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# The Use of Mobile Units In a Pandemic or Disaster Situations

Teresa Davis McGinley  
tdmginl@calumet.purdue.edu

Barbara Nicolai  
bnicolai@calumet.purdue.edu

Technology  
Purdue University Calumet  
Hammond, Indiana 46323, USA

## Abstract

In the past decade, the world has seen large and deadly natural disasters, such as hurricanes, tsunamis, and earthquakes. These disasters, as well as recent pandemics, all have several unavoidable results in common. Disasters cause huge loss of life, enormous amounts of property damage, and long recovery times. A pandemic may have a need to vaccinate many people as well as bring the need to provide vital resources to an area under quarantine. A response tool needed by emergency response personnel has needs to handle mobile units in a data communication system. This paper explores how mobile units are used in disaster and pandemic situations and how this knowledge can be implemented into an existing data communication model.

**Keywords:** disaster management system, database tracking system, communication system, mobile unit, pandemic tracking system

## 1. INTRODUCTION

"In August 2005, Hurricane Katrina devastated the coasts of Louisiana, Mississippi, and Alabama, causing more than 1800 fatalities, and leaving more than 60,000 people homeless" (Nicolai, Puntillo, Bilow, 2009). Mismanagement and lack of leadership was a major problem in handling the response efforts. In order to understand and plan for future responses to disasters, research has been conducted to help identify and understand different pieces of disaster management. As we learn about the different pieces of disaster management, they can be combined into an information technology solution that can be used anywhere from a local agency to a national or federal agency.

Mobile units can be critical tools when responding to a disaster or pandemic situation. Mobile units can be used to provide: medical, mortuary and laundry services in addition they can

provide a kitchen to prepare meals. This paper will look deeper into how mobile units have been used during disasters. Followed by a discussion on how they can be managed using a disaster management information solution.

## 2. BACKGROUND

Merriam-Webster defines mobile as "the capability of moving or being moved" therefore a mobile unit is a vehicle or other structure that can be moved. During a disaster or pandemic situation, to be mobile is critical in helping the people that are affected. After the January 2010 earthquake that hit Haiti, mobile was the only way to get medical care to the injured due to the mass destruction. Mobile hospitals were setup by many volunteer agencies to help as the infrastructure was severely damaged. After Hurricane Katrina, mobile hospitals were necessary to treat the wounded in areas that had severe damage. During a pandemic situa-

tion, mobile vaccine clinics are used to vaccinate mass quantities of people in the most convenient fashion.

A mobile medical unit can consist of a back-pack that is carried by medics to a tent that is setup in a field to a semi-truck that can be positioned where it is most needed. Mobile medical units have been dispatched after a disaster has struck, during times of war and during a pandemic in order to isolate the infected.

Staffing a mobile unit can vary greatly. A mobile unit can consist of one person to hundreds. One or two people may only be needed when going to remote areas with a back-pack. Many people such as nurses, doctors, paramedics and other support personnel are needed to staff a tent hospital.

Dispatching a mobile unit can take as little as a couple of hours to many days. As an example of dispatching a tent hospital, an Israeli field hospital was deployed after the Earthquake in Haiti in January 2010. The first patient was seen within 89 hours of the earthquake.

Other forms of mobile units can consist of water purification, mortuary services, laundry facilities, kitchens, laboratories and mobile emergency response support. The following paragraphs give examples of these types of services and how they have been used.

Clean drinking water is a basic necessity anytime but it becomes especially crucial during a disaster. Disasters bring with them much destruction including power interruptions. Without adequate power, water cannot be disinfected and distributed as it would normally happen. An Emergency Plant System (EPS) by Portaquea is designed to be set up in about two hours and provide drinking water to 3,000 to 12,000 people a day (Bogle & Younos, 2008). This system can be transported by truck, helicopter or airplane.

In an effort to handle the deceased from a disaster, a mobile mortuary can be deployed. The United States Department of Health and Human Services (HHS) has established Disaster Mortuary Operational Response Teams (DMORTs) to assist local organizations during a disaster. The primary functions of the DMORT are to assist in victim identification and mortuary services and are staffed with temporary federal employees.

A mobile kitchen can become a critical resource especially after a disaster strikes. The

American Red Cross operates five mobile kitchens that can be deployed during times of crisis. The kitchen, which is a 53-foot trailer, can prepare 12,000 to 15,000 meals a day (Hunter, 2009). The trailer is self contained with a generator, ovens, steam kettle, water heater, sinks, refrigerator and a walk-in freezer. A minimum of 6 people are needed to operate the kitchen. Food is brought from the kitchen to shelters or neighborhoods that are in need.

