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SUMMARIZING INFORMATION FROM WEB SITES ON DISTRIBUTED POWER GENERATION AND ALTERNATIVE ENERGY DEVELOPMENT

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ABSTRACT

The World Wide Web (WWW) has become a huge repository of information and knowledge, and an essential channel for information exchange. Many sites and thousands of pages of information on distributed power generation and alternate energy development are being added or modified constantly and the task of finding the most appropriate information is getting difficult. While search engines are capable to return a collection of links according to key terms and some forms of ranking mechanism, it is still necessary to access the Web page and navigate through the site in order to find the information. This paper proposes an interactive summarization framework called iWISE to facilitate the process by providing a summary of the information on the Web site. The proposed approach makes use of graphical visualization, tag clouds and text summarization. A number of cases are presented and compared in this paper with a discussion on future work.

1. INTRODUCTION

The world is facing an urgent challenge of how to develop alternative energy and distributed power generation efficiently. Most of the world's energy demands at present are still relying on crude oil, coal and natural gas [1]. It can be said that such resources are finite and there are limitations on the supply side of the equation and eventually such resources will not be able to meet the upward demands. In 2006, it has been reported that the total world production of energy was already unable to maintain further growth in demand [2]. Also, the price of crude oil has undergone extreme fluctuations [3]. For example, the oil prices in 2008 had been rapidly increased in the first half and then dropped steeply in the second half of the year [4]. This has a significant impact on the world economy [5]. On the other hand, environmental issues due to 'greenhouse effects' as a consequence of CO₂ emission from fossil fuel consumption, may have contributed towards the global climate change [6]. That will affect many generations to come and it is predictable that this will have enormous social, economic and environmental implications [8]. Hence, there is an

urgent need to develop alternate energy and distributed power generation which has to be environmental friendly, sustainable, reliable and hopefully, cheap.

One of the solutions is to reduce the world's dependence on fossil fuels by escalating the reliance on alternative or sustainable energy sources. Many governments, research and commercial organizations have already committed considerable amount of effort and resources to this cause. Such effort can be further facilitated by providing and exchanging up-to-date information and knowledge among the researchers and related bodies in the discipline. An effective means for the provision and distribution of information cheaply and quickly is to use the World-Wide-Web on the Internet. At present, the number of Web sites has significantly increased approximately ten times from 1996 to 2009 at 224 million Web sites [9]. Information on alternative energy have already been provided by many Web sites as indicated in a survey study by the authors [10]. However, the enormous amount of information on the Web leads to the phenomenon of "information overload" and this has caused much burden on the researchers [11]. An inefficient process or inability of locating the required information may lead to wasted efforts and hinders the promotion and development of alternative energy. Although search engines are currently the de-facto tool that most searches on the web are based on, a large amount of results are normally produced due to information overloading. Users still have to visit each individual Web page in order to identify whether it contains the desired information. On the other hand, search engines also deployed their own algorithms or mechanisms in ranking the results and some of them may be based on financial interest. Hence, the results do not provide any context or quality of the sites. As a solution to these problems, a new approach termed iWISE, *an intelligent Website Information Summarization Engine*, is proposed in this paper. The proposed approach presents the information from the web sites with a comprehensive overview by using visualization and summarization techniques. This approach is believed having the potential to reduce

the time to identify and traverse the information in a Web site.

This paper is organized with an introduction and aims of this paper. Summarization Technology is then described in Section 2, and visualization and summarization engine are explained in Section 3. Application towards alternative energy information on the web is illustrated in Section 4, and the conclusion including discussion on future work in Section 5 followed by acknowledgement and references.

2. SUMMARIZATION TECHNOLOGY

A summary is used to provide the key meaning of an original source of information in a reduced and concise representation. This representation could be in the forms of graphics, tables or text. Computer programs using various intelligent techniques may also be used to create a summary. A number of the related methodologies and techniques in iWISE are explained in the following subsections.

