Internationalization of HydroServer Lite

An Essential Element to Expand Water Sharing Capabilities

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INTERNATIONALIZATION OF HYDROSERVER LITE -
AN ESSENTIAL ELEMENT TO EXPAND WATER SHARING CAPABILITIES

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Justin Relitz is the only author of this paper and did all of the work described here. He created the crowdsourcing translation application and coordinated with the HydroServer Lite team to expand water-sharing capabilities of the BYU World Water Project. Justin is currently a Master’s Student in Civil Engineering at Brigham Young University with an emphasis in Water Resources.

ABSTRACT: Managing, archiving, and sharing large amounts of water data are essential tasks to provide information to clients, customers, government agencies, or citizens about possible problems and are essential for engineers to make good decisions. HydroServer Lite, a web-based application, is a robust, inexpensive, data sharing and archiving solution that is easy to deploy and maintain. While widely accepted as a project of NFS created under the leadership of CUAHSI, it was limited to being available in English and later in Spanish as part of the BYU World Water Project. Building on the Spanish translation I wanted to provide other languages so that the tool could be made available to all non-English speakers. A fundamental part of this initiative is a crowdsourcing translation application that I created to have others help me translate terms needed to internationalize the HydroServer Lite application and make it freely available in multiple languages.

KEY TERMS: HydroServer; crowdsourcing; translation; Brigham Young University; World Water Project
INTRODUCTION

Storing and sharing reliable water data easily and efficiently is critical to making important water resources decisions that create safe, sustainable, and thriving communities. Most of the communities we live in have water infrastructure and data from streamflow gages, rain gages, and other observational devices that are critical for policy makers, water agencies, and engineers to determine current and future needs. These water data sources can be used to predict floods, determine the cause of damage to a community, watershed management, and to plan for future growth (Miller, Guertin et al. 2004). Database management software can be expensive, especially for developing countries with limited resources, however thanks to efforts like the Brigham Young University (BYU) World Water Project and the Consortium of Universities for the Advancement of Hydrological Science, Inc. (CUAHSI) (Tarboton, Maidment et al. 2010), storing and sharing this water data is becoming easier for the international community.

Sharing water data on an international scale with many different languages presents its own constraints (Jones and Dale 1977). The BYU World Water Project is “part of an international ‘grass-roots’ effort to resolve this problem through the development of tools, technologies, and standards for sharing water and climate data in a manner conducive to rapid scientific advancement” (University, 2015 #9). Central to this project is the use of the CUAHSI Hydrologic Information System (HIS) tools and standards like WaterML, to store and disseminate the water data in a consistent format (OGC 2015). Other studies and web applications have been done to provide web services to water resource managers to provide free, publicly accessible data series using the WaterML format (Kadlec and Ames 2011). An important initiative of CUAHSI has been the development of the open source HIS tool HydroServer Lite, which is explained further at
https://hydroserverlite.codeplex.com/ (Conner, Ames et al. 2013), which is a companion to the open-source desktop tool HydroDesktop (Ames, Horsburgh et al. 2012). HydroServer Lite has been established as a platform to publish space-time hydrologic datasets at a point such as rainfall and stream flow (Jeffery S. Horsburgh 2010). Some systems have already been created to access data in excel from a HydroServer for hydrologic data (Pinthonga and Daniel 2014). The idea is to use these systems and expand upon them to make them accessible to the broader international communities that do not have command of the English language.

HydroServer Lite is a hydrological data hosting server that is designed to be used by any organization that collects water resource data. It is a simple, user friendly, web-based version of the HydroServer created by CUAHSI and illustrated in detail in Figure 1.

Figure 1. Conceptual Overview of HydroServer from CUAHSI
These tools are important for organizations to store, manage, and share water data. An important objective of the BYU World Water Project effort is to make this available to developing countries. A translation from the original English version into Spanish was the initial attempt to make explore the possibility of multiple language support. This allowed Spanish-speaking countries to use this application, which makes it easier agencies involved in storing, managing, and sharing the data to disseminate it to scientific and public groups that need it for their own work. These types of sustainable water data sharing tools are free to use and can be very helpful in developing countries where the capacity does not exist and commercials solutions are costly. One example of using these tools was with an organization INETER from Nicaragua. Isaias Montoya, the director of Water Resources at INETER said the following about how HydroServer has helped their organization, “This will help us perform hydrologic studies. Without data, we have no studies. Without studies, we do not have knowledge, and without knowledge we cannot improve the conditions of our watersheds.” This proves how useful it has already been to a major organization in Nicaragua and it can do the same with more availability to other non-English speaking countries.

