The GPII Unified Listing

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Abstract. Individuals with disabilities are often unable to find assistive technology that meets their needs. While different databases of assistive technologies currently exist, individuals with disabilities are not aware of all of them and unable to take advantage of them. The Global Public Inclusive Infrastructure (GPII) Unified Listing's objectives are 1) to create a single unified listing, that covers not only assistive technologies that relate to accessing ICT but also includes access features built directly in to main-stream ICT as well. 2) to create an open marketplace of accessible and personalizable solutions. The unified listing will be bidirectionally federated with databases such as EASTIN. Development of a method to harmonize and federate the data contained in the different databases is complete and work is underway to create a mechanism to extract information relevant to ICT access from the federated data.

Keywords: Federated databases, EASTIN, accessibility, assistive technologies, access technologies.

1 Introduction

Assistive technologies and access technologies typically cater to small segments of the overall population. There are some products such as Jaws (Freedom Scientific) that are used much more widely than a typical AT product [1] but the typical user base for an AT product is quite small. Additionally, AT developers and vendors often do not have resources to market their products widely. As a result, potential users of AT have a difficult time finding AT that might fit their needs. AT that meets their needs may be available but due to the lack of a resource that allows them to know about it, it is invisible to users who need it. As a solution to this problem, databases of AT have been created. Some of these databases include AbleData, European Assistive Technology Information Network (EASTIN), Open Source Assistive Technology Software (OATS), Open Accessibility Everywhere Group (OAEG) etc.

- Abledata: Abledata's database of assistive technology has over 40,000 products that are available from domestic and international sources to consumers, organizations, professionals, and caregivers within the United States. It is sponsored by the National Institute for Disability and Rehabilitation Research. [2]

- EASTIN: The EASTIN website is run by a European network of member organizations running established national information systems in their Country [3]. The EASTIN website aggregates disability product information from its member databases. It contains information on more than 70,000 products and 20,000 AT manufacturers, suppliers and retailers. The databases represented in the EASTIN website include:

  — Portale SIVA (Italy) (http://portale.siva.it/);
  — Rehadat (Germany) (http://www.rehadat.de/)
  — HMI-Basen (Denmark) (http://www.hmi-basen.dk/);
  — DLF Data (UK) (http://www.dlf-data.org.uk/);
  — Handicat (France) (http://www.handicat.com/);
  — Vlibank (Belgium) (http://www.vlibank.be/);
  — Catàlogo de Ayudas Técnicas (Spain) (http://www.catalogo-ceapat.org/)
  — Vilans (Holland) (http://www.vilans.nl/)

The EASTIN database follows the ISO 9999:2011 standard . The ISO 9999 method is considered to be the most widely used method to classify assistive technology devices. The ISO 9999 is a three-level classification system that clusters AT products round "CLASSES" (e.g. mobility, communication, recreation, etc.), then round "SUBCLASSES" (e.g. within class "mobility": powered wheelchairs, cars adaptations, etc.), eventually round "DIVISIONS" (e.g. within subclass "powered wheelchairs": electric motor-driven wheelchair with manual steering, electric motor-driven wheelchair with powered steering, etc.). Each ISO 9999 classification item has a numerical code: for instance, item "electric motor-driven wheelchair with powered steering" has the code 12.23.06, where the first two digits stand for Class 12 "mobility", the following two digits stand for subclass 12.23 "powered wheelchairs" and the last two digits stand for this specific division [4].

- OATS: It is a web based one-stop "shop" for end users, clinicians and open-source developers to meet, exchange notes, promote new ideas, develop new software and download reliable open-source AT software [5]. The OATS website currently hosts more than 150 items of open source assistive technology software.
- OAEG: The key partners of the AEGIS consortium, a European Funded project (AEGIS project, n.d.), together with users' representatives and the active support of the Scientific Advisory Board have developed an Open Accessibility Everywhere Group (OAEG) with the aim to promote the uptake of the AEGIS accessibility open source solutions through a coherent set of incentives and ultimately standardization, and maintain and upgrade the AEGIS Open Accessible Framework and the individual open source software resulting from the project, after the project's lifetime. The OAEG website includes information on accessibility standards, a blog aggregator, and a repository of open source AT software and resources for development [6].

