A Web-Based Communication Tool for Arabic-Speaking Newcomers to Canada

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***Abstract*—The development of a communication aid tool for Non-English-Speaking newcomers to Canada is very important for their integration, self-reliance and contribution to the new society. Such a tool will indeed overcome the language barriers that the newcomers might be challenged with, which will ease their struggle in their first days in a foreign country. Following on a previous work extending the Pictopages software to address these challenges for the Arabic-speaking new comers to Saskatchewan, Canada, we propose a new web-based communication tool relying on a multilingual ontology. More precisely, the multilingual ontology is used to structure items, extracted automatically from Wikipedia via a Natural Language Processing (NLP) module. Our proposed communication tool allows newcomers to communicate and to interact with the target community via audio, text and visual symbols. In this regard, the tool includes several functionalities, such as a multilingual automatic speech-to-speech translation, localisation via Google Maps web mapping service, and important information and resources for newcomers. The latter are well-organized in a hierarchical manner, thanks to our proposed multilingual ontology.**

Keywords- Communication aid; Pictogram; Audio-visual strategy; Multilingual ontology; NLP.

I. INTRODUCTION

Communication aid tools that target people with intellectual or developmental disabilities have demonstrated their capability to help communicating successfully with others. The provided tools play a significant role to overcome communication issues as they are based on several technologies, including pictograms (clear symbols in black and white) and audio messages. Nowadays, it is important to make these communication aid tools available to newcomers. These tools will not only help to communicate but encourage users to engage a discussion in the new language. In other words, through a well-developed communication assistant system, newcomers will overcome their language barriers and be able to better share and transmit their opinions, ideas and thoughts. This will lead to improve their communication skills in the target language and facilitate their integration in the new society.

In [1], a new methodology has been proposed to develop a communication aid tool for Arabic-speaking new comers to Saskatchewan, Canada. The target tool extends the Pictopages software by attaching Arabic and English audio messages to a set of pictograms. More precisely, the user will communicate by selecting the appropriate pictogram symbol, which will output an audio sound in both languages (Arabic and English). Indeed, pictograms are symbols that express a clear and adequate visual representation of a given item, concept, location, service, etc. The methodology and the related tool do however have the following limitations. First, Pictopages software is only available for IPads, which limits its usability by newcomers. Second, while Pictopages allows the addition and customization of new pictograms, audio messages have to be produced and added manually. This is a tedious task especially given that users have different needs, over time, which will translate to a large number of items that have to be added dynamically. Finally, the methodology requires a face to face interaction with a set of participants to evaluate the new tool. This latter phase is not practical due to the current COVID-19 measures, among other challenges.

Our main goal in this paper is to follow up on the work in [1], and to address its limitations. More precisely, we propose a new Web-based communication tool for Arabic-speaking newcomers to Canada, meeting the following main objectives.

1) Facilitate the communication (of Arabic-speaking newcomers) in the two official languages of the host country (English and French),
2) improve communication skills in the two target languages,
3) encourage community engagement,
4) and accelerate newcomers integration, self-reliance and contribution to society.

Our proposed tool relies on a multilingual ontology, Wikipedia and Application Programming Interfaces (APIs). In addition to Arabic, English and French, our tool can be easily extended to other languages. Besides, different scenarios from a daily life/needs of a newcomer are represented and updated via a large set of items that are extracted automatically from Arabic Wikipedia. Also, these items are structured into a multilingual ontology created via an NLP module, and annotated through a Web Ontology Language (OWL) language. Indeed, the multilingual aspect is ensured by an API that extracts information from Wikipedia articles. Furthermore, audio messages associated with items are also recorded through an API. This latter API allows the recording of the same tone of a male

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or a female voice, and reads a word or a phrase based on its punctuation. Moreover, our proposed tool helps newcomers to find geographic locations of the important places that they might be looking for, such as hospitals, schools and grocery stores. Finally, the tool is linked to Websites for public services like emergency services, such as police and fire departments. The evaluation of the tool is conducted through a feedback survey component for end-users. This will help performing a perfective maintenance of the software.