A mobile laundry facility can be used in a disaster area to help residents and cleanup crews do laundry. During a flooding disaster, clothing must be laundered to become usable again. After Hurricane Katrina, **Tide Loads of Hope** provided a free mobile laundry to residents. They "washed more than 35,000 loads of laundry for more than 20,000 families" (Ninecooks, 2009).

Federal Emergency Management Agency (FEMA) is part of the U.S. Department of Homeland Security. "FEMA's mission is to support our citizens and first responders to ensure that as a nation we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards." One of the aspects of first responders is for it to be mobile. FEMA has a "Mobile Emergency Response Support" (MERS) that provides power, heating, ventilation, and cooling, for a large office building, also diesel fuel, and water to a disaster area. In addition there is an Emergency Operations Vehicle (EOV) that can provide office workspace for 20-25 people. It has self-contained generators, provides local and wide area networks, video conferencing, computers, radios and telephone. The EOV is critical in organizing the disaster response in an area hit by disaster.

During the avian flu (H5N1) in Thailand, a study was conducted to see if a mobile laboratory could be an efficient method for diagnosis. In the case of avian flu, it was important to diagnose the strain of virus in order to prevent further infection. It was determined that a mobile laboratory could be used to successfully diagnose the strain in 6-8 hours instead of the 3-4 days it took in an in-house laboratory (Leuprasert, et al., 2008).

### 3. PROPOSED INFORMATION TECHNOLOGY SOLUTION

This paper discusses different kinds of mobile units that can be used in a disaster or pandemic situation. Mobile units can be integrated into the proposed Disaster Communication System by Nicolai, Bilow, and Puntillo. The model that they proposed is flexible, scalable and modular allowing for the addition of mobile unit management. The model they described is also dual purpose allowing it to handle day-to-day activities of a township agency or be expanded to accommodate a disaster. As an example of a day-to-day activity in a Township agency, a client may request transportation to the hospital for medical testing. While in disaster mode, a mobile unit may be dispatched to provide food and water to a flooded neighborhood.

#### **4. RELATIONAL DATABASE SYSTEM MODEL**

Figure 1 in the appendix, the Data Flow Diagram, explains how a client requests emergency services during a disaster. A client places a call to the call center and requests services. For example, the client needs food, water and shelter due to a flood. The call center gathers the appropriate client information including their current location. Note: the location will be stored using longitude and latitude so that it can utilize a Geographic information system (GIS). An encounter record is generated and associated with the particular disaster that the client is associated with. Once the services are approved the mobile unit is dispatched to the appropriate location to provide the necessary services. The mobile unit will also be equipped with a GPS device so that the GIS will be able to determine which mobile unit is closest to the dispatch based on location.

Figure 2, the Enhanced Entity Relationship Diagram describes the relationships between the agency, clients, encounters and service providers during both regular business functions as well as disasters. A client may request services through the agency or the call center. Once the client contacts the call center, an encounter is created for the services that are being requested during that call only. A client may have one or many encounters for a disaster or regular business function. An encounter is related to either a disaster or a case. A mobile unit is dispatched from the call center only and is tied to the encounter.

Figure 2 also shows the relationship between the person who can be a client and an employee. If the person is an employee, they can be assigned to a mobile unit, call center and an

agency. An employee can be used in one or more of the areas.

A mobile unit may also provide services to such as vaccine distribution to a group of people. In this case, a mobile unit is dispatched to a location and the client information is gathered on the mobile unit itself. Tracking the client and the vaccine information is key in case there is a vaccine recall or problem.

#### **5. TECHNICAL DESIGN**

The proposed design consists of both a software and hardware solution. The software will consist of a web user interface build on the ASP.NET framework with a SQL Server database. The use of ASP.NET and SQL Server provide a low cost and robust solution. For the prototype, the freeware versions will be utilized so that the expense will be minimal if any to setup and test.

A web user interface allows for real time information gathering and retrieval. A database and software solution that responds quickly to requests is critical for providing immediate decision making for both day-to-day activity as well as during a disaster. The proposed solution is also modular so that if a portion like the agency is not required, the solution will still function without it.

A wireless network is proposed along with wireless handheld devices and/or laptops. A handheld device may be easier to work with during a disaster. Either way, the devices can be transported between the agency and disaster areas so they can have dual purpose. The data is collected on the handheld device or laptop and stored in the SQL Server database transmitted through the wireless network. The database is located on a server with backup support that is built on the Linux open-source platform. Linux can be implemented on the server, handheld device and laptop making it easy to communicate.