My research project was to expand upon this by developing a crowdsourcing translation application to make HydroServer Lite available in additional languages. Making this application available to other countries in their own language can be critical because it can facilitate adoption amongst government employees typically charged with this responsibility, who do not have a command of the English language. Thus the objectives of my research were to increase the international support in HydroServer. Crowdsourcing is defined as “to utilize labor contributed by the general public to a project, often via the internet without compensation” (Dictionary 2015). Crowdsourcing is capable of completing the large tedious tasks using problem-solving capacity of
the masses. It is critical on the web, especially since the internet has become more accessible to the general public (Doan, Ramakrishnan et al. 2011). I used crowdsourcing as a way to improve science, specifically for expanding HydroServer Lite.

This research solves the issue of being able to share water data easily in many languages through the use of HydroServer Lite. This will be described in later detail throughout the rest of the paper in the procedures and results sections.

PROCEDURES

In the beginning stages of my research one of the main challenges I faced was how to translate the application into many other languages. Crowdsourcing has become a popular way to solve these types of challenges through the efforts of people willing to volunteer their time and talents. Yet, using crowdsourcing would involve finding a community with a lot of language ability to help with the translations. Through the Internet it is much easier to reach people all over the world that have these kinds of language abilities, but finding a community in a single location where the project could easily be explained is a challenge. Fortunately at BYU about 70 percent of BYU students speak a language other than their native tongue (BYU 2011) so I engaged a crowdsourcing group of BYU undergraduate students in Civil and Environmental engineering. This has been an ideal community to start translating for HydroServer Lite. Once languages are initially “seeded” professionals and/or native speakers around the world will be able to do more translations and enhance the accuracy of the translations.
Creating the Translation Application

The translation application uses many resources to make it fully functional. A couple of programming languages were used for the front-end (what the user sees on the website) like JavaScript, HTML, and CSS. Then PHP was used as the server-side scripting language to connect with the database. A MySQL database was used for its popularity as the world’s most open source database and for its capability to relate data from tables. The website can be found at: http://worldwater.byu.edu/translation.php. When you go to this webpage there is a landing page, which is shown in Figure 2, for people to sign up, and login to help with the translations. After logging in to the system users have a home page where they choose a language to translate and help in making HydroServer Lite more accessible.

Figure 2. Landing page for HydroServer Lite Translation Application
A work flow chart is shown in Figure 3 to show how a user would use the translation application using the resources just described and the landing page shown in Figure 2.

**Figure 3. Flow Chart for Web Application Use**

**Connecting with HydroServer Lite Application**

After creating my website I needed to coordinate my efforts with the HydroServer Lite team at BYU to see how they could interact with my database easily to show the translations online. This took some time to figure out how the databases would interact correctly but luckily my database structure was easy to use in their Observations Data Model (ODM) database to connect all of the translations done by volunteers to the HydroServer Lite Application. After my coordination efforts were finished the translations could be seen on the HydroServer Lite web application hosted at the BYU World Water website as shown in Figure 4.
Figure 4. HydroServer Lite System on BYU World Water Website in Spanish

Figure 4 shows the web application in Spanish with translations done previously. As users enter the HydroServer Lite Application there is a button on the top right-hand side of the screen that lets you choose the language you want to use as shown in Figure 5.

Figure 5. Languages to choose from in the HydroServer Lite Application

Since Spanish was largely completed before I started to create the crowdsourcing translation application I worked with BYU Undergraduate students through the BYU American Society of
Civil Engineers (ASCE) Student Chapter to help me out with the translations for the other languages. The languages started thus far on the application are the following: Italian, Portuguese, German, Dutch, Bulgarian, Croatian, Ukrainian, French, Russian, Tagalog, Czech, Spanish, and Chinese. Other languages are easily added since anyone can request a new language. As a result of this application being developed volunteers started to sign up for the website and translate terms to help in the Internationalization of HydroServer Lite.

**Examples of HydroServer Lite being used by others**

The HydroServer Lite system is beginning to be used by people from other nations. Last semester another student and I worked with an individual from Namibia, Africa to setup the HydroServer Lite to upload and share data the resources of her country. I informed her that we could help set up a way so that she could translate the application into her own language at one point and that made her excited. This could possibly be done in the future but she said the resource proved to be a great way to store and share water data in her country, where they have such limited sources to store and share data in a web-based application like HydroServer Lite.

