Wireless Emergency Communications:
Accessible Alerts for People with Disabilities

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Introduction

It is estimated that 54 million United States residents have some type of disability[2] including: 28 million with severe hearing loss, 18.6 million with visual disabilities and approximately 25 million with physical disabilities that impinge on mobility such as walking one-quarter mile or climbing a flight of 10 stairs. Not included in this number are approximately 35 million Americans (12.4 % of the total population) who are over the age of 65 years[3] and represent a population that frequently faces many of the same limitations as people with disabilities. The incidence of aging into disability is expected to increase by 2030 when the over 65 population will double to 70 million or 20 % of the total U.S. population.[4]

The needs of these populations are a critical consideration when developing technology to facilitate emergency and public safety communications. Although few mainstream or non-assistive technologies are designed specifically to anticipate the needs of persons with disabilities, there is growing interest in better meeting the needs of all people during an emergency.[5]

In 2004, the American Red Cross responded to almost 70,000 disasters, large and small and "...no state or territory was left untouched."[6] Natural and man-made disasters are often unpredictable and therefore numerous advocacy groups in the United States are working to encourage the development of emergency information and communication technologies that serve both the general population and people with disabilities. Research on the needs of people with disabilities emerged from reports on the impact of Hurricane Katrina which devastated parts of New Orleans, Louisiana in 2005 and additional reports by disability advocacy groups.[7] There are strong

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[1] The Rehabilitation Engineering Research Center for Wireless Technologies is sponsored by the National Institute on Disability and Rehabilitation Research (NIDRR) of the U.S. Department of Education under grant number H133E060061. The opinions contained in this paper are those of the author and do not necessarily reflect those of the U.S. Department of Education or NIDRR.

[2] National Organization on Disability, 2007

[3] Census 2000.

[4] Day, J. (1996). Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050. Current Population Reports (P25-1130). U.S. Bureau of the Census.

[5] www.IAEM.COM/publications/intro.htm

[6] "America's Disasters 2004 – Meeting the Challenge." At http://www.redcross.org/pubs

[7] A 2007 report published by the University of Kansas Research and Training Center on Independent Living, *Assessing the Impact of Hurricane Katrina on Persons with Disabilities*, summarized the results of surveys, focus groups, and interviews conducted in six research sites on the Gulf Coast to document the major barriers faced by centers for independent living (CILs) and emergency managers in responding to the needs of people with disabilities during Katrina.

disability advocates in the United States that are concerned with the delivery of emergency communications.[8] These entities and others provide a formative base for continued research and development into technology solutions for accessible communications during emergency preparation, alerting and recovery. The Wireless RERC has collaborated with many government, industry and educational organizations to work toward a common goal of assuring that emergency information be delivered in methods that are accessible to persons who are blind or who have low vision, to those who are deaf or hard of hearing, and to those who are mobility impaired. Some of those involved in development activities are working toward assuring that the content in the emergency alerts and communications be understandable, available in accessible formats, and capable of receipt by persons with disabilities over different networks and devices, including mobile and wireless.[9]

In the United States, wireless information and communications technologies play an increasing role in education, employment, healthcare, and other aspects of independent living for people with and without disabilities.[10] With more than 60% of the U.S. population using wireless services, access to these services has become vital to full participation in society.[11] Recent environmental disasters further emphasize the importance of including these technologies in planning effective responses to these events. As more users rely on wireless devices as their primary source of communications, receiving alerts on their devices needs to be considered in any emergency communications scenario.

The Wireless RERC's Survey of User Needs of people with disabilities indicated they are significant users of wireless products and services.[12] In its survey of more than 1200 members of the Consumer Advisory Network from 2001-2007 that number increased from 72% to 85% who stated they used wireless products. Everyday use increased from 40% to 65% and 77% indicated that wireless devices were very important in their daily life.

TABLE 1

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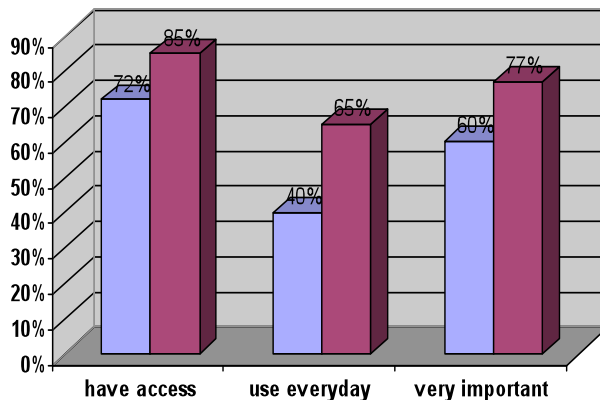
[8] See http://tap.gallaudet.edu/Emergency-Resources.htm and also the Gallaudet State of the science conference proceedings.
[9] Extensive research on this topic with consumers who have sensory disabilities is underway through the Access Alerts project funded by the U.S. Department of Commerce and conducted by the WGBH National Center for Accessible Media (NCAM).
[10] Mitchell, H., Jones, M, Peifer, J. *Proceedings of State of Technology Conference on Mobile Wireless Technologies for People with Disabilities*, 2006, Atlanta. GA. USA.
[11] Cellular Telephone and Internet Association statistics.
[12] Mueller, J., Jones, M., Broderick, L., Haberman, V. Assessment of user needs in wireless technologies. *Assistive Technology*. 2005; 17:57-71.