While these databases serves the needs of individuals with disabilities, lack of co-ordination between them means that users still have to search each of these databases individually. In many cases, they might not be aware of the database thus presenting the original problem again, i.e. the lack of information about AT. Co-ordination amongst databases is difficult as each of the databases follows its own conventions and as a result even similar fields in the various databases are different. For example, the "manufacturer name" field EASTIN database is conceptually the same as the field "entity" in the OAEG database.

Mainstream ICT also includes access features that make the products more usable and accessible. Currently, except for the Global Accessibility Reporting Initiative (GARI) database that lists the access features in mainstream phones, tablets and apps [7], there is no other resource that lists access features in mainstream ICT.

AT developers may face restrictions from the established marketplaces for selling their products. Popular marketplaces such as the Apple App Store, Google Play reserve the right to reject an application if it does not conform to their guidelines. Developers also often sell their software directly to avoid paying transaction fees to the marketplaces, or to provide discounts.

To address these challenges, a federated listing of assistive products, called as the Unified Listing was proposed under the Cloud4all project. The Cloud4all is a European Union funded project under the seventh framework program and advances the concept of the Global Public Inclusive Infrastructure (GPII) [8]. The GPII will provide an infrastructure that extends from the content and service providers (authors of Web and ICT content) to the devices used to access these content and services. It builds on existing ICT/Web/Cloud/Accessibility standards and work and will provide additional infrastructure to make it easier to apply and use them to provide anywhere, any device, any content accessibility [9] .

The objectives of the Unified Listing are [10]:

- To create a single unified listing, that covers not only assistive technologies that relate to accessing ICT but also includes access features built directly in to mainstream ICT as well.
- To create an open marketplace of accessible and personalizable solutions

2   Targeted Users of the Unified Listing

- Consumers
- Manufacturers
- Vendors
- Clinicians, Teachers, Vocational Counselors, and other Professionals Family, Friends, Caregivers, and others close to consumers
- Funding Agencies
- NGO and other organizations supporting consumers
- Government Funders and Policy makers
- Public

3 Approach

The Unified Listing is a "lossless" "crediting" Federated Database. It contains a full copy of the record fields for the databases it federates with as well as a set of standard common fields. All data is clearly identified with its origin(s) and use data fed back to sources for their crediting and reporting. Maintaining record data for all federating databases also facilitates their matching and use of GPII UL federated data [10].

The unified listing data structure is based on the EASTIN data structure. The EASTIN database aggregates the contents of eight databases on assistive technology products. In order to reflect the contents of all contributing databases, the UL dataset will be the union of the fields of the source databases. However, this may also lead to redundancy as the same fields might be referred to by different names in different databases. To avoid redundancy, similar concepts with different names in different databases will be mapped. For example, the "manufacturer name" field in EASTIN databases is conceptually the same as the field "entity" in the OAEG database).

In the Unified Listing database each record will be represented by a "multi-layer" structure (Table 1) there will be a layer for storing the product description of each of the source databases and a layer for the product description of the GPII Unified Listing as well as each available translation of each database. Specific product settings will also be part of the record. There will also be a "unique product ID" that will allow the Unified Listing to track the same product coming from different databases – and different versions of the same product.

The preliminary dataset for AT products in the Unified Listing is represented in Fig. 1. Each product record is made up of a single GPII product info and N original source product info. If the product is one of the "Cloud4all compatible" applications (i.e. it has been adapted to work with the cloud4all infrastructure), a link to the json file with the specific settings of the product is also included in the dataset.

4 Federation of the Unified Listing with EASTIN

A bidirectional federation between EASTIN network and GPII Unified Listing will be established in such a way that the users of the GPII Unified Listing web portal can access information coming from the EASTIN databases, and users of the EASTIN Web Portal can access information coming from the GPII Unified Listing.