The rest of the paper is structured as follows. In the next section, we present an overview of the different communication aid methods. In this regard, we will first present a classification of the known methods. Then, we present previous communication aids based on pictograms. Section 3 is dedicated to a related work that has been conducted to address the communication aid for non English-speakers, using Pictopages. In Section 4, we describe our proposed methodology. Section 5 provides the details of the multilingual ontology we have adopted. Section 6 presents the different components of our web-based application. Finally, concluding remarks and ideas for future works are listed in Section 7.

II. Overview of communication aid methods

A communication aid is a means of connection to help people who are struggling with troubles of speech and communication. Likewise, this aid assists individuals through facilitating their interaction and discussion with people around them. Besides, it allows them to share meanings more effectively [2]. Initially, a communication aid was just a simple letter written on a board. Nowadays, this communication aid has evolved to complex systems relying on sophisticated electronic devices.

A. Augmentative and Alternative Communication

Augmentative and Alternative Communication (AAC) is a generic term that refers to those communication methods supporting or replacing speech. AAC helps people to convey their thoughts and encourages them to express their needs. Moreover, AAC provides an opportunity for individuals to connect non only with family and friends but also to understand and interact with their environment, such as in a workplace or a shopping center [3]. AAC methods are classified into two main classes; the first one, named “aided AAC”, comprises two sub-classes: “non electronic” and “electronic tools”. The second class is called “Unaided AAC” as it does not require the use of material or equipment. In what follows, we will describe briefly each class and sub-class.

B. Unaided Communication

Unaided communication methods are based on sign language, gestures and body movements. This kind of communication methods are frequently used and understood by people. According to gestures and body movements, the majority of people are able to recognize facial expressions, communication through eye looking, and pre-verbal gestures such as pointing. However, a sign language is needed for individuals with hearing and speech impairment. Besides, a sign language has different types related to several cultures; among these languages, we quote American Sign Language and British Sign Language [3].

C. Aided Communication

Communication methods become sophisticated and as they keep pace with technological progress. In this context, we list aided communication methods, which are based on the use of equipment. Moreover, there are two sub-classes of aided communication methods; ”Low-tech” and ”High-tech”. These sub-classes differ in terms of the used technologies. Low-tech methods use old techniques characterized by their simplicity. On the other hand, High-tech tools are based on modern techniques using advanced features. In what follows, we present each sub-class.

1) Low-tech communication aid: Low-tech communication aids use writing methods to transmit the information. These methods can be boards and books, which include significant symbols, meaningful letters or words and relevant pictures. Symbols could be described graphically as in Blissymbolics [4], which is a language containing thousands of symbols and in Boardmaker [5], which is a graphic database dedicated to make communication aids. The communication aids made via Boardmaker can contain thousand symbols translated into various languages. In this kind of communication aid, individuals can rely on eye-pointing to select a symbol or touch it directly through fingers or other movements, assuming they have the ability to move. Otherwise, symbol selection can be done by another person that follows the individual’s instructions until getting the desired symbol [3] [6].

2) High-tech communication aid: High-tech communication aids allows to store and retrieve messages, having an electronic format, which helps individuals communicating through a speech output [7]. The High-tech communication aids can also be named SGD and VOCA, which stand respectively for Speech Generating Devices and Voice Output Communication Aids [8]. For these types of communication aids, the output speech can be generated through two manners, digitized and synthesized. According to digitized output speech, the devices play words or completed phrases, which are recorded. In general, these devices are the most understandable. For the synthesized output speech, the devices exploit a text to speech software for those who are not capable to spell words. High-tech communication aids have two categories of devices. The first one is called “dedicated devices” developed exclusively for AAC, while the second one (“non-dedicated devices”) refers to computers running a software, to mimic AAC devices. High-tech communication aids can be classified into static and dynamic devices. Static devices, which can be modified manually, contain symbols having a position fixed on a paper overlays. On the other hand, dynamic devices contain symbols, which can be modified through a page linked to vocabularies and messages [7] [9].

D. Communication aids based on Pictograms

Pictograms are methods of communication that are considered as figurative and informative drawings. Pictograms can

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substitute written instructions to express information that can be quickly processed, such as road traffic signs. This kind of warning and mandatory information requires clear symbols acting as indicators. In addition, pictograms can provide a compromise between native and non-native speakers for a given language or between users with low level of literacy. Through pictogram symbols, old people suffering from visual impairment can interact with other people. Moreover, pictograms are useful for industries to spread legal information to their workers, such as the use of dangerous and hazardous materials [10] [11] [12]. In what follows, we present some previous communication aids based on pictograms.