2.1 Text Summarization

Text summarization is a process used to produce a summary based on the original information. The summary can be produced by extraction or abstraction from the original text [12]. A summary by extraction is to find a part of text that can be considered as indicative of the content using choosing the best rank of sentences [11]. The most common technique is the statistical approach that examines sentences, phrases, or words based on frequency or histogram. They are then ranked and the highest rank sentences and phrases are used to produce a summary. There are a diversity of such techniques being developed and applied.

The other approach is summary by abstraction, which aims to a summary using natural language processing (NLP) techniques based on the original semantics. NLP attempts to understand and process human languages by extracting key phrases of the original text [13]. It can also be applied with machine learning using both supervised and unsupervised learning approaches. For example, the original text and its key phrases can be set as a training set in the form of a classifier, which determines a threshold for choosing the key phrases. This will set limits on different domains and the classifier has to be defined with some rules in each domain with specific knowledge, and a number of training data sets are needed.

On the other hand, unsupervised learning can also be used as a part of the summarization process. One of the techniques is based on an algorithm to examine the original text in order to identify key phrases,

which represent most of the main meaning in the original document.

Furthermore, there is a hybrid approach which applies both statistics and natural language processing for producing useful summaries [14].

2.2. Tag Cloud

Tag cloud is a group of tags that are extracted from related words in the original text [15]. It can represent the original information in a form of an image of short phrases or words, which is considered to be a form of visual summary. Tags can be extracted by applying statistical approaches such as finding frequency of words. Unsupervised learning techniques such as clustering can be applied to identify and select the words that are properly related to the original document [16].

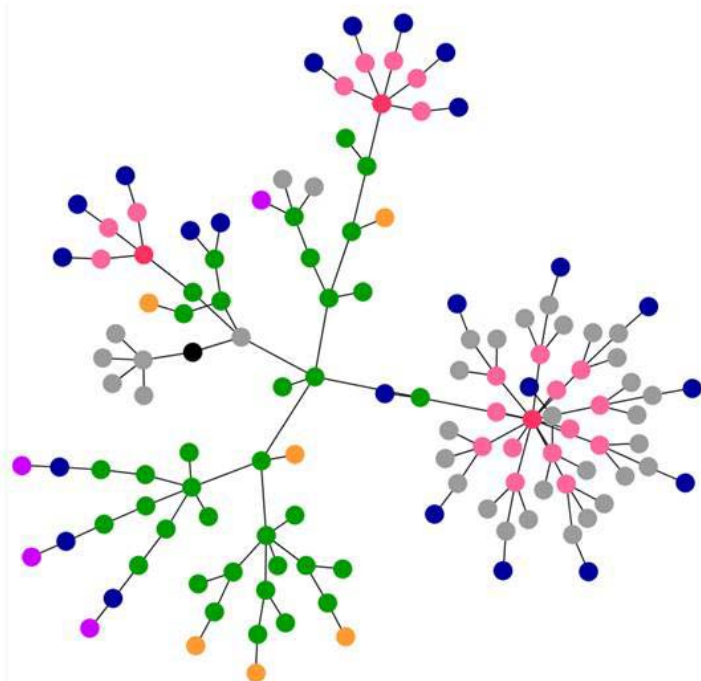
The cloud normally shows the extracted tags in different illustration according to style, color and size from the underlining words or phrases in the original text. Visualization of the cloud may use diverse algorithms to fit the words in one limited layout. The limited area can be fitted the tags by using spatial clustering algorithm [16] [17]. On the other hand, the cloud may also be represented in different ways such as in a circular layout [18]. Further filtering of the tags could be applied based on specific domain and elimination of non-representative words.

2.3. Summarization of Web pages

Web pages in electronic format can provide better interactive and visual information than normal print based documents. The information on the Web page can include sound, video, hyperlinks, and interactivity. Web page uses Hypertext Markup Language (HTML) to format its content in a normal text file consists of HTML tags and content. The latest Web pages may also include the use of Extended Hypertext Markup Language (XHTML), Extensible Markup Language (XML) and Script languages. The formatted contents are required to be displayed in a browser. If the content is predominately text, it can be summarized by text summarization techniques. A summary of the information on the Web page has more steps than text summarization due to the inclusion of HTML tags and other script languages which have to be removed first. Furthermore, the content also has to be rearranged before working on the summarization process. For example, the content that is displayed in tables needs to be carefully restructured.