Video phones and video relay services are making it possible to have telephone conversations in sign language. Wireless technologies are also becoming part of the unique social and cultural fabric of the deaf community. Short Messaging Service (SMS) text messaging is a part of the new wave of alternative communication for people who are deaf and hard of hearing. Emergency broadcasts and 911 telephone services are being adapted to exploit new wireless data networks and mobile devices. The Federal Communications Commission (FCC) has mandated that all cell phone networks support Enhanced 911 (E911) so that a person calling 911 from their cell phone can be located. Carriers are using GPS (global positioning system) and triangulation to meet this mandate. The FCC, along with other Federal organizations, has made access to the Emergency Alert System (EAS) for persons with disabilities a priority. With increased use of wireless devices by people of all abilities, it is important to ensure these devices are accessible by all users especially in emergency situations.

Universal Access to Technologies

In August 2004, the Federal Communications Commission (FCC) released a Notice of Proposed Rulemaking (NPRM) to review the Emergency Alert System (EAS). The FCC recognized the importance of creating a sound emergency communications system and requested comments from the public on how this could be accomplished. Through multiple rulemakings and requests for comments, it is clear that the FCC was concerned with issues of accessible emergency communications. Several recommendations made by the Wireless RERC about the potential of digital wireless technologies to assist people with disabilities during an emergency appeared in the FCC's *1st Report and Order and Further Notice of Proposed Rulemaking*[13] which stated: "we amend the FCC rules to ensure that persons with disabilities have access to public warnings." The Wireless RERC comments[14] highlighted its concern for the accessibility of next generation, digitally-based alert and warning systems for people with disabilities. It recommended that all wireless device users would benefit from a multi-modal approach to providing accessible, timely, wireless emergency warnings and alerts and communication, especially people with disabilities. Along with continued filing of comments before the FCC, the Wireless RERC has been researching current and proposed approaches to transmit emergency alerts and warnings to wireless devices; examining interoperability issues; conducting evaluation of various technology solutions for transmitting accessible emergency alerts and warnings over wireless networks; and working with other stakeholders to test the robustness of any proposed systems.

Given the importance of effective communications in emergency situations, persons with disabilities have a right to receive alerts in the most user friendly, applicable and commonly used modality of the individual. An important approach to the development of inclusive emergency communications systems focuses on the design and implementation of appropriate user interfaces and a wide range of devices capable of receiving emergency communications. The Wireless RERC is developing and testing cost-effective devices on digital advanced communications platforms and wireless technologies capable of ensuring equal access to emergency warnings and alerts by people with disabilities. For example, there is the possibility the alerts could be transmitted by text

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[13] Federal Communications Commission. Amendment of Part 73, Subpart G, of the Commission's Rules Regarding the Emergency Alert System (FO Docket 91-301/FO Docket 91-171) First Report and Order and Further Notice of Proposed Rulemaking (2005).
[14] Wireless RERC Comments (2006) In the Matter of the Review of the Emergency Alert System (EB Docket 04-296).

messages, audio recordings, video or graphics, opening the possibility of sending out additional detailed information to specific sectors, like hospitals or emergency responders. Specifically, early research and development has focused on building wireless emergency communications software and testing of a compatible service for use by stakeholders in the emergency management and disability communities. While the Wireless RERC emergency communications team is building a prototype software, it is beginning to find there might be alternative software solutions which need to be explored. An example is exploration into alternative software options for receiving alert feeds via the Internet from entities such as the National Weather Service and the California Emergency Digital Information Service which uses a standardized XML format known as the Common Alerting Protocol. The Internet would allow another method of transmitting messages without the complexity of interfacing with television stations, and provide system redundancy in case the terrestrial broadcast stations are off the air. It would further permit sending emergency alerts in the most user-friendly, applicable and commonly used modality of the individual, thus allowing customized presentation of alerts based on user needs/preferences. Creating software and testing the service after diligent monitoring would provide a rapidly deployable solution where feeds on the Internet could be 'broadcast' via SMS. In late 2007 the Wireless RERC Emergency Communications project (WEC) refined its initial technical approach to this swifter more robust system.