In 1976, Maharaj S. developed a visual strategy based on pictograms, which aims to ensure the communication for non-verbal individuals. In 1980, Maharaj's pictogram application started to be used internationally. As a main goal, this application aims to offer a communication strategy for both children and adults with disabilities that impaired their verbal communication capabilities, such as cerebral palsy, autism and Alzheimer [13]. The provided symbols consist of a white symbol (corresponding to a simplified "picture") on a black background. The white symbol refracts light to provide the strongest impact for communication while the black background removes the possibility of figure ground confusions. The proposed symbols can illustrate objects, concepts or actions. They can also provide adaptive opportunities for communication especially for those who require such assistance for communicating with people around them, as well as providing a platform to create classroom materials for their benefit.

Similarly, low-tech to high-tech aids are available, from symbol-based communication boards (e.g., printable from software applications) to symbol and picture-based applications on mobile devices, as well as specialized, and dedicated messaging devices. Similarly, there has also been some use of pictograms to assist in the teaching of alternate languages [14], or in discordant language situations for specific needs (e.g., delivery of healthcare services) [15]. We also note some use of pictograms to help refugees to communicate in the language of their host countries [16] [17].

In [14], the author reports on a work using a method based on pictograms for teaching Turkish as a new foreign language. The proposed method uses both pictograms and sentences based on a context to build a new Turkish vocabulary. Besides, this work lists original pictogram patterns to show the value of this technique. In this regard, the author aims to help Turkish learners to use pictograms in a context to enhance their communication skills level in this target language. The proposed approach described uses a bold, high impact, text-based style of pictograms, where words are shown in a variety of fonts, sizes, alignments, and colors with added images, such as a leaf growing out of a letter, a cartoon drawing of a sad man sitting on a letter (with pools of tears below), a backdrop of a sun peeking above the clouds, letters with eyes and mouths, and "cold" blue letters (one with a toque) in what appears to be a snowfall. These teaching aids were intended for use in a classroom setting. It was reported that this approach was not only effective for teaching Turkish vocabulary, but it also increases the ease of learning and the vocabulary.

In [18], a teaching strategy is proposed for kindergarten students based on pictograms' assistance, which is based on mixing words with symbolic pictures. Indeed, the author believes that students can understand the relationship linking oral and written languages through learning how to recount, read and write short poems and rhymes in Spanish. Moreover, pictograms are used to illustrate poems and to ease not only students' understanding but to enhance their reading level so they become fluent. Pictograms, considered among the first writing forms, help boosting students' ability to learn and communicate (talking, listening, writing and reading). Furthermore, students start reading a poem with a short form, and identify pictograms in rhyme. Then, they practice the identified words and end up by composing and reciting their own poems.

In [15], the authors discuss the use of pictograms for health care in the context of US Navy exercises intended to provide training for humanitarian and disaster relief to U.S. military, Non-Governmental Organization (NGO), and other associated personnel. This work is motivated by the fact that communication between those providing medical care and those receiving it was problematic. This is due to either a lack of skilled translators or to translators who had little or no knowledge of medical terminology and practice. In most cases, it was not possible for English-speaking medical personnel to determine whether the message transmitted was correctly translated. In some cases where NGO translators were available to monitor local translators, it was found that the information was not being accurately delivered, with some of the information being highly inaccurate. Consequently, there was a need to provide medical staff with alternate methods of communication; additionally, those methods would require testing for effectiveness and validity before being put into practice. One potential method identified was the use pictograms representing common medical conditions and symptoms. To determine whether such pictograms would be capable of meeting the 85% level of accuracy specified by the American National Standards Institute (ANSI), thirty-six images (including three duplicates) were provided to medical personnel for interpretation. It was found that over 75% of the (unique) images met the ANSI criterion. This suggested that the use of pictograms could be a viable communication method when the medical staff and patients do not speak the same language.

