What is missing from the Current Disaster Model?

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Abstract

The initial concept of a disaster management database solution was sparked in the fall of 2005 with the worst natural disaster of the decade to hit southern Louisiana. The lack of response and preparation for such a disaster left hundreds of thousands of people homeless, hungry and without support for weeks. This aftermath of this disaster resulted in even more deaths that could have easily been avoided if there had been a plan of action in place to handle such a situation (Research Design for a Natural Disaster). After 3 years of development, a prototype was produced. This prototype had the capability to identify missing and displaced people, identify bodies, document and distribute resources, provide transportation, medical, food, housing, and other services to disaster victims. All of these features and more were included in this portable online system to track and report on a disaster. Such items such as the number of missing people, locations of available resources, and the worst locations of a disaster could be easily identified with the use of this system. Further, the central location of this system would fall in the local township, which in any situation is the first to respond to any situation.

Keywords: Geographical Information System, disaster management system, database tracking system, communication system, mobile unit, pandemic tracking system, indigent population

1. INTRODUCTION

After more discussion between key developers of this project and in class development, a new module was modeled to handle a pandemic situation. This portion of the project was created when the initial scare of pandemic flu in the US was first identified. Research was done to see how the US and other governments have responded to past pandemics so that an overall picture could be developed to create this new pandemic module. Some items considered were vaccinations both available and distributed, vaccination types, risk factors, mobile distribution, warehousing, and triage. With all of these new components and a preexisting disaster management system, a pandemic module of this magnitude was the obvious next step in development.
Presently more disasters have occurred worldwide such as the massive earthquake, which has struck Haiti. According to Telegraph, This earthquake resulted in over 200,000 dead, more than 300,000 injured, and 250,000 homes destroyed (Telegraph, 2010). New criticisms of this disaster sound strikingly familiar to those of the Katrina disaster in 2005. New research from this disaster may introduce new components to the Disaster Management System that may have been previously neglected.

According to Brown, "Until fairly recently, disaster responders relied on their senses and common sense to identify problems. The notion of measuring what you could see was viewed as an academic response to things such as earthquakes, hurricanes, and tsunamis" (Brown, 2010). This is how the disaster was handled in the first few weeks until recently when a survey was conducted. This survey provided more insight as to what further actions to take to provide aid to the Haitian people.

It is time to get back to the roots of this project and focus on the people in these situations whether it is a disaster or a pandemic. The ultimate goal of this is to help people and the sooner we take action and develop a system the quicker it can be utilized to assist in catastrophic situations to bring order and peace. All of the disasters and pandemic situations since the conception of this system have shown a need for a structured system which can be used to provide assistance to those in need. This will lead to shortened disaster recovery times, pandemic tracking and management, and reportable data that can be used as a bench marker to provide aide in future disasters.

2. BACKGROUND

Preparation is vital to the success of mitigating the human losses after a natural, terrorist, or accidental disaster. One method that can be used to support a disaster or pandemic is a Geographical Information System or GIS. A GIS graphically depicts the path of a virus or disease, the destruction path of a hurricane, or the areas most devastated by a nuclear explosion. These models can be scaled up to be a nationwide chart of affected areas or be as small as a few miles wide.

"Preparing for a pandemic or any national disaster requires the utilization of medical information since the populations bring into those disasters their medical conditions and the results of chemical, biological, radiological, and nuclear explosives are disease, disability, and or death. The IT requirements to support biosurveillance involve integration of agency data, integration of voice, images, geographic locators, and legal and clinical records. What Hurricane Katrina demonstrated in the US was that at a minimum the data required to make clinical decisions for continuity of care in evacuees with chronic health conditions needed to include allergies, current diagnosis, medication profiles, and laboratory results. With the movement of evacuees to different states in the country, additional IT resources required were intake registries, scheduling and stalling, tracking of computerized physician order entries, GIS systems, and the visual movement of evacuees." (McCormick, 2008)

A GIS module can be used to depict the spread of a virus over a state, country, or continent. According to Managing Travel, when the SARS pandemic of 2003 broke out, airports were screening passengers to decrease exportation of the disease spread in the US (Managing Travel, 2009). If a GIS module had been in place, more screening or flight restrictions could have been implemented depending on the levels of infection in specific areas. The way people travel is a key way to spread disease, but proper planning for a pandemic can slow or stop it. Knowing the most afflicted areas of a pandemic can help to plan and predict its spread.