On the other hand, metadata in a Web page can be used as a form of its summary because the metadata is used metatags to provide a short description.

http://www.scottishpowerrenewables.com/



almost argyll
 awarded capacity doubled
 energy following granted green home
 installed offshore
 lymouth offshore
renewables
 rights
scottishpower
 site spr sustainability installing
 today windfarm

- Legend:
- Black:** The HTML tag the root node
 - Blue:** Hyperlinks
 - Red:** Set of Table Tag
 - Gray:** The rest tags
 - Green:** Division Tag
 - Orange:** Set of Paragraph Tag
 - Violet:** Image Tag
 - Yellow:** Set of Form Tags

- **SCOTTISHPOWER RENEWABLES AWARDED OFFSHORE WIND SITE – ARGYLL ARRAY**
- ScottishPower Renewables (SPR) has been awarded the rights to investigate the potential for an offshore windfarm west of Argyll and the island of Tiree, following the Crown Estate's Scottish Territorial Waters tendering process.
- **SCOTTISHPOWER RENEWABLES ALMOST DOUBLES INSTALLED CAPACITY IN 2008**
- ScottishPower Renewables (SPR) released figures today showing that the installed capacity of their green energy projects almost doubled during 2008, from 382MW to 665MW.
- Following a successful planning appeal ScottishPower Renewables is pleased to announce that approval has been granted for Lymouth Windfarm.

Figure 4. An actual result in this approach

http://www.scottishpowerrenewables.com/



almost argyll
 awarded capacity doubled
 energy following granted green home
 installed offshore
 lymouth offshore
renewables
 rights
scottishpower
 site spr sustainability installing
 today windfarm

- Legend:
- Black:** The HTML tag the root node
 - Blue:** Hyperlinks
 - Red:** Set of Table Tag
 - Gray:** The rest tags
 - Green:** Division Tag
 - Orange:** Set of Paragraph Tag
 - Violet:** Image Tag
 - Yellow:** Set of Form Tags

Figure 5. A thumbnail on a linked node is shown in the drill down feature

http://www.scottishpowerrenewables.com/pages/press-room.asp?article=46



developed
 government offshore potential process renewables
 rights
 scottishpower site
 uk windfarm

- Legend:
- Black:** The HTML tag the root node
 - Blue:** Hyperlinks
 - Red:** Set of Table Tag
 - Gray:** The rest tags
 - Green:** Division Tag
 - Orange:** Set of Paragraph Tag
 - Violet:** Image Tag
 - Yellow:** Set of Form Tags

Figure 6. Illustration of a result after clicking a linked node

4. ALTERNATIVE ENERGY INFORMATION APPLICATION

In this paper, four Web sites containing information on power generation and alternative energy development have been investigated.

ScottishPower Renewables⁴ is a part of Iberdrola Renewables, which is one of the biggest producers of renewable energy of the world. This Web site has also been used in the earlier examples and shown in Figures 1 to 6.

China Light and Power (CLP) group⁵ is one of the largest electricity investor and operators in the Asia Pacific region. The result of the engine is shown in Figure 7.

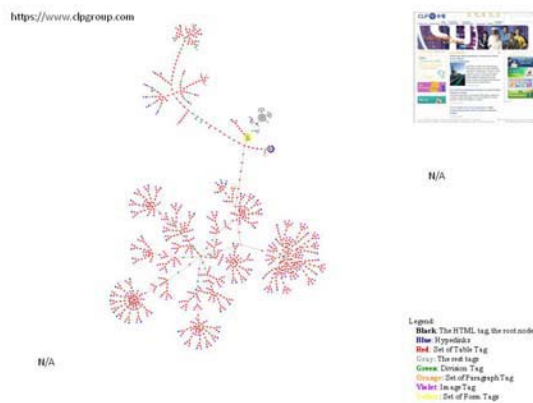


Figure 7. View of home page of CLP group

In this figure, text summarization and tag cloud could not be generated since both ExtractorLive and TagCrowd do not support Secure Sockets Layout (SSL), which has been used at the Web site of CLP group.