Some research work have been conducted to manage the knowledge behind the graphic display of pictograms. By doing so, these pictograms could rely on an important semantic level of the associated vocabularies. In [19], the authors present an AAC device, called "Pictogrammar", to assist people with language impairments. Pictogrammar is based on two types of ontology. The first one, called Simple Upper Ontology (SUpO), is defined as a formal semantic ontology describing detailed knowledge of actualities. The latter can be simple

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words, with an important interest, to avoid and solve linguistic issues in order to automate the grammatical supervision. The second type, called PictOntology, is defined as an ontology developed to manage a set of pictograms linked to SUpO. Furthermore, PictOntology has four main properties. The first one is to share a common ontology for students, language pathologists, family and caregivers. The second property consists in implementing an effective predictive parser. Then, the third one is the motor planning overload, and the last property consists in generating a natural language, which is grammatically correct even if the input is not.

In order to encourage pictogram-based communication within medical settings, [20] developed a smartwatch application that offers a small number of pictogram's symbols that are designed specifically for emergency medical applications. The proposed application is developed through intuitive icons and interactive symbols. It is composed of four basic parts. The first one, Band aid, describes how to communicate a need for medical aid, while the second part is designated for moods and emotions via smiley face icons. Then, the third part is an apple icon to describe diet and allergy issues. Finally, the last one is a call out balloon for the chat.

In regards to developing health care applications, several research work on the use and evaluation of pictograms have been reported in the literature. In [21], the authors assess and investigate the impact of pictograms on the medication adherence through relevant articles from medical databases, such as PubMed and MEDLINE. The experimental investigation show that ten of seventeen studies have reported the significant role of pictograms, which complement the textual and oral information associated with medication. According to the reported studies, pictograms are efficient to illustrate graphically medical instructions and improve patient's understanding.

Following on the success in the pharmaceutical area, the impact of using meaningful pictograms is sill increasing. Besides, the graphical representations offered by pictograms are considered as an important means to convey clear and understandable messages. For instance, the target people, low-literacy patients, might need pictograms to remind them about the time to take a given medicine [22].

In the agriculture field, a new application based on pictograms is proposed in [23] to help low-literacy farmers. The proposed application allows farmers to manipulate complex machines. The authors relied on an artist to create graphics related to the instructions to operate the machines. In addition, the authors added some sketches following the work in [24].

Note that the use of pictograms is not the only approach adopted to develop communication aid. Smart devices are also used to assist in communication and engagement. In [25], the authors conducted an evaluation of a smartphone application, to assist individuals having intellectual, visual and motor disabilities, to use Whats-App messages, telephone calls, and access to leisure activities. The proposed application relies on a smartphone (Samsung A3) having an automated process via a MacroDroid application [26]. It has been found that, without this tool, the participants' performance is close to zero on communication and leisure activities. During the conducted experiment, the authors observe that the frequency of sending and receiving Whats-App messages and the use of leisure activities increases.

In [27], the authors evaluate an extended version of a smartphone aided application, which supports daily communication and leisure activities for individuals with intellectual and/or visual disabilities. The involved participants have participated in the program listed in [25]. In addition, the extended application depends on a new smartphone (a Samsung Galaxy J4 Plus device, which is operated by an Android 9.0 operating system and MacroDroid). This application relies on alternated periods dedicated for the participants to be engaged in communication and leisure with periods in which they were provided with instructions for daily activities. With the smartphone-aided application in [25], the participants were engaged in communication and leisure. However, they did not use any activity. It has been noted that, with the extended smartphone aided application, the participants maintain successful communication and leisure engagement. The participants also start carrying out activities with success.

III. Extending Pictopages for Arabic-speaking newcomers to Canada

In [1], a methodology has been proposed to develop a communication aid tool based on Pictopages software to allow Arabic-speaking newcomers to select, from a list of pictrograms, the message to be communicated. Upon selection, the communication aid provides a recorded audio output of the corresponding word, phrase, or sentence in Arabic and English. Pictopages is available on iOS devices and has been commonly adopted for special needs individuals. The idea is to extend it to assist the Arabic-speaking refugees new community in Saskatchewan, Canada. The methodology and the related tool (extending Pictopages) has the following limitations. First, Pictopages software is only available for iPads, which makes it out of reach to newcomers. Second, Pictopages requires a manual addition and customization of new pictrograms. Moreover, audio messages related to the added pictograms have then to be manually produced and added. This manual process is a tedious task especially given that we will expect to add a large number of items meeting the users' needs and requirements. In [28], the authors highlight and criticize the manual aspect of creating pictograms, and consider this process as time consuming, and causing complicated navigation by the end-users. Moreover, the methodology in [1] for building and evaluating the tool requires the recruitment and face-to-face interaction with a set of volunteers, from the Arabic-speaking refugee community. These two tasks have been facilitated by the Regina Public Library (RPL), and initial meetings have been conducted to collect feedback on common interest areas (as shown in Figure 1). However, face to face interaction with the participants to evaluate the new tool is not currently possible due to the current COVID-19 measures. Regardless of the situation with the pandemic, the recruitment procedure is restricted to those individuals in connection with

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RPL. This limits the diversity in terms of literacy level, English skills, age group and others.

