Handheld Computer Application for Medical Disaster Management

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ABSTRACT

We developed a prototype system that can provide reliable communications in the event of a medical disaster. The system uses redundant wireless protocols on handheld computers to deploy medical personnel, and to facilitate communication between ancillary treatment sites and a command center.

BACKGROUND

A terrorist attack on downtown Washington, DC, or other urban center, may result in hundreds of people needing medical assistance. Hospital emergency departments would be quickly overwhelmed by the influx of patients and medical personnel converging on their facilities. Another approach is to utilize ancillary medical personnel in other departments and from ambulatory facilities [1]. A major challenge with this approach is to maintain communications and manage clinical information [2,3].

The terrorist attack on 9-11 resulted in sporadic communications. Telephone lines, cellular phones, radios, and pagers periodically went down because of circuit overload and military blackout. Similar outages are expected if another disaster occurs. To address this issue, and increase the reliability of communications during a crisis, we developed a system that simultaneously uses several communication alternatives, all of which can be deployed on handheld computers.

TOOL DESCRIPTION

We developed a prototype handheld system on the Pocket PC 2003 platform using 802.11, Bluetooth, and GSM protocols. The handheld software was developed with Microsoft Embedded Visual C++. The network server was developed under Windows XP with Microsoft Visual C++.

In the event of a medical disaster, the system can alert and deploy medical personnel to ancillary treatment sites according to a predefined disaster protocol. The system can manage information related to a patient's clinical status and suspicion of exposure to biological, chemical, or hazardous agents. It also allows personnel to send clinical data and messages from ancillary sites to a central command center.

The system has several features, which were optimized for handheld computers [4]. We limit the need for free-form data entry by restricting input to the selection of text from previously-defined lists. To save screen space, we use objects that combined navigation and context, which reduces the need for separate navigation objects such as scroll bars, buttons, and menus.

We use optimistic fragmentation to share data over weakly connected wireless networks [5]. Shadow processes on a fixed server are used to monitor locks. Each lock has an expiration time. The system optimistically assumes the database is consistent unless there is an expired lock that a client failed to release. Inconsistencies are resolved through a quorum algorithm.

The server was implemented with a multi-thread architecture. It supports multiple connections through different TCP/IP protocols to the same handheld computer. The server also tracks performance, to ensure the fastest and most reliable protocol is used when communicating with each client.

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