3. CURRENT RESEARCH

Predictions based on data can be used to depict other items besides pandemics. According to Carrara, "A landslide hazard map obtained by systematic data manipulation within a GIS is assumed to be more objective than a comparable hand-made product derived from the same input data and founded on the same conceptual model. Geographical data can now be handled in a GIS environment by users who are not experts in either GIS or natural hazard process fields"(Carrara, 2000). What makes this so attractive is that to use a system such as this, very little training is needed for data entry. Data models like the ones that are used to predict landslides are the same ones that can be used to predict floods like the one in Munster, Indiana in 2008. A flood map such as the one below is used to predict flooding along the Mississippi River. See figure 1 in the Appendix for a sample GIS model.

Another example of GIS being implemented with community knowledge is taking place in Viet Nam. Understanding previous behavior and primary locations a flood can occur, decisions can be made to aid in the prevention of flooding.

"Linking community knowledge with modern techniques to record and analyze risk related data is one way of engaging and mobilizing community capacity. Realizing the important roles of local community in hazard identification and assessment, Development Workshop carried out a participatory Geographic Information System hazard-mapping project in Viet Nam. The purpose was to prepare detail flood risk maps for commune planners, villagers and other stakeholders, to identify the magnitude and extent of past flood disasters, and to make recommendations for local authorities and decision makers regarding flood risk reduction activities based on local knowledge and needs. The use of GIS at local levels; the need for combining modern technology and indigenous knowledge into disaster management can aid in disasters; and suggest a way to mobilize available human and technical resources in order to strengthen a good partnership between local communities and local and national institutions. Correlating hazard risk and loss/damage caused by disasters and the contribution that domestic risk maps in the community can make to reduce this risk. The disadvantages, advantages, and lessons learned from the GIS flood risk-mapping project are presented through a case study of Quang Tho Commune in Thua Thien Hue province, Central Viet Nam" (Tran, P., Shaw, R., Chantry, G., & Norton, J., 2009).

Knowing the outcomes of disaster, pandemic, or an act of terrorism is impossible. However, previous experiences and data can help make some educated hypothesis. According to Holt, "Having information about preexisting chronic diseases and available public health assets is critical to ensuring an adequate public health response to natural disasters and acts of terrorism"(Holt, 2008) Using a combination of data from the Behavioral Risk Factor Surveillance System and geographic information systems (GIS) technology prediction information is derived. An example of using previous experiences and GIS focuses on counties in states that are within 100 miles of the Gulf of Mexico and the Atlantic Ocean coastlines.

To illustrate the flexible nature of planning made possible through the interactive use of a GIS, a hypothetical scenario of a hurricane making landfall in Myrtle Beach, South Carolina" (Holt, 2008). Since Hurricane Katrina, much research has been conducted to study the potential for future natural disasters. Not even one year later Louisiana has several coordinated systems in place to manage disasters and mitigate the aftereffects of one.