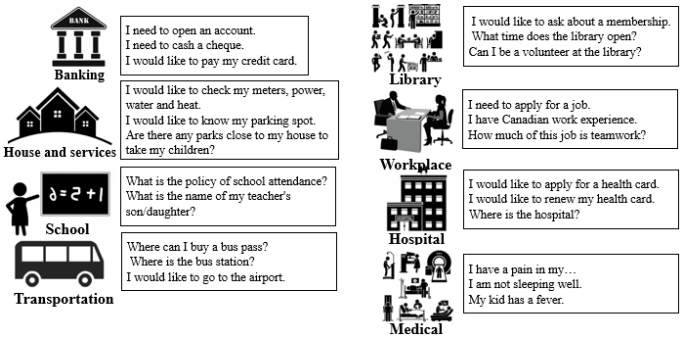

Fig. 1. Newcomers' areas of interest

IV. Proposed System

Our proposed system is meant to address the objectives and overcoming the limitations of the tool reported in the previous section [1]. More precisely, our ultimate goal is to facilitate the communication in the host country official languages (English and French), improve verbal communication skills, encourage community engagement, and accelerate newcomers integration, self-reliance and contribution to society. Therefore, our objective consists in building a web-based communication system that assists newcomers in different scenarios, such as daily routine, seeking a service, and when facing emergency situations. In this regard, we first start by gathering an initial study corpus containing more than 800 unstructured articles from Arabic Wikipedia. The corpus is then provided as an input to an NLP module to extract and annotate Arabic items, thanks to the Finite-State transducer formalism. Furthermore, all the established Finite-State transducers will merge extraction paths and annotation nodes, which defines the OWL syntax to generate a structured output. Besides, these Finite-State transducers are regrouped in a cascade acting on the study corpus in a precise order to reduce the execution time and to minimize the extraction and annotation errors. This way, the NLP process leads to the generation of an Arabic ontology that becomes multilingual by adding English and French (and other languages) via a translation API related to Wikipedia. Thereafter, all the annotated and structured items go through a process consisting in organizing them based on our multilingual ontology's levels and calling the adequate image and link to Wikipedia. The organization process is included in the creation of the Web pages composing our communication tool using Web design languages. Likewise, important functionalities, such as automatic audio message for each item's label in three languages, are also added. Finally, we propose new features, such as translation (text-to-text and speech-to-speech), text-to-speech conversion, speech recognition and localization via APIs. In what follows, we present the architecture of our proposed system.

Our proposed system evolves over time (according to users' needs) and can easily be extended, thanks to its dynamic multilingual ontology and other features. Moreover, our system follows a three-layer architecture, as shown in Figure 2.

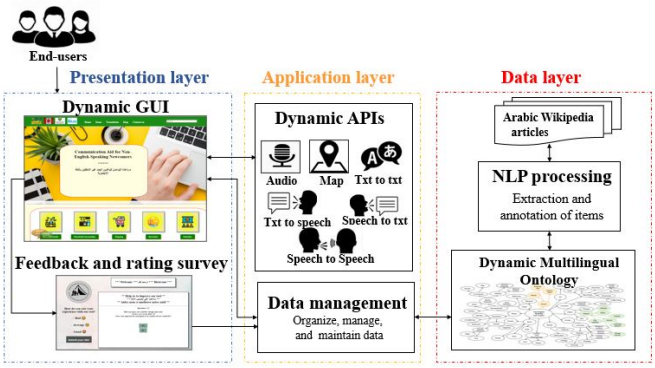

Fig. 2. Architecture of our proposed system

The first one (leftmost layer), called "Presentation", aims to present a Web-based GUI in an ergonomic view, in order to interact with users and collect their requests and feedback. The received feedback can be seen as a form of learning users' requirements and preferences, in order to achieve a perfective maintenance of our system. The second layer, called "Application" layer, is the heart of our system. This layer works behind the "Presentation" layer, and executes users requests through a communication with APIs and the "Data" layer.

