

Migrating, Tagalong Displays in the Emergency Management Context

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Abstract

Observations of Emergency Operations Centers suggest that migratory displays that tag along with moving workers may fit the task demands better than static workstations. An example of RFID-based migratory displays is described.

Keywords

Displays, Emergency Management, Migratory

ACM Classification Keywords

H5.m. Information interfaces and presentation

Introduction

In the past several years, the need for Emergency Management tools that work more effectively, efficiently and flexibly has become a stark realization. In a wide range of domains, ranging from natural catastrophic disasters to network intrusion to bioterror incidents, there are urgent requirements for systems that help detect emergency situations early, analyze options, plan reactions and manage their recovery. While the application of powerful new technologies can improve these systems to some degree [6], they ultimately require the careful inferential capabilities, judgment and decision-making of humans. Hence, user interface and interaction design is a key factor in their success.

Designing the user interface of Emergency Management tools requires consideration of very different issues than those associated with more typical business and consumer applications [4]. The Emergency Management environment, including its users, tasks and contexts, is highly diverse and includes events that are, in one way or another, all uncertain, stressful and extreme. To permit humans to be productive in this environment requires careful and knowledgeable design based on real user needs.

Dynamics of the Emergency Operations Center

When a terrorism incident occurs or is likely, a group of responders called incident managers are responsible for making decisions about what strategies and tactical actions to take to respond to the crisis and begin recovery. Typically, this takes place within an Emergency Operations Center (EOC) that can house, depending on the size of the incident and municipality, between two and thirty responders, and will have equipment ranging widely in sophistication. The incident managers are each given specific "roles" whose

responsibilities are predefined in the National Incident Management System (NIMS) specifications and each role is recognizable by a distinguishing identification vest, which is always worn when in the EOC. NIMS, [2] for example, specifies an Incident Commander, a Logistics Manager, a Public-relations Manager, etc. Depending on the size of the EOC, each manager may also have a staff assigned to do aspects of the role's work function.

Despite wide differences in needs, size and technologies, the traditional layout of most EOC's is quite constant. In particular, EOC's are invariably laid out in static sets of workstations where each workstation is assigned to a particular worker. These workstations provide tools that are specific to the role/workers' needs, such as an Incident command system, messaging and notification, GIS tools, epidemiological tools, etc.. Another common aspect of most EOC's is a public display or displays that are meant to present information that is required by all work roles, e.g. situational awareness and shared or interdependent functions.

We have observed an EOC in the process of responding to a bioterror-related emergency exercise (TOPOFF-3) . Based on those observations, our analysis suggests that the traditional layout of specialized, static workstations and public, shared information displays may not be the most effective work layout for all functions. Some form of ubiquitous, migrating displays might provide a more efficient use of resources [3, 5].

First, our observations suggest that many workers spend a significant amount of time moving around within the EOC, rather than remaining at their own workstations. There are several reasons for this. In many cases, workers' role requires that they communicate with other workers in the EOC. While some EOCs may have electronic messaging systems that can reduce the need for this movement, it can

sometimes be more efficient to walk over and communicate directly because workers are often in close proximity. Moreover, workstation displays are often already potentially cluttered with a large amount of incident; cluttering more with messages poses design issues.

Another, key reason for the movement is associated with the special role of the Incident Commander (IC). Incident Commanders tend to “roam” widely throughout the EOC, often followed by several other workers who are attempting to communicate with him/her. From a management perspective, it is critical for the IC to be visible to the staff and also provide continual guidance and leadership. One experienced IC said “One of the reasons I walked around was I needed to see what was going on in different areas, approximately 30 different disciplines... hence the roaming. Gave a lot of direction and asked lots of questions. Consequently, people following me around with updates.”

Second, our observations suggest that the public display of information may often be inefficient- specifically, a good deal of the information displayed in public, shared displays may actually only relevant to a subset of the workers. This observation derives from a questionnaire administered to the participants in one EOC during the TOPOFF3 exercise. During that exercise, a list was compiled of all the information made available on public displays- which in the case of this EOC generally consisted of paper posters on the EOC walls that were updated manually at regular intervals. This information included, e.g. # deceased victims, # resource requests made to federal or state authorities, etc. Participants were asked to rate the value of each of data for their own EOC roles. The results suggest that, out of 27 types of information displayed to 9 different roles, no one piece of information was rated as “critical” for all job roles, and

that only a small subset of six information types displayed was rated higher than “absolutely unimportant” by nearly everyone. Almost all of the information types displayed were considered either “critical” or “very important”, but each type only by one or two of the roles. This suggests that most of the information displayed had a specialized audience, and only a small portion was of general interest.

EVEST Prototype

The dynamic nature of the EOC, together with the specialized nature of much of its information suggests that migratory displays may be highly effective in this environment. To explore design options, we are implementing the EVEST (Electronic Vest) system. EVEST has two key goals. First is to display all the information needed without requiring personnel to return to their static workstation to see it. That is, the goal is to support the natural mobility observed in the EOC environment rather than impose a static layout. The second goal is to avoid cluttering the display of personnel with information that is needed by others but not by them. EVEST is implemented by inserting an active RFID tag into the identification vest of key EOC participants. The objective is to orient and personalize the information systems that support the participant’s decision making as they roam around the EOC by monitoring both their presence and whereabouts.

When the IC, for example, enters the EOC, the EVEST system detects his/her presence and:

- Updates the public presence display and makes an audio announcement to show the IC’s presence
- Prepares the role-specialized display screen and computing environment for the IC.
- Manages three (or more) dynamic displays such that as the IC moves about the EOC, his proximity to each is detected and his role-specialized

environment is shown on the display that is most visible to him.

The EVEST architecture consists of components that (i) collect RFID signals from personnel and determine proximity to displays, (ii) determine the privilege of personnel detected (iii) decide information display policies, (iv) maintain profiles about roles and their privileges and (v) interface to the ICS.

Open Research Topics

EVEST is currently in initial prototype form and is being used to explore a variety of issues:

- **Content:** One issue concerns whether the dynamic displays ought to change in their entirety toward the needs of the closest personnel, or whether just a portion of the screen should be specialized.
- **Multiple people:** A critical issue is to decide how best to handle the display needs of multiple people, all roaming simultaneously. There are several alternatives ranging from the display of multiple different areas on the screen, to the development of a priority algorithm that can decide which of several possible specialized displays is shown.
- **Persons vs Roles:** Still another issue concerns whether EVEST should identify personnel only by their roles or whether it is useful to go further and modify displays based on, e.g. level of experience and personal preferences.

Acknowledgements

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- **Display vs interactive System:** It is not currently clear whether the EVEST system is best applied only to the presentation of status information or whether it would be useful to use it to provide personnel with a complete, interactive system. Part of this decision depends on whether the scheme is reliable enough to handle authorization and login procedures.
- **Inside/outside the EOC:** The initial EVEST concept was developed as a way of directing information to personnel only when they are inside the EOC. However, with wider-range RFID technology, it might also be possible to direct information when personnel are in surrounding areas. For example, information could be sent to the IC via a hand-held device when giving press conferences outside the EOC.
- **Evaluation measurement:** A final key issue concerns how best to evaluate the effectiveness and usability of EVEST. Abowd and Mynat [1] have discussed the difficulties in evaluating the usability of ubiquitous systems and have stressed the importance of authentic settings. Testing usability during actual emergency incidents is unlikely to be possible- especially of a system like EVEST which deviates significantly from traditional practices, but it might be possible to do so during practice exercises.

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