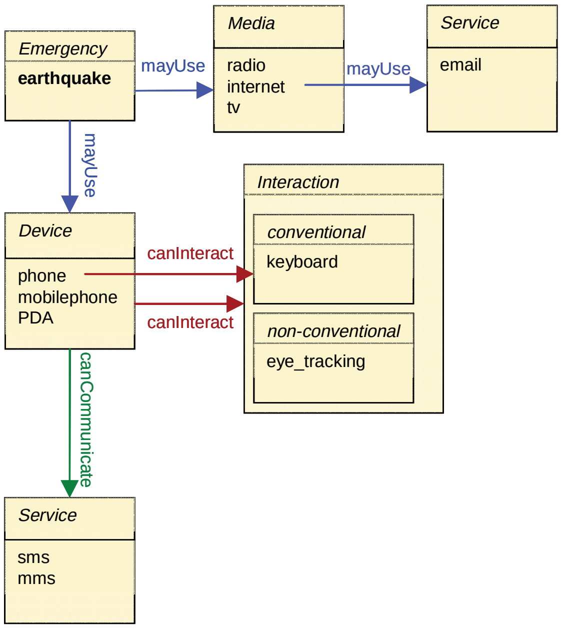

Fig. 3. The definition of the earthquake with media and devices used to alert

At this stage the ENS can retrieve information from SEMA4A about the alert to transmit. The person, in our case, is using a PDA connected to internet: the ENS can send the alert as an internet message (e.g. an e-mail). From the ontology, we can obtain the kind of information that the message can send: texts, figures, videos or sounds (see Figure 4).

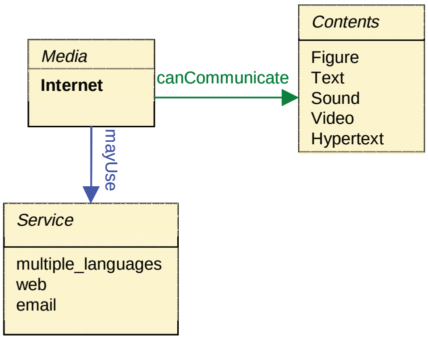

Fig. 4. Internet characterization

In this example, the message sent by the ENS contains an image with the map of the emergency plan and textual information. The map can be a simple image, an interactive image or a image based service, like the one available at StreetView[2] of GoogleMaps. For example, an interactive map could allow a virtual walk-through between two points: in our case, Maria can visualize the route between her position (e.g. her house) and an emergency site (e.g. the Prince of Peace Lutheran Church, 38451 Fremont Blvd, Fremont, CA 94536 where the civil protection has established a first-aid center). With the eyes movement she can navigate virtually along this route, turning left or right (by looking left or right) and going back or on (by looking down

[2] *maps.google.com/streetview*

or up). Another possible functionality can be the direct interaction with icons of emergency sites: she could decide to call a hospital indicated on the map just with a special sequence of eyes movements (e.g. a wink).

The disability chosen in this example does not have a set of guidelines that could guarantee the accessibility of information. To ensure that the user can access to proposed information, the ENS has to adapt the message, depending on the emergency and the device she is using. In case of a person with coordination difficulty, the used device depends on the kind of difficulty. If she has difficulty using hands, as in our example, she needs a non-conventional interaction to access her device that does not involve hands. The eye tracking is an example of non-conventional interaction that substitutes the mouse and the keyboard with the eyes movements [10, 11]. A similar scenario can involve an elderly person with arthritis and limited motor capacities. Moreover, here we have considered a PDA, but the eye tracking can be used with any kind of devices that have a camera and appropriate software.

In Figure 5 we can see an example of an eye tracker developed by us (using the OpenCV[3] libraries and Google Streetview[4] APIs) to synchronize the eye movements with the walk-through presented to the user. The mobile device (the Ultra-Mobile PC in Figure 6), equipped with a camera and the eye-tracking application, allows the user to check which street she has to take in order to follow the evacuation plan, by providing a view at street level. A wheelchair could be easily equipped with such device, for guiding the user through the streets of a city and interacting without hands by employing only the head and eye movements.

Fig. 5. The eye-tracker together with Google streetview running on an Ultra-Mobile PC equipped with wifi connection

5 Future Evaluation

The goal of this work is to determine whether the adaptation to users' abilities can improve the notification of emergencies. We are planning an evaluation to

[3] OpenCV are a set of open-source libraries for developing Computer Vision and Pattern Recognition algorithms in C; available at *sourceforge.net/projects/opencvlibrary*

[4] Google Streetview Application Programming Interfaces are part of Google maps API; available at *google.es/apis/maps*

demonstrate that interactive accessible notifications can help people to reach emergency point quickly.

We will consider just one independent variable: the type of notifications. The classic one is a standard message about the emergency, sent via radio or via web services. Notifications we proposed here are adapted to the user's profile and the occurred emergency. The location of the evaluation will be the central square of Leganés, the site of University campus. We will not locate the evaluation in a building of the University campus because we may have problems with devices that need GPS.

We are planning to simulate an emergency fire and to ask to involved students to go from the square to the nearest hospital. They will perform this task under two different conditions: receiving notifications from a classic system and receiving interactive accessible notifications. In the first case, they will receive a message with general information about the emergency and they have to find additional specification, like the nearest emergency point, calling to an emergency number. In the second case, received information depends on the used devices and the particular emergency. For example, if one of students has a PDA, she can receive an email with a map and all emergency points visualized.

In order to compare the performance of the students in these two different situations, we will select the arrival time to the hospital and the difficulties met along the route as dependent variables and metrics. At the end of the evaluation, we will analyze obtained results looking at these variables. The objective is to confirm the initial hypothesis: accessible notifications permit to reduce the arrival time to an emergency point in case of people with limited abilities.

6 Conclusion and Future Works

In this paper we presented an approach for managing accessible notifications through non-conventional interfaces for emergency management systems. We designed and developed an ontology (SEMA4A) made of three integrated parts in order to automatically adapt emergency notifications to users' abilities, kinds of devices they could use, and the type of emergency they are involved in. The information codified in the ontology could be used to adapt notifications to different devices accessible through different interaction paradigms, depending on the user's abilities. In the example shown in this paper we used information to adapt notification for a user with motor impairment, presenting a scenario in which the user receives an evacuation plan that could be accessed by a PDA and an eye tracker to compensate her disabilities. The use of non-conventional interfaces, like the eyes movements for navigating Google Street images and directions, is an emerging field raising interest among researchers and companies, like Microsoft that has, recently, released a library called Touchless[5] which allow users to interact with recognized object through a simple webcam.

Finally, we intend to extend the models and classes of non-conventional interfaces and paradigms in our ontology building relations with classes of users' abilities and emergency characteristics to automatically adapt notifications for a wider set of users and innovative devices.

[5] *http://www.codeplex.com/touchless*

Acknowledgments. This work is funded by the project UIA4SIGE (TSI2007-03394) supported by the Ministry of Education and by an agreement with the DGPCE of the Ministry of Interior.

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