V. Multilingual Ontology

Our proposed multilingual ontology has been created by following two main phases. In the first phase, an NLP process is conducted to extract and annotate Arabic items. Then, the second phase consists in translating these Arabic items in English and French, based on a Wikipedia API. The NLP process exploits a deep linguistic study that we have done using an Arabic Wikipedia corpus. Analyzing this corpus allows us to identify the candidate items through studying their forms or context, and to explore the related concepts and sub-concepts. Furthermore, the resulting conceptualization has an important level of granularity that increases based on the richness of the article content. A linguistic study has been performed to match the identified terms and their associated concepts with the OWL annotation syntax. This permits to specify the annotation path that will be exploited during the NLP process. Figure 3 describes our multilingual ontology with its concepts and sub-concepts.

After conducting the NLP process corresponding to phase one, we generate the OWL files from the semi-structured articles storing the extracted and annotated Arabic items thanks to an extractor that we have implemented in PHP. These generated OWL files are the input to the second phase, we described earlier for translating items from Arabic to English and French, to obtain the final multilingual form of our ontology. This translation process is also ensured by a PHP code that sends the queries to a Wikipedia API and organizes the obtained results to facilitate their integration in

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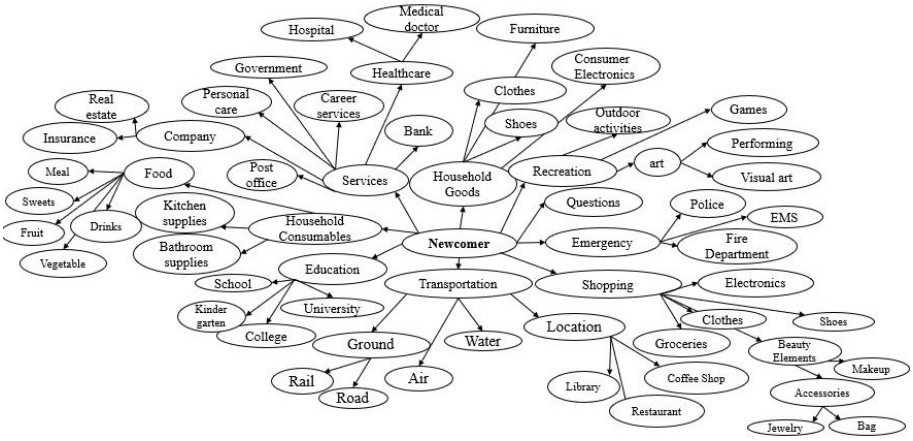

Fig. 3. Proposed Multilingual Ontology

our Web-based communication tool. Figure 4 illustrates an example taken from the OWL file associated with the sub-sub-concept “Fruits”, which belongs to the sub-concept “Food”. The latter belongs in its turn to the main concept “Household Consumables”, as shown in Figure 3.

```
<owl:Thing rdf:about="#أنـاناس">
<rdf:type rdf:resource="#Fruits"/>
<rdfs:label xml:lang="en">Pineapple</rdfs:label>
<rdfs:label xml:lang="fr">Ananas</rdfs:label>
</owl:Thing>
<owl:Thing rdf:about="#تفـاح">
<rdf:type rdf:resource="#Fruits"/>
<rdfs:label xml:lang="en">Apple</rdfs:label>
<rdfs:label xml:lang="fr">Pomme</rdfs:label>
</owl:Thing>
<owl:Thing rdf:about="#موز">
<rdf:type rdf:resource="#Fruits"/>
<rdfs:label xml:lang="en">Banana</rdfs:label>
<rdfs:label xml:lang="fr">Banane</rdfs:label>
</owl:Thing>
```

Fig. 4. Example of extracted items annotated in OWL

VI. Web-based Application

Our proposed communication tool is a dynamic Web-based application, which belongs to the High-tech category. The related Web-pages are coded using HTML, PHP, JavaScript and CSS. The main page contains five main sections respectively describing; the tool’s objective, the ten main items representing the topics of interest, the translation module, the map localisation module and the Contact us/Survey rubric. In what follows, we describe each section.

