

The Chemical Companion: Evaluating Usability in a Mobile Emergency Response Environment

Benjamin Medlin and Valerie Lafond-Favieres

Georgia Tech Research Institute,
Logistics and Maintenance Applied Research Center,
Atlanta, Georgia, USA
{Ben.Medlin, Valerie.Lafond}@gtri.gatech.edu

Abstract. Evaluating software usability for a user environment that is mobile, high-stress, and hindered by factors including limited visibility and bulky protective clothing is a unique challenge. In addition, small form factor computers have very limited screen space for GUI presentation which presents additional design and usability issues. The paper discusses usability testing techniques for these types of scenarios along with the pros and cons of each technique and ideas for enhancement.

Keywords: Software, Usability, Evaluation, Testing

1 Introduction

The Chemical Companion is a mobile emergency response tool that provides first responders with decision support for hazardous environments that are contaminated with chemical agents. The software is deployed on small form factor computers such as a PDA, handheld PC, or Smartphone which allows the users anytime, mobile access to the software and related critical data. Development and usability testing for a system like the Chemical Companion presents several challenges because of the unique environment and user scenarios. The working environment is one of high stress for the user who is normally either on the scene or in route to a chemical-related incident. Furthermore, if the user is on the scene and mobile, he/she will typically be wearing a full ensemble of protective clothing and a breathing apparatus, all of which handicap their ability to use the system in a normal manner. This paper will present several approaches to evaluating usability in this type of environment based on actual experiences during development of the Chemical Companion. Along with brief commentary about each approach, the paper will present ideas for improvement based on our findings.

2 Approaches to Usability Evaluation

2.1 Simulate the User Environment

The technique of attempting to simulate the actual user environment is very important for software like the Chemical Companion. During the requirements gathering phase of the development cycle, being able to simulate user scenarios helps show the software designers exactly what limitations and factors must be addressed and illustrates why certain requirements exist. In the case of the Chemical Companion, the final design had to accommodate limited visibility due to the protective clothing and breathing apparatus that a firefighter or hazmat responder is usually wearing when on the scene of a chemical spill. The software developers and designers were able to experience the thick, heavy clothing and bulky face masks by suiting up and completing several standard emergency response training drills. Incorporating the small touch screen devices into the drills demonstrated the low visibility and limited input capability users would likely experience.



Fig. 1. Software developers for the Chemical Companion project go through simulated user scenarios.

The technique of simulating the environment along with evaluating the “Context of Use” [1] is one that the software team used multiple times during the development lifecycle. In the early requirements gathering and design stages, it helps to clarify the requirements and to also give the designers some ideas for how to handle the different requirements. Once an initial design has been developed, continued testing in the simulated environment helps provide valuable feedback and ideas for improvements.

2.2 Paper Prototypes

Initial development of the Chemical Companion involved building paper-based prototypes and wireframes which allowed the design team to get feedback on potential GUI layouts. The prototypes also let the users get a feel for how the menu system and navigation would operate. Because it was not possible to meet with the users on a frequent basis, wireframe images were placed online to solicit feedback via email and online surveys. The wireframes included a minimal amount of functionality to allow the users to navigate through the menu system and simulate interaction with the software.

2.3 Direct Observation

In most cases, direct observation of the user environment is the best approach to take to get a clear understanding of the user's tasks and behaviours. Observations of various users trying to navigate the software made it possible to determine where navigational bottlenecks might exist and where and how users experience difficulties. Early in the design phase of the Chemical Companion, it was evident that the GUI would require oversized buttons, contrasting imagery, and limited text-based input from the users.

2.4 User Interviews and Surveys

The Chemical Companion project utilized a series of user interviews and online surveys to gather usability feedback from BETA testers. This method of evaluating usability was not in-situ, but it allowed for the developers to get written and verbal feedback about the design. Using interviews and surveys also provided the opportunity to broaden the pool of BETA testers, since physical visits were not required. Although the type of data usually available through direct observation had to be sacrificed, this method allowed for the gathering of valuable feedback from users located in other parts of the country. The testers proved to be very candid about their likes and dislikes during interviews. Conducting follow-up surveys, usually administered via a website, allowed the development team to learn of possible enhancements and feature requests that users would like to see in future versions.

3 Future Enhancements to Usability Evaluation

The dangerous working environment of firefighters and other first responders makes it difficult for a software development team to gather meaningful usability data once a system has been deployed to the end users. Some ideas the software team discussed as potential future enhancements for the Chemical Companion application are intelligent background monitoring process, real-time feedback mechanisms, and video monitoring.

3.1 Intelligent Background Monitoring

A background monitoring process is an automated method of gathering a variety of different metrics in a discrete fashion and recording them for future retrieval. Similar to a screen recorder [2], this background process would run behind the scenes on the same user computer and not interfere with the normal operations of the software. It works by monitoring parameters such as the length of time it took the user to navigate the system, how many searches a user had to perform to find the desired result, and an audit trail of any errors encountered. The data could be recorded into a local database file and retrieved when a user performs software upgrades or connects their device to the Internet.

3.2 Real-time User Feedback

Another option is to try and build in mechanisms for real-time feedback that would not interfere with normal operations. Similar to a feedback link on a normal website, a feedback icon could be present on the screen at all times. If a user so desired, they could click the icon and submit a short sentence or two about issues they had or improvements they would like to see made. The feedback could be stored for future retrieval or it could be transmitted immediately for devices that had Internet connectivity [3].

3.3 Video Monitoring

As it is impractical (and likely dangerous) to have software developers on scene during an actual chemical emergency, being able to review any video footage of the users responding to an incident would be highly informative. Video could also be used in conjunction with interviews, allowing users to provide more detail regarding certain actions. While video could provide a rich source of data, obtaining the permission to record users could be difficult. Also, this method of testing would have to be designed in such a way as to mitigate possible behavior modification caused by the presence of the cameras.

4 Conclusions

Usability testing in a mobile emergency response environment presents numerous challenges because of the high-stress, highly constrained environment. Approaches taken to gather relevant usability data must not interfere with the potentially critical operations already taking place in these types of environments. This paper has discussed several approaches which allow for performing usability “in the wild” based on actual experiences during development of the Chemical Companion.

References

1. Maguire, M.: Context of Use with usability activities. *Int. J. Human-Computer Studies*. 55, 453-483 (2001)
2. Thompson, S. M.: Remote Observation Strategies for Usability Testing. *Information Technology and Libraries* 22, no. 1, p. 22. ALA (March 2003)
3. Hartson, H. R. et al.: Remote Evaluation: The Network as an Extension of the Usability Laboratory. In: *Conference Proceedings on Human Factors in Computing Systems, Vancouver, British Columbia (1996)*,
http://acm.org/sigchi/chi96/proceedings/papers/Hartson/hrh_txt.htm