e.g. the `alt` tag for images) . The approach taken by Alipi is that these rewriting rules need not be a fixed a priori. There might be multiple versions of these rewrites e.g., by a user, the page author, a third party, or even the renarration service. The fixed strategy is then a special case of the Alipi approach, where only one standard re-narration is available. Thus Alipi accommodates multiple strategies for accessibility: fetching re-narrations of a page from somewhere else on the web, or restructuring a page in place based on a standard specification without fetching anything externally, or a combination of the two, where rewriting parts of a document requires fetching a re-narrated snippet from an external service.

3.2 Alipi Architecture

Alipi relies on three main subsystems: (a) a subsystem for re-narrators to create narrations, (b) a subsystem for indexing web pages to their re-narrations, and, (c) a subsystem that re-narrates the web page they are reading.

Schematics capturing the architecture of Alipi are shown in Figures 1 and 2. In Figure 1, re-narrations of the web page P consisting of multiple elements (E and E') are being created and indexed. A set of re-narrators create a set of re-narrations $E1, E2$, etc. for the element E. These re-narrations exists as an independent entities on the web each with its own url $U1, U2$, etc. Alipi requires all re-narrations to be publicly accessible pages on the Web in order to ensure a decentralised re-narration model. The decentralized re-narration model of Alipi is important from the point of view of allowing users to have control of their re-narrations and to decouple documents from their re-narrations so that they are treated as regular Web pages. Each re-narration contains a `foruri` attribute in its meta-data to refer to the original object of re-narration (arrow 1). A crawler fetches the original page and existing re-narrations (arrows labelled

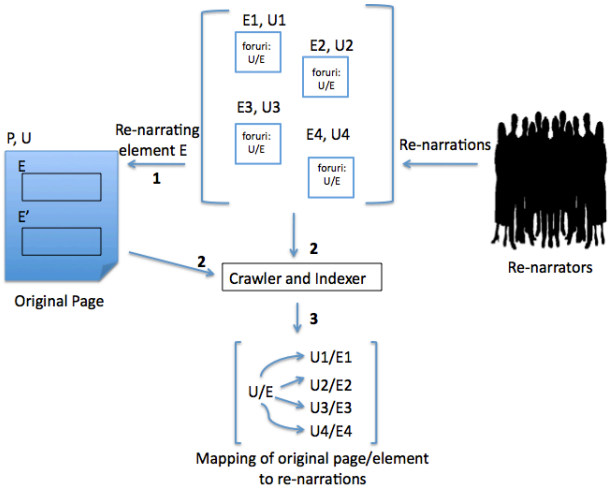

Figure 1: Schematic describing the creation and indexing of re-narrations of a page P with url U.

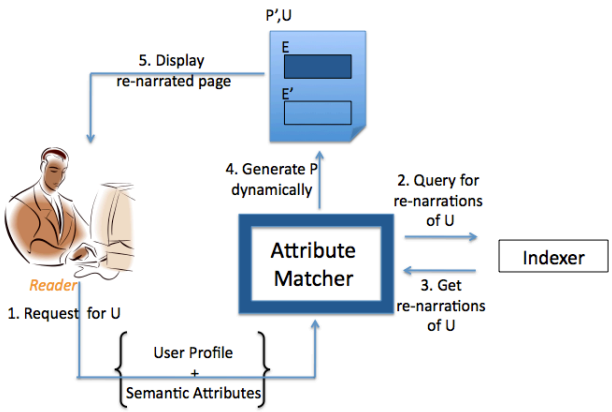

Figure 2: Schematic describing generation of re-narrated web page by the plugin.

2) created for the page P's element U/E and generates an index (arrow 3).

Figure 2 shows how a page with possibly several re-narrations is rendered to the user consuming the page. When a user requests the page at url U (arrow 1), the user's profile containing various semantic attributes are matched are sent to an attribute matcher. The matcher queries the indexer for the appropriate set of re-narrations of the requested page. The appropriate re-narration, chosen on the basis of the user's semantic attributes are then rendered in the user's browser as a re-narration P' of P at the same url.

The architecture proposed affords flexibility in terms of implementation. The set of semantic attributes that identify a target group can belong to ontologies defined and published by the re-narrator. The indexer could leverage the semantic attributes related to the target group, e.g., language and location for efficient retrieval. The matching could be done either at the user's end, or at the index server's end, or even at a separate "matching server" depending on the application. The matching process could range from simple attribute matching to a complex set of matching between ontologies combining several re-narrations. The generated

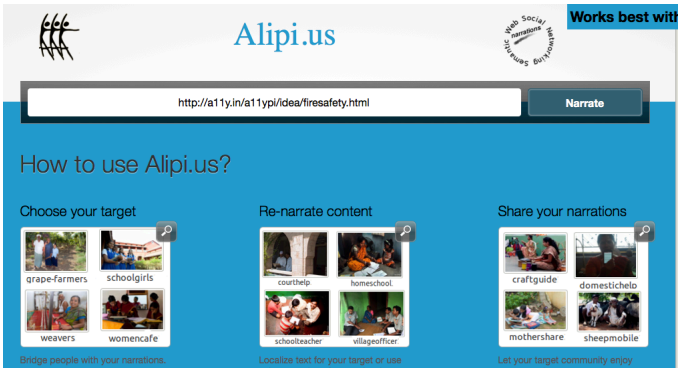

Figure 3: Alipi service offering re-narration of web pages. The text box contains the URL of a page on fire safety that the user wishes to re-narrate.

page could be composed at the matching server and delivered to the user's browser.