Figure 5 lists the ten main topics of interests. Upon selection of the chosen item, an audio message is generated to read the item’s label in the appropriate language. To navigate, the end-user needs to click on the chosen topic to get the related subset of items, in a hierarchical manner. Figure 3 in Section V lists the hierarchy of the different items. Among the main items, we added new information related to the COVID-19 pandemic, as shown in Figure 6.

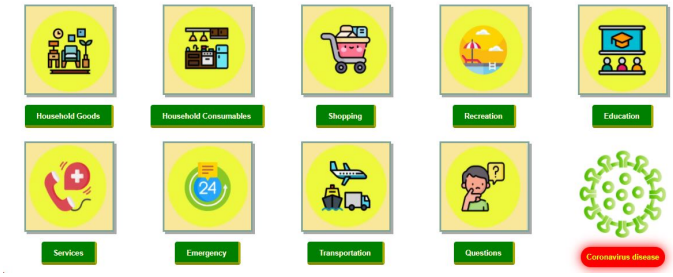

Fig. 5. Main items of our communication aid

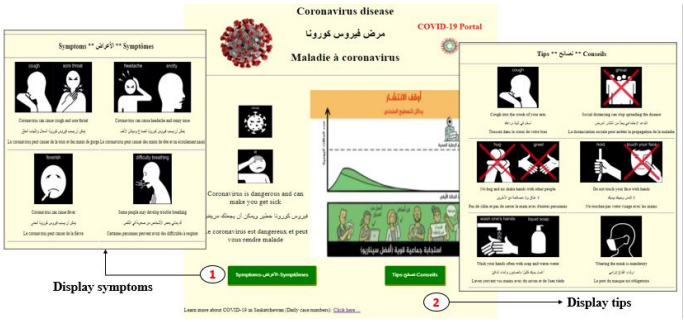

Fig. 6. Covid-19 information

These information are presented in an animated way, with audio messages, in order to attract users’ attention. In this regard, we provided two links where the first one reports on daily information regarding the pandemic in Saskatchewan. The second link displays the disease’s portal provided by Wikipedia.

A. Multilingual, Linked and Acoustic Items

Our communication aid contains items, which are associated with concepts corresponding to our ontology’s levels listed in Figure 3. These items are represented by a colorful picture and buttons in three languages. We choose the 3D design to create these buttons in order to adapt our communication aid to new devices using touch screen features. Figure 7 shows

an item called “air mattress”, which belongs to the furniture’s items.

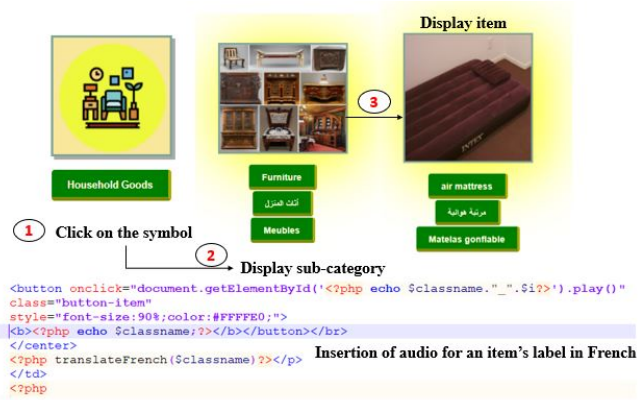

Fig. 7. Example of a multilingual item with audio output messages

The three labels related to this item are generated automatically via an API called MediaWiki API [29]. This API accepts several parameters, and the user can select the target language. We should mention that the generation of audio messages is done automatically via a Google API taking the labels as an input and generating an audio output. At first, we store this audio output after giving it a key in a hidden HTML tag. Then, we call the audio via a JavaScript instruction added to a “Onclick” function in the target button. The picture related to each item is linked to Arabic Wikipedia to help those newcomers who can read to get more information. Figure 3 also shows the difference between a colorful symbol and a picture, for recognizing a given item.

B. Translation and Speech Recognition

Translation is among the most important features for newcomers. Our tool provides three options for this feature: text-to-text, speech-to-speech, and text-to-speech. The first module, related to a text-to-text translation is illustrated in Figure 8.

Fig. 8. Text to text translation

The second module, related to text-to-speech conversion, helps newcomers to learn and improve their pronunciation in English and French. This module can also be used to learn the Arabic language. The third module, related to speech-to-speech translation (see Figure 9), can be handy for those with visual impairment. This service allows users to speak into the microphone using their native language. The listener will then receive the translated speech in the target language.