"The LSU Hurricane Public Health Center, Louisiana Geological Survey and LSU Coastal Studies Institute had consolidated over sixty layers of GIS data and imagery of New Orleans when Hurricane Katrina struck in 2005. This GIS framework had been incorporated into a web-based GIS portal utilizing ESRI ArcIMS. The intent of the data layers was to support cross-disciplinary research on hurricane public health vulnerability in New Orleans, and to be made available to emergency managers and requesting agencies via a password-protected webpage. This New Orleans GIS portal with associated data layers organized in ESRI ArcGIS was transformed into a mapping support tool for search and rescue missions in the weeks following Hurricane Katrina. Mapping of 911 calls, hospital evacuation, and military and Red Cross coordination were among the types of mapping support provided to every level of agency and organization. This paper will demonstrate some examples of how geospatial technologies enhanced public health and disaster management following Hurricane Katrina" (Peele, R., Binselam, S., Streva, K., Heerden, V., Snead, J., Braud, D., 2006).

There are many aspects to disasters and pandemics that have been discussed, however there are some effects that cannot be measured or calculated in preparation for or response to situations like this. The psychological effect a disaster has and the loss of everything takes a huge toll on a person even if they are not physically injured. According to Somasundaram, "Disaster-stricken communities often experience disruption of family and community life, work, normal networks, institutions, and structures. Loss of motivation, dependence on relief, hostility, and despair can sometimes develop in members of the community exposed to disasters. As much as we work to provide emergency relief and look after survivors' basic needs, their right of access to health care has to be recognized, including care for mental health as well as physical health. Mental health problems will cause difficulties in normal functioning, working capacity, relationships, and family life. A major challenge for humanitarian agencies is to understand that the mental health consequences of emergencies can cause a level of distress that may hamper recovery as well as rehabilitation and to incorporate culturally appropriate psychosocial assistance programs in relief efforts, in cases of both war and natural disasters" (Somasundaram, 2008). It is difficult to provide relief to those who feel they have no hope when all is lost, however, with time and community support people can eventually return to their normal lives.

The next disaster or pandemic may strike at any time and we need to have pull out all of the stops and have a plan in place. "Technology innovations in biotechnology discovery, drugs, and vaccines may be able to lower the impact. However, responding will demand the use of new technologies, international collaboration, and cooperation of the entire world community. The multiple groups of biosurveillance include the family, neighborhood, local community, large cities, states, countries, continents, and the global community, which will be affected. The toolkits needed include advanced virus and disease detection, enhanced surveillance and alert systems, decision support tools for emergency responders and clinicians, GIS mapping, automated planning, and scheduling of essential personnel, broad communication links, and outreach" (McCormick, 2008). If we can constantly adapt changing technologies to aid in disasters and pandemics more people can benefit from more immediate relief and preventative actions.

4. DATA WAREHOUSE MODEL

The results of the research so far have led to the creation of a data-warehousing model, which can be used for reporting and applying the GIS module. A portion of this data model can be viewed in Appendix figure 2. This explains how the geographical regions can be mapped out during a pandemic or disaster efficiently and what services/products are provided.

5. CONCLUSION

Where does the world stand when it comes to disaster and pandemic response? Several disaster stricken areas have taken huge steps to be more prepared by looking at what went wrong. Places such as Louisiana, South Carolina, and Viet Nam have developed systems to monitor and measure possible outcomes for a disaster with the use of community information and GIS. Several governments worldwide have plans in place to lessen the spread of pandemic disease and infection using the same methodologies used in a disaster and enhanced communication. What is missing is one solid all-encompassing system to house all of this information to expedite decision-making and response with GIS tools and pandemic tracking. The system we have developed thus far can collect data and provide trend information; however, its scope needs to be broadened to encompass GIS technology to display this data.

6. NEXT STEPS

Further development needs to be done on the GIS module to support/implement the coordinate based data that will be provided by the warehouse. More data is needed to test this system and more aspects of products and services can be explored to broaden the systems usage. More use cases are needed to better slice the data in the data warehouse and tell a bigger story about a disaster or pandemic both during and after so that areas can be better prepared to handle their aftermath.