The EASTIN search engine provides a specific set of APIs to receive input data from the EASTIN information providers (online databases) and make them visible in the EASTIN portal. The EASTIN search engine calls a set of Web Services that must be implemented by any information provider that aims to send data to the engine. Both the Web Service functions and the exchanged data format have been standardized by the EASTIN consortium and these standards must be followed by the external information providers. To provide data retrieved by the EASTIN search engine from the EASTIN databases to the GPII Unified Listing, a specific set of Web Services has been be implemented within the Cloud4all project that contains functions

Table 1. Structure of Unified Listing database record

GPII global unique product sync number	5475		
GPII Product Name	Dasher		
GPII Manufacturer Name	Cavendish Labs-Inference group		
GPII Description	Dasher is a special on screen keyboard that….		
...	...		
Information Provider (name-country)	EASTIN-SIVA (IT)	EASTIN-HMI (DK)	AbleData (US)
Product Name	Inference group Dasher	Dasher	Dasher
Product Code (in info prov. DB)	15478	5478	487
Primary ISO code	22.36.18 Input Software	22.36.18 Input Software	-
Manufacturer info	The Inference group	Cavendish laboratory	Inference group
Text description in original language	Dasher è un software gratuito che permette di scrivere…	Auf dem Bildschirm erscheint ein vertikal angeordnetes...	Dasher is a text entry system…
Image			-
...	…	…	…
Specific Settings			
Setting name	values		
Font size	10- 38 pt		
Scanning speed	slow, medium, fast		
Voice output	on; off		
...	...		

Fig. 1. Preliminary dataset for AT products in the Unified Listing

to extract data using the EASTIN search engine. These Web Services are to be exposed by the EASTIN search engine and will be accessed by a specific application aimed at collecting the data retrieved from EASTIN into the GPII Unified Listing database. (Since the data source is marked when a search is carried out, the fact that the GPII Unified Listing will be part of the EASTIN network will not cause a problem since the data received by GPII Unified Listing from the GPII Unified Listing (Because because it is part of the EASTIN network) can be ignored.)

Details on the federation between the Unifield Listing and EASTIN can be found in the paper "Federating Databases of Assistive Technology Products: Latest Advancements of the European Assistive Technology Information Network" by Gower, Andrich,& Agnoletto to be presented at HCII 2014 Conference [11].

5   Product Similarity

As the Unified Listing will federate information from various sources, it is very likely that the same products could be listed more than once in the listing. In order to prevent this, an algorithm for product similarity is under development [12]. Similarity is a property of a couple of product records A-B. Similarity represents the probability that product described in record A is the same as the one described in record B. The fields to be compared for assessing product similarity are:

- Commerical name
- Manufacturer: name and country

- ISO 9999 classification codes: primary and optional ISO codes
- Insert date

The comparison of each field results in a score of (0-1). The similarity is then calculated as the weighted average of the scores. The current formula for calculating similarity is:

Similarity = (commercial name x 0.62 + manufacturer x 0.28 + classification codes x 0.08 + insert date x 0.02)

The weights are based on the opinions of two ICT experts and will be adjusted further based on tests that are to be conducted as part of the Cloud4all project.

6   Innovations in the Unified Listing

An innovative aspect of the Unified Listing is that the database uses a layered rather than flat structure so that it has a record of all of the databases with which it federates. By aligning them and giving them a common product identifier is possible to provide only one copy of the product in search results even if it appears in many databases. Once it is found an individual can flip through the different descriptions of the product from different databases if they wish. Or look for a description in a language they are most familiar with. The database will allow users to specify preferred languages and the database will automatically display results in the most preferred language that exists for that entry. (It will also auto-translate – but this is of less quality). Because of this 'single record' ability, the user does not need to find the same products repeated many times in search results. Also, because of this feature is possible for differences between databases to be detected and/or corrections to be made to multiple layers of a record. The synchronization with the other databases will then return a corrected record that would match the format for each of the different databases. For the fields are common, a correction need only be made once. Where they differ the change, on the Unified Listing may have to be made to different layers, but this is fairly straightforward for a manufacturer. (Much easier than going to each of the different databases providers and looking up a record in order to correct it.) Federation with the Unified Listing therefore will provide the ability not just access the information in the Unified Listing but also to have corrections that are made in it automatically fed back to each of the databases that federate with it, either directly or with moderation, eliminating the need to reenter data. This approach also solves a major complaint of companies that often will not update any databases because they get requests from so many. The ability to go to one location and correct entries for their products and have it propagate to all of the other databases is of great interest to them.