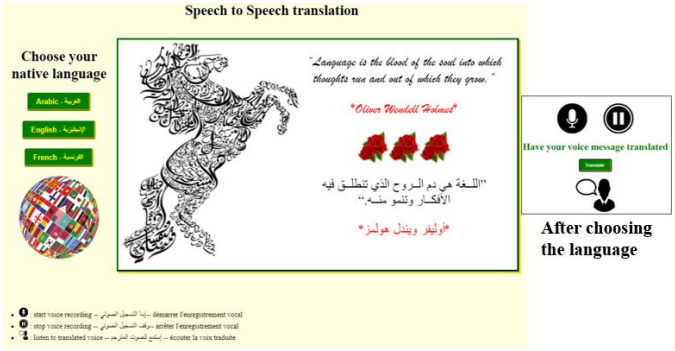

Fig. 9. Speech to speech translation

For each recognized language, we start by translating transcripts, thanks to the used API, into the target language. Then, we convert the translated transcript into a voice record. By doing so, the final audio message is added and ready to be played by the listener. Here, the voice recognition is ensured through a Speech Recognition API [30]. As mentioned earlier, the three modules can be extended to other natural languages.

C. Geographic Localisation

A localisation service is provided via Google Maps web mapping service. Through this feature, the user can see the map and locates the target destination before going out thanks to the street view option. Figure 10 illustrates the result for searching “University of Regina” using the localisation service that we provide.

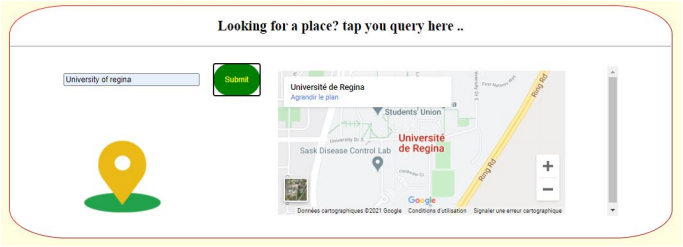

Fig. 10. Geographic localisation of the University of Regina

D. Feedback survey

To collect users’ feedback, we implemented a survey that allows to improve our tool’s functionalities, features and services. This survey includes a set of Yes/No questions, and rating, in three languages. Figure 11 shows the survey form, which aims to measure the end-users’ satisfaction. Feedback are anonymous so participants feel more comfortable, as their privacy is protected.

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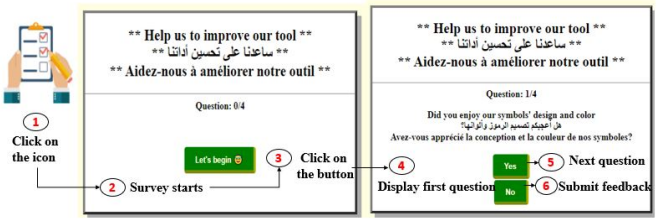

Fig. 11. Survey to collect users' feedback

VII. Conclusion and Future Work

We propose an extensible and dynamic Web-based communication tool for Arabic-speaking newcomers to Saskatchewan, Canada. Our communication tool follows a three-layer architecture designed to efficiently process end-users' requests. The top-layer ("Presentation layer") corresponds to a Web-based interface including five main sections, offering different services to the end-user. Among these services, a large set of items, corresponding to the main common information to newcomers, are arranged in a hierarchical manner, thanks to our multilingual ontology. These items are linked to Wikipedia, and are presented with text and audio sound messages, in three languages, generated automatically through an audio API. The other services include the speech/text translation module, the map localisation module, and a feedback survey. The speech/text translation module is particularly important as it allows a real-time verbal/text translation in the three languages. This can be a very useful communication tool for newcomers, especially in their first days in the host country.

In the near future, we plan to improve our tool's features and add new ones based on users' feedback. Then, we will enrich the textual communication of the chat-bot that we have implemented by adding an auditory option. This latter, aims to accelerate the time response and decision making, especially when the end-user has an emergent query requiring a quick response. Moreover, we will develop a learning module for young children in order to improve and develop their communication skills in the host country language(s). This will be done using known cartoon characters in animated conversations.

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