#### **6. CONCLUSION**

A mobile unit is a critical tool that can be used in disaster and pandemic situations. The mobile unit can be defined as anything that is portable or can be moved. Mobile medical units have been established from tractor-trailers as well as tent camps. These units can take the place of a fully functional hospital to a vaccine distribution center. The U.S. Navy

even has a mobile hospital in the form of a ship. This ship can go to where the need is for medical services. Other kinds of mobile units are important as well, including mobile water systems to provide clean water to victims of disasters. Kitchens that can provide meals to people in shelters or neighborhoods that have no power or clean water. Even mobile laundry services can help flooded communities recover quicker. Mobile generators can provide electricity to an office building that could also be converted into a makeshift shelter. All these services have been used during one kind of disaster or another. Understanding what a mobile unit can consist of and how it can be used can make an automated system more robust. An organization that is planning for a disaster needs to be able to consider all the options that are available and when they may need to be called upon. As we continue to learn from disasters, mobile units continue to evolve making them more efficient and effective.

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## Appendix A

Figure 1

Data Flow Diagram Levels 1 & 2

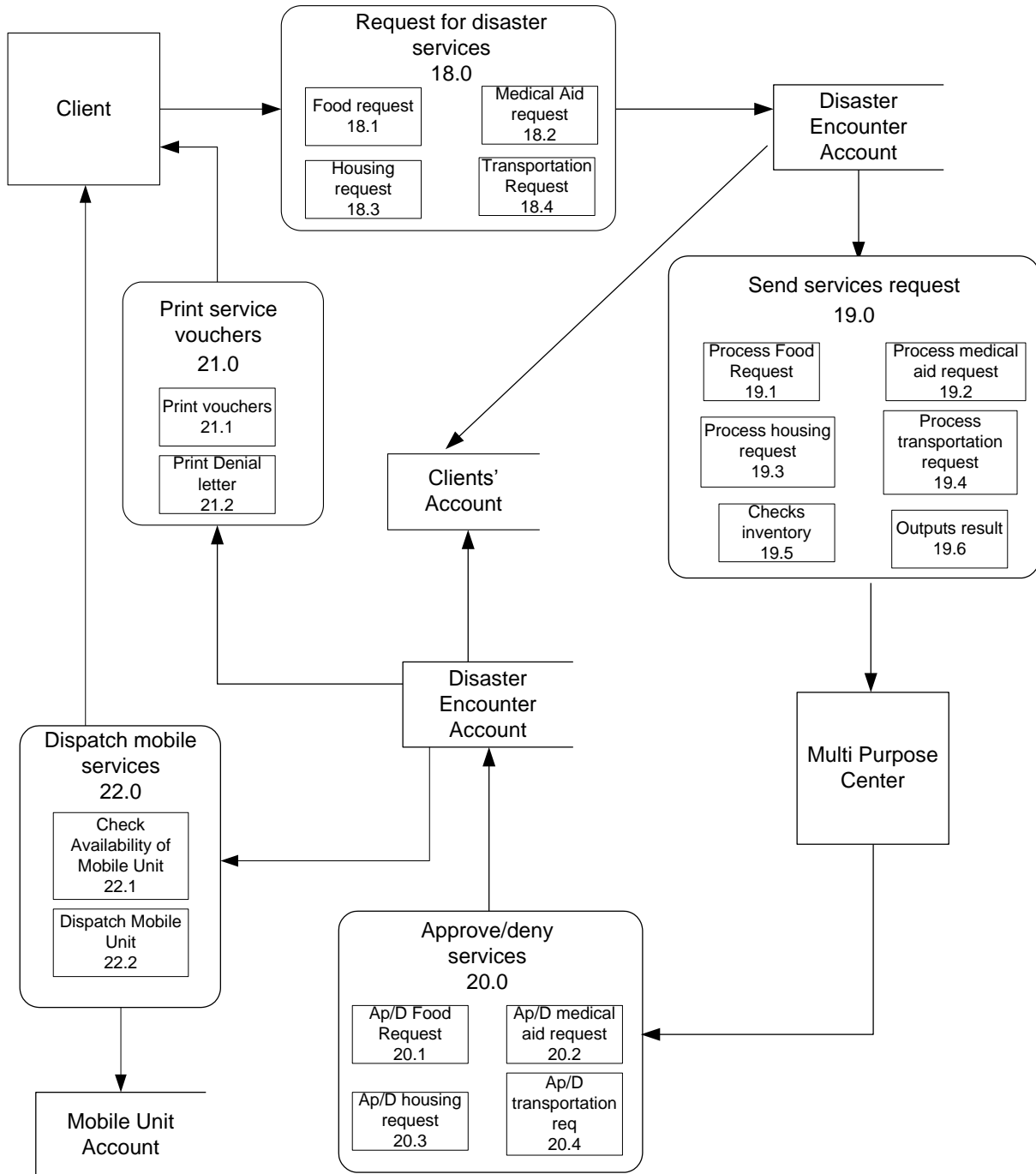


Figure2