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Appendix

Figure 1

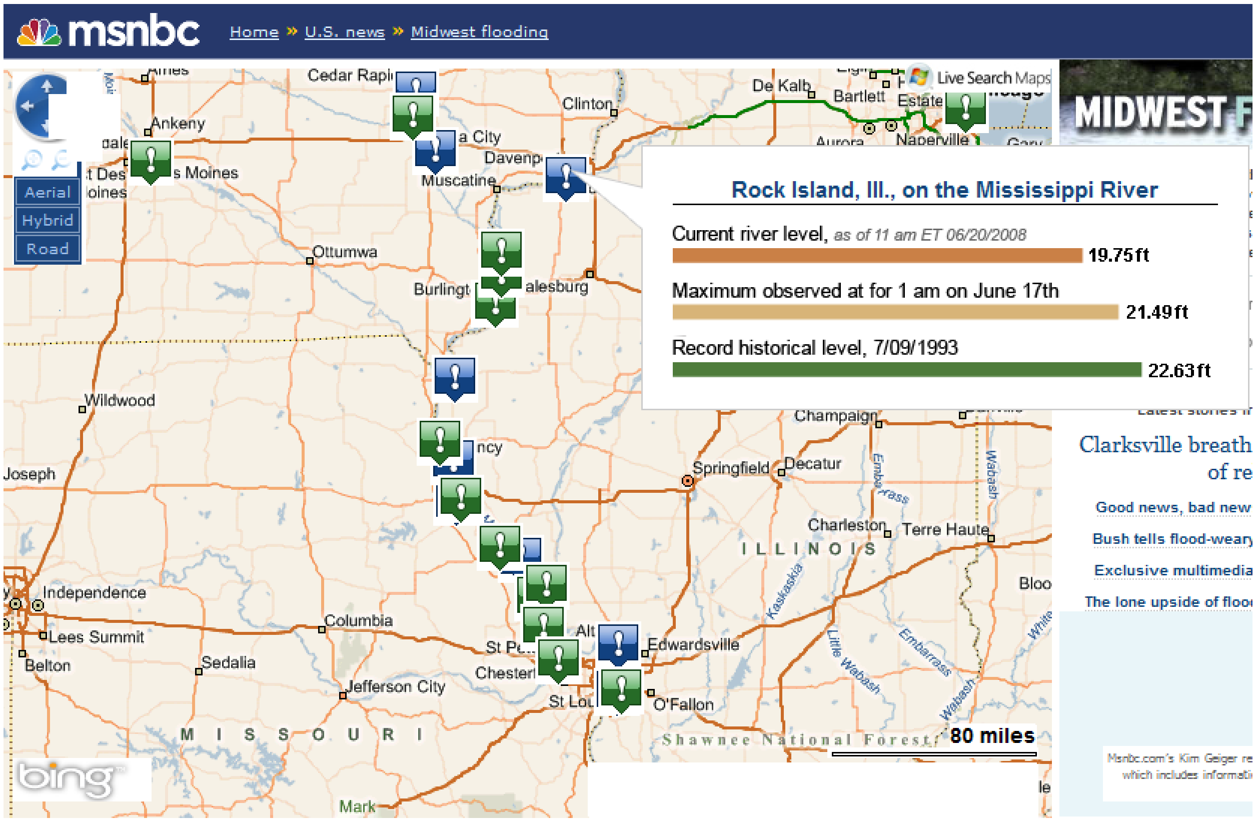
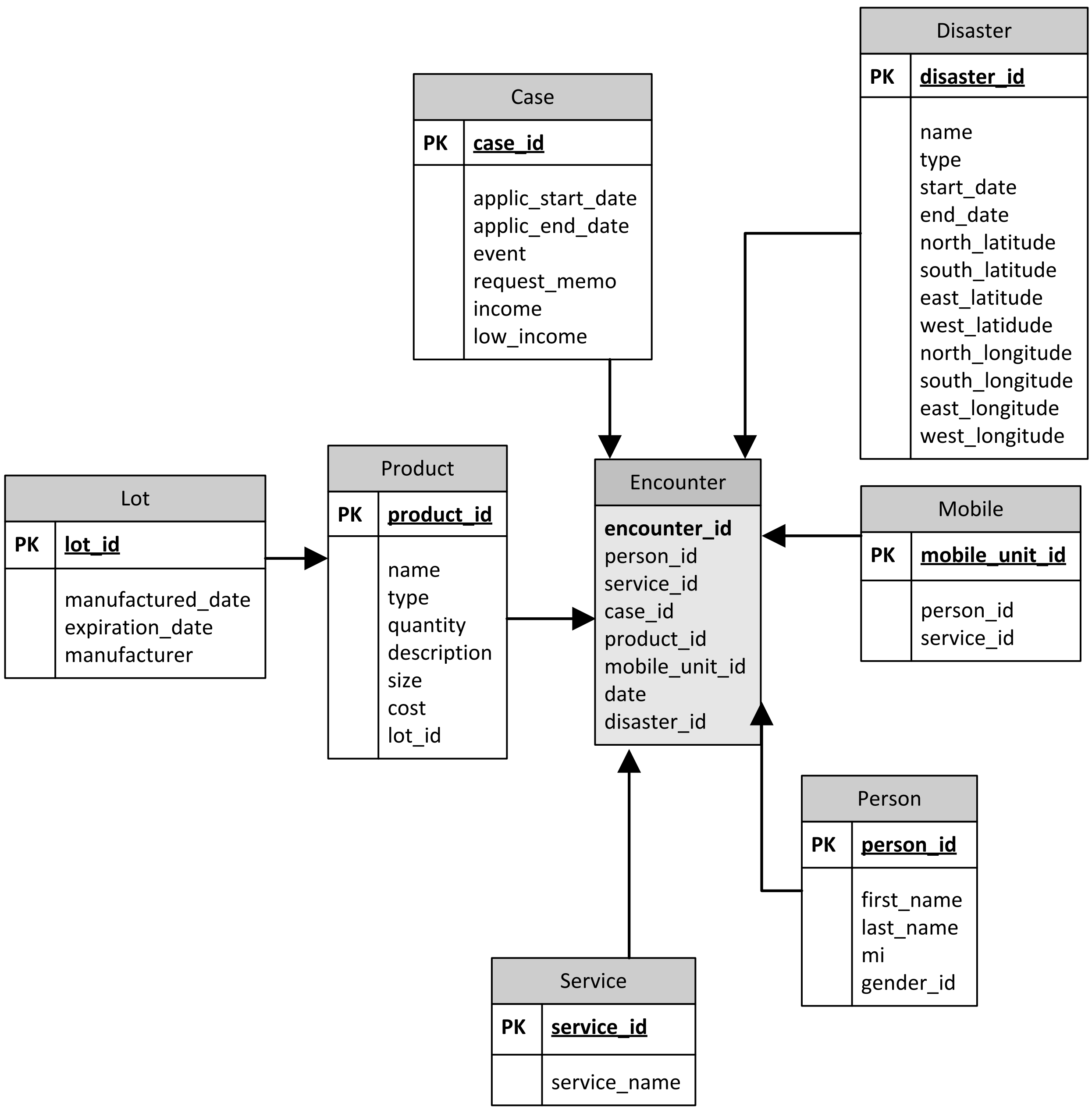


Figure 2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name
type
start_date
end_date
north_latitude
south_latitude
east_latitude
west_latidude
north_longitude
south_longitude
east_longitude
west_longitude
Case
PK case_id
applic_start_date
applic_end_date
event
request_memo
income
low_income
Lot
PK lot_id
manufactured_date
expiration_date
manufacturer
Product
PK product_id
name
type
quantity
description
size
cost
lot_id
Encounter
encounter_id
person_id
service_id
case_id
product_id
mobile_unit_id
date
disaster_id
Mobile
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person_id
service_id
Person
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last_name
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gender_id
Service
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