Bangkok Renewable Energy⁶ is a leader producer in Methyl Ester (B100) in Thailand. The result of summarization of the site is shown in Figure 8.

Sustainable Power Corp (SSTP)⁷ produces biofuel and focuses on turnkey development and management of independent bio fuel manufacturing and power plants utilizing green energy facilities. The result of summarization of this site is shown in Figure 9.

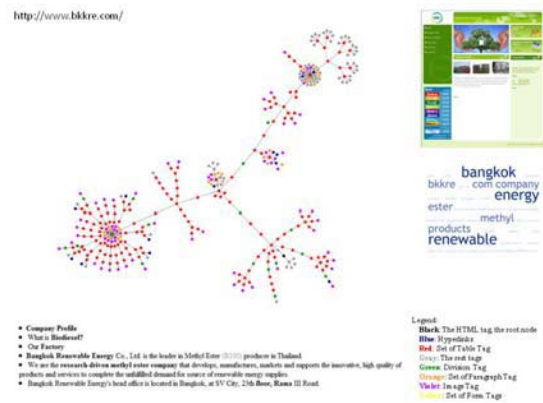


Figure 8. An overview of the Bangkok Renewable Energy home page

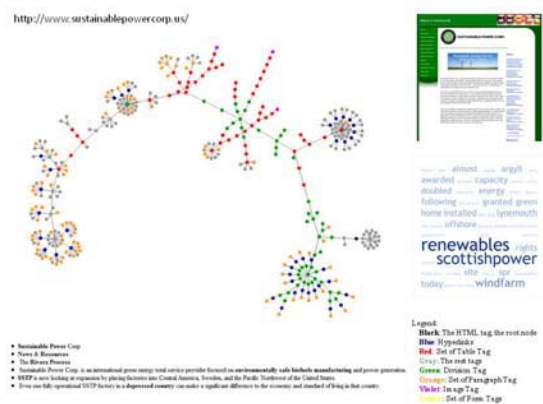


Figure 9. A View from iWISE of the Sustainable Power Corp home page

Based on Figures 4 to 9, a user is able to gain an overview and requires to spend less time on each Web page as they can be used as a summary. Using the DVT and information from the tag cloud and summary, a user may determine whether the site is appropriate to meet their needs. Moreover, the Document Type View on each page represents the complexity of a page as each node uses a unique color to represent a HTML tag. For example, if there are many nodes that represent paragraph tag, it means that there is more text content. Similarly, the text summarization and tag cloud will provide a quick summary of the key words and phrases contained in the sites. However, it is recognized at this stage the security system incorporated in the site is limiting the capability of this approach at this moment.

5. CONCLUSION

The World Wide Web (WWW) has become a huge repository of information and it also serves as an essential channel for information exchange. There are already in existence many hundreds and thousands of web pages of information on distributed power generation and alternate energy

⁴ <http://www.scottishpowerrenewables.com>

⁵ <https://www.clpgroup.com>

⁶ <http://www.bkkre.com>

⁷ <http://www.sustainablepowercorp.us>

development. Although web pages with such information can be accessed and ranked by search engines, there is no indication on the amount and the diversity of content in any of these pages. The users have to access the Web page and navigate through the site before they can determine whether the information is appropriate. This paper proposed an interactive summarization framework called iWISE to facilitate the process. The proposed approach is based on Document type view (DTV), Text Summarization and Tag Cloud. In addition, thumbnails associated with specific nodes can be provided in drill-down mode. Four web sites from companies or organizations dealing with power generation and alternate energy development have been compared. The next phase of the research is to provide a quantitative and qualitative assessment based on the summarization. It is believed that the approach will assist researchers to acquire relevant information and be able to carry out objective assessment of the websites.