But perhaps the greatest/largest innovation in the unified database is its coverage of not only assistive technologies but also the access features in mainstream products. As mentioned previously, the only database where this currently exists is the GARI database for mobile phones that was generated in response to government mandate. No similar database exists however for anything outside of the phone accessibility

features. The Unified Listing will provide information for the first time on both assistive technologies and on access features in mainstream ICT. It will also draw in the data from GARI and provide a much easier to use interface for consumers – a common complain of GARI. As a result, for the first time, users will be able to conduct a single search and find not only assistive technologies but features that exist in mainstream technologies that they would otherwise not be aware of. It will also help them to determine which of several mainstream devices might be usable directly by them.

To provide information in different languages the database will both store multiple languages for a record where they exist and couple with automatic translation engines from Google to make it easier to serve information in multiple languages. Currently databases are usually available only in one or two languages. In fact the reason that many duplicate databases exist is because they are developed in different languages. The Unified Listing, with its multilayer data records, will allow viewers to store and present different language translations of the data. The translations will be handled using a combination of auto-translation and human correction using crowdsourcing techniques. The auto-translation could also transform the records in to accessible formats.

Important for sustainability, the Unified Listing has also championed a new practice wherein all federated database records that originated from another database are clearly marked as to their origin. The power of a truly federated database is the fact that the efforts to maintain the data can be spread across many database teams who then share the results. However, if the databases are anonymously federated, it can begin to look like all of the databases are redundant. This can cause some or most to lose their funding. Therefore the origin of the data is important to preserve. In addition the unified database will also be introducing another innovation in that it will track the number of times that data from another database was accessed in the Unified Listing. These usage statistics are then fed back to the original source database so that that database can report not only the number of searches done on their database, but also the number of searches done on their data remotely.

7   Open Marketplace

Accompanying the Unified Listing will be an Open Marketplace. Whereas the Unified Listing will be comprehensive, and list all products available from all vendors and marketplaces (e.g. the iOS App Store, Google Play, Microsoft's App store etc.) the Open Marketplace will only contain products that a vendor chooses to sell through the Open Marketplace. The purpose of the Open Marketplace is not to compete with the other marketplaces, or to carry a full range or as many products as possible. Instead the purpose of the Open Marketplace is to provide those individuals or companies who cannot market or market internationally themselves with an easy mechanism for selling their product internationally. This will include the ability to automatically handle the financial transactions needed to purchase products in currencies other than the manufacturer's base currency. Where products are located in any of the app stores, users will be able to find them easily using the Unified Listing, which will

then direct them to whichever app store the product resides. If it is in the Open Marketplace and someplace else as well, the user will directed to both. So the Open Marketplace becomes an extension of, or complement to, all of the other markets that are out there. However it is a market where users can upload and sell apps or program or services that cannot be listed elsewhere.

8   Conclusion and Future Work

The Unified Listing is a novel listing that will cover not only assistive technologies that relate to accessing ICT but also include access features built directly in to mainstream ICT as well. It draws upon the standardized data structure of the EASTIN database and will federate multiple databases bidirectionally. The development of the Unified Listing is ongoing. The development effort consists of two phases.

- Development of a method to harmonize and federate the data contained in the different databases, thus creating a single entry point to all available resources. This phase is complete. As part of this activity, the preliminary results of the ETNA and ATIS4AII thematic networks, aimed at creating an online European platform for assistive technology and accessibility devices and services, were studied.
- The next phase involves creating a mechanism to extract information relevant to ICT access from the federated data. This information will be made available to the GPII marketplace so that users who are looking for assistive technology to access mainstream ICT can benefit from it. This phase is currently underway. The success criteria for this phase is a prototype of the single entry point to retrieve the required information and data, and integration of federated data in the GPII marketplace with origin data intact

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