4. ALIPI PROTOTYPE

The *Alipi* prototype implements the core ideas of the Alipi architecture for re-narration. In the prototype implementation, the re-narration is implemented as a service[2]. A screenshot of the server's entry page is shown in Figure 3. A user visiting this service can choose a web page for re-narration, specify the target groups and publish the re-narration at a url of her choice.

The re-narrator can define alternative text such as translations or simplifications or provide alternative media such as audio or video according to the target audience. Furthermore, the re-narrator can provide meta information such as the language, geographical region, nature of re-narration (i.e. translation), and tags to identify the target audience. Once the re-narration is completed the re-narrator publishes it.

Alipi keeps track of the source, target, and language of each re-narration. Any number of re-narrations may exist for any given source page. Typically, a re-narrator would publish the re-narration at say, her publicly accessible blog. Alipi maintains a blog for those who do not have their own blog. Re-narrated posts *alipi* are indexed on an *alipi* server by crawling the content and the meta data in the tags of the posts.

Alipi renders re-narrations by user choice. Furthermore, it can merge multiple re-narrations of a document in order to deliver the most complete re-narration. This is done by examining the xpath ids of the re-narrated elements.

A user may have a locally installed browser extension for carrying out the re-narration. Prototype browser extensions for Firefox and Android has been implemented [5]. This extension also indicates what re-narrations of a web page visited by a user are available.

Figures 4 shows a page on fire safety in English ready for re-narration. The figure also shows a dialog box requesting the replacement of the image of the fire truck. The re-narrated version of the page is illustrated in Figure 5. In the re-narrated version, the image has changed to reflect a

[2]The Alipi prototype re-narration service is available at http://alipi.us

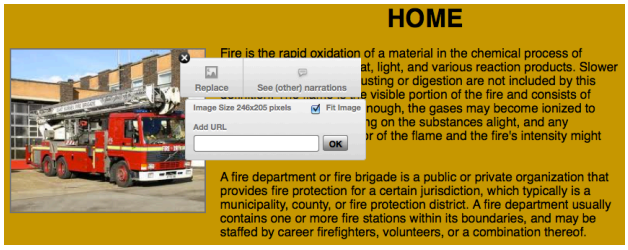

Figure 4: The page on fire safety being edited for re-narration. Note the popup on the image of the fire truck inviting its replacement, i.e., re-narration.

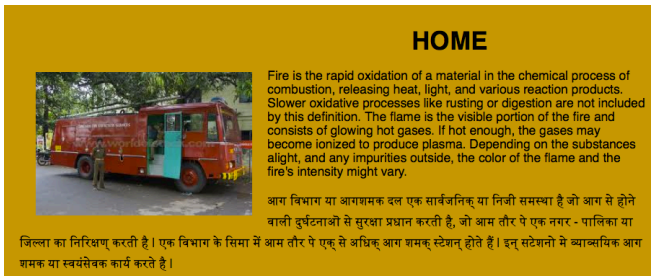

Figure 5: Re-narrated version of the fire safety page of Figure 4. The second paragraph has been replaced by text in Hindi and the picture has been replaced with an image containing an Indian fire truck.

local (Indian) version of the fire truck. Also, one paragraph of the English text has been replaced to target users who read Hindi.

5. CONCLUSIONS AND FUTURE WORK

In this paper, we have presented Alipi, a framework that supports the position that accessibility needs to be defined in a larger context. The Alipi framework emphasises re-narration as a general approach to address accessibility over the Web. Furthermore, the decentralisation and multiplicity of the re-narrations eliminates the top-down, normative approach of WCAG guidelines and enables re-narration communities to form around specific needs as experienced and articulated by those communities and its accessibility enablers without global norms of what accessible content ought to look like. Broadly speaking, this approach creates a web of re-narrations, the re-narration web.

Several interesting technical questions have emerged as we embark on developing Alipi from a prototype to a more robust implementation and test with sizeable user communities. To cite just a few examples, what is a metric for matching or comparing the relatedness of two re-narrations. What is the best way of presenting multiple candidate re-narrations to the user and combine it with the user profile? What optimizations are possible in the indexing and delivery of the matching pages? What are the security implications of the architecture? Finally, in the architecture we propose for Alipi we plan to build on rich *ontological* structures shared across social networks created in a distributed, decentralised manner, used with browsers extensions and web services. Specifically, we wish to build on distributed active social networks [8], browser based editors for re-narrations [9], HTML5, Web 2.0, browser extensibility and smart mobiles. Thus we foresee Alipi leveraging the Semantic Web in a comprehensive way. From a social perspective, it would also be interesting to study formally how communities share and evolve around re-narrations and what issues become dominant within these re-narrations.

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