Dr. Jim Nelson, Civil Engineering Professor, BYU has also shared this technology with agencies in the Dominican Republic and Nicaragua. We have set up HydroServer Lite applications for them on the World Water site so they can use it. Since Spanish is a fully functional language it makes it easier for them to use it and illustrates the possibilities as other languages are completed. Figure 6 shows one of these instances set up for INETER’s (a major agency in Nicaragua) data.
Figure 6. Example of Nicaragua’s Data on HydroServer Lite

Figure 7 shows all of the sites where there is data stored for INETER on the HydroServer Lite. This is just one example of the many uses for the HydroServer Lite and how the internationalization of HydroServer Lite has made it easier for agencies and organizations to share their data.
HydroServer Lite as a tool can be useful to lots of different people and organizations around the world in enabling others to share critical data faster and easier.

RESULTS

Crowdsourcing Translation Application Results

After people started signing up I developed a method in the application to keep track of how many people were involved and how many translations were being done. The website started to be used in the Fall 2014 semester by BYU Civil Engineering Undergraduate Students and a couple of other volunteers at BYU. Figure 8 shows some statistics of how many translations have been done so far.

Figure 8. Number of Translations Done Per Language - HydroServer Lite
There is also a process built into the web application to review all of the initial translations for quality control purposes. There have been a few translations reviewed already but the review process is a major endeavor that will be implemented in the near future. Figure 9 shows how many translations have been done compared to how many terms need to be translated.

**Figure 9. Number of Translations Done Compared to Total Terms - HydroServer Lite**

Approximately 76% of Spanish terms have been translated, however the remaining 24% are mostly for the back-end interface with the databases that is not seen by most users. 4,755 initial translations and 422 reviewed translations have been done so far by 51 users as shown in Table 1.

**Table 1. Statistics from HydroServer Lite Translation Application**

<table>
<thead>
<tr>
<th></th>
<th>Total Number ofTranslations Done</th>
<th>Total Number ofReviewed Translations</th>
<th>Total Number ofUsers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish</td>
<td>3,033</td>
<td>422</td>
<td>51</td>
</tr>
<tr>
<td>Chinese</td>
<td>848</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tagalog</td>
<td>3,941</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech</td>
<td>355</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russian</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>French</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dutch</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portuguese</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italian</td>
<td>50</td>
<td></td>
<td></td>
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<tr>
<td>Source: BYU World Water Translation of HydroServer Lite</td>
<td></td>
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</tbody>
</table>
Users of the application have been receptive to how easy the application is to use and have been eager to help others share water data in their native tongues. To give users a sense of pride and competition as they complete translations I give them some feedback on their homepage to show how many translations they have completed overall and per language. An example of this is shown in Figure 10.

We thank you for all your help!
No. of Translations you completed so far: 15
Languages that you have done translations for so far:

Dutch: 14
Czech: 1

Figure 10. Translation Feedback for individual users

The feedback explained above helps because BYU ASCE likes to track the hours of service of anyone that helps in the translations and this feedback helps the BYU ASCE Officers know that the students have accomplished something. The service rendered by the BYU ASCE Students is an important part of making this possible. There have also been a couple of other native speakers at BYU, specifically from the Czech Republic and China that have helped as well. Later it will be turned over to agencies or volunteers with native speakers to review and polish the translations for quality control.
CONCLUSION

The Internationalization of HydroServer Lite extends its data sharing capabilities to a more diverse group of water scientists. This will enable agencies, companies, and individuals with the technology to store and share water data online with customers, clients, or citizens interested in using their data. This helps to accomplish the goal for “sharing water and climate data in a manner conducive to rapid scientific advancement” (BYU 2015) as stated in the mission of the BYU World Water Project. This also helps in the development of “an internet-based system for sharing hydrologic data” (CUAHSI 2014), as stated in the CUAHSI HIS mission.

My research involved creating a crowdsourcing translation application and dynamically linking them to the HydroServer Lite application to be used for sharing critical water data around the world. One of the most important things I found in doing this research was how critical it is to use resources around you, like the BYU students and colleagues that helped me with my web programming, to create a tool to help others. Further recommendations include getting native speakers to review all of the translations, and making the application more mobile-friendly so that all types of users could help in the translation process. Overall this will help others use this in their own native tongue and make it easier to share critical water information.
LITERATURE CITED