TABLE 2
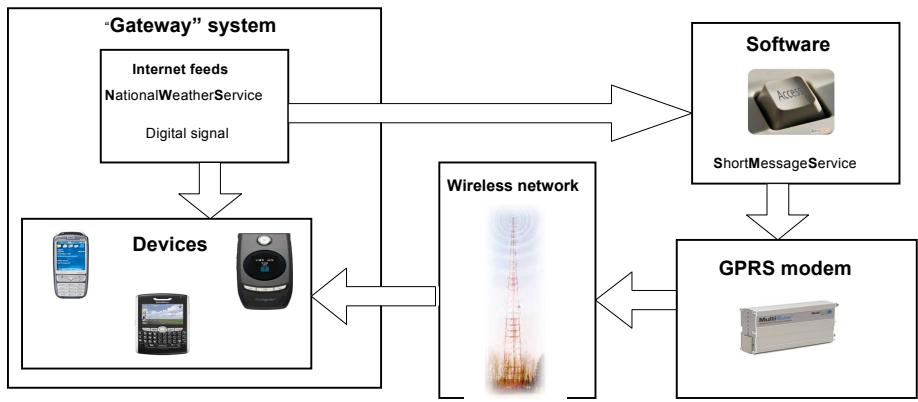
Two of four field tests have been conducted to examine the accessibility and effectiveness of alerts to wireless devices. Though only at the half-way mark for testing, and although both quantitative and qualitative data collected from the user experiences has not been completed, the initial findings have been promising. In both tests there were three classes of users: technical savvy, mixed ability and infrequent users. Field test one revealed that 94% of blind, low vision test participants found the WEC emergency alert software an improvement over how they currently receive emergency alerts. Field test two revealed that 81% of deaf, hard-of-hearing and blind, low-vision test participants found the software an improvement. The third test group at the National Technological Institute for the Deaf will represent persons who are deaf, hard-of-hearing and the fourth test will combine all user groups and refine the technical aspects of the technology to better reflect the test subject suggestions for improvement of an accessible alerting system. A full report on the field tests is expected to be completed in the winter of 2008 when all the results and user feedback is complete. A full report will also be submitted to the Federal Communications

Commission to assist their efforts in assuring that mobile wireless emergency communications and alerts are accessible to people with disabilities.

There are several other areas of exploration and development which might prove beneficial to people with disabilities receiving accessible alerts. One such area is cell broadcasting, FM sub-carrier, and other new emergency data technology developments which can offer short-term solutions for local emergency management alerts. New cell phone technology and services may provide additional warning capabilities through the delivery of messages via multimedia within the next several years. Additionally, third-generation wireless systems (3G) are evolving and also hold promise as a method to provide sufficient bandwidth to transmit multimedia content in real- or near real-time to mobile devices. The team is exploring embedded hyperlinks to a library of predefined emergency alert information provided in American Sign Language, or customized audio instructions for blind users.

While cell broadcast messages are currently used in Europe, they are only in the testing phase in the United States. However, cell broadcasting holds a great deal of promise in that it uses negligible bandwidth, so it won't overload the system in an emergency. Several hurdles stand in the way of implementing a cell broadcasting emergency alert system in the U.S. Major concerns come from two stakeholder groups--consumers and wireless service providers.[78] Consumers are fearful of receiving spam and concerned about the authenticity of the emergency communications. Service providers have a fear of losing revenue from SMS services, being liable in the case of a false alarm, and losing customers from poor experiences with emergency alert cell broadcasting. These large network operators have thus far resisted the implementation of cell broadcasting and have been successful in fending off regulation. Prior to deploying this technology, these concerns must be addressed. One goal would be to narrow the alert messaging capacity and create accessible messages to be received by devices commonly used by people with disabilities.

Conclusion

Next generation, low-cost wireless solutions have the potential to create a plethora of devices that are accessible, user friendly *and* have the capacity to provide emergency communications and services.[15] The benefits of increased accessibility, and in many cases universal design to emergency communications devices, will benefit both people with disabilities and those people without disabilities. The development activities of the Wireless RERC emergency communications team should lead to customized applications for presenting emergency alerts to people with disabilities from emergency management official sources; create prototype software/gateway to add-on to handheld devices that are affordable and capable of receiving alerts and emergency messages; provide universal design elements for use by wireless manufacturers, and designers of AT equipment on solutions for incorporating alerts into the development of new devices, and the development of technical recommendations on protocols and interoperability for appropriate stakeholders. The public has a right to expect that policy makers and the industry will work toward a common goal of providing emergency communications services and devices that are truly effective and can assist in the timely warning and alerting of all people in any emergency situation.

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[15] Proceedings of the State of Technology conference of the Wireless RERC May 2004, Development Strategies to Advance the Creation of Wireless Devices, page 187.