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7. REFERENCES

- [1] EIA, *Annual Energy Review 2007*. 2008, Energy Information Administration.
- [2] EIA. *World Energy Overview: 1995-2006*. 2008 June-December 2008 [cited 2009 Mar]; Available from: <http://www.eia.doe.gov/iea/overview.html>.
- [3] Davis, Stacy C., Susan W. Diegel and Robert G. Boundy, *Transportation Energy Data Book: Edition 27*. 27 ed. 2008, Oak Ridge. 361.
- [4] EIA, *Annual Energy Outlook 2009 with Projections to 2030*. 2009, Energy Information Administration.
- [5] Berrah, Noureddine, et al., *Sustainable energy in China: the closing window of opportunity*. 2007, Washington: The World Bank.
- [6] Cubasch, Ulrich, Yihui Ding, Cecilie Mauritzen, Abdalah Mokssit, Thomas Peterson, Michael Prather, *Historical Overview of Climate Change Science*. 2008, The University Corporation for Atmospheric Research: Colorado. p. 36.
- [7] Evans, Rebert L., *Fueling Our Future : An Introduction to Sustainable Energy*. 1st ed. 2007, Cambridge: Cambridge university press.
- [8] RoughGuides, *The mini rough guide to Energy and our planet*. The first edition ed. 2008, London: Rough Guides. 96.
- [9] Netcraft. *March 2009 Web Server Survey*. 2009 2 March 2009 [cited 2009 Mar 28]; Available from: <http://news.netcraft.com/archives/2009/03/index.html>.
- [10] Thanadechteemapat, Wigrain and Chun Che Fung. *A Survey on the Use of Web Technologies in the Promotion of Sustainable Energy in the 9th Postgraduate Electrical Engineering & Computing Symposium (PEECS 2008)*. 2008. Perth.
- [11] Huantong, Geng, et al. *A Novel Automatic Text Summarization Study Based on Term Co-Occurrence*. in *Cognitive Informatics, 2006. ICCI 2006. 5th IEEE International Conference on*. 2006.
- [12] Sornil, O. and K. Gree-ut. *An Automatic Text Summarization Approach using Content-Based and Graph-Based Characteristics*. in *Cybernetics and Intelligent Systems, 2006 IEEE Conference on*. 2006.
- [13] Jiang-Liang, Hou and A. W. J. Tsai, *Knowledge Reuse Enhancement with Motional Visual Representation*. Knowledge and Data Engineering, IEEE Transactions on, 2008. 20(10): p. 1424-1439.
- [14] Amitay, Einat and Paris Cecile, *Automatically summarising Web sites: is there a way around it?*, in *Proceedings of the ninth international conference on Information and knowledge management*. 2000, ACM: McLean, Virginia, United States.
- [15] McKie, S. *Scriptclud.com: Content Clouds for Screenplays*. in *Semantic Media Adaptation and Personalization, Second International Workshop on*. 2007.
- [16] Rivadeneira, A. W., et al., *Getting our head in the clouds: toward evaluation studies of tagclouds*, in *Proceedings of the SIGCHI conference on Human factors in computing systems*. 2007, ACM: San Jose, California, USA.
- [17] Slingsby, A., et al. *Interactive Tag Maps and Tag Clouds for the Multiscale Exploration of Large Spatio-temporal Datasets*. in *Information Visualization, 2007. IV '07. 11th International Conference*. 2007.
- [18] Seifert, C., et al. *On the Beauty and Usability of Tag Clouds*. in *Information Visualisation, 2008. IV '08. 12th International Conference*. 2008.
- [19] Kobayashi, Mei and Takeda Koichi, *Information retrieval on the web*. ACM Comput. Surv., 2000. 32(2): p. 144-173.
- [20] Hearst, M. A. and D. Rosner. *Tag Clouds: Data Analysis Tool or Social Signaller?* in *Hawaii International Conference on System Sciences, Proceedings of the 41st Annual*. 2008.