Development of a Web-base State Agricultural Emergency Response System

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Abstract

Agriculture is under constant threat of natural disasters, exotic animal diseases, pests, and potential bioterrorism. In the case of agricultural emergency, county, state, federal, and volunteer organizations need to work together to prevent outbreaks and conduct emergency management. One of the challenges in agricultural emergency management is to provide the right information at the right time. Information technology provides a means to assist decision makers, first responders, and emergency response teams in the event of emergency. To effectively cope in an agricultural emergency, a joint effort based on a new concept, the State Agricultural Response Team (SART), has been made in Florida. This paper describes a newly developed web application that provides a communication bridge and much needed resources for agricultural response teams.

Key words: agriculture emergency, information technology.

1 Introduction

Agriculture accounts for about 13 percent of the United States’ annual gross domestic product (Horn and Breeze, 1999). As mobility and agricultural trade increase, animal and human health risk factors increase as exposure to diseases from foreign sources increases. Exotics are commonly seen on modern hobby farms, hunting preserves, in aquaculture, and as pets; the variety of backgrounds of these animals presents wider exposure to diseases for which immune systems are often unprepared. Exotic pest introduction and outbreaks represent threats to agriculture, to our environment, and to the health and national security of the United States (Sequeira, 1999). Disasters and animal diseases in the past decade have shown that damage to production agriculture can be not only an economic crisis to individuals and communities but, especially in animal production agriculture, can prove to be an environmental and public health challenge (NEMA, 2002). An outbreak of an animal disease could prompt the international community to impose export restrictions on U.S. agricultural goods, resulting in severe financial losses for U.S. producers.

Florida’s $13 billion agricultural industry is often at risk for natural and man-made disasters. In the past, Florida has been struck by many destructive hurricanes. In addition, Florida has 14 major seaports and 131 public airports. Each year over 75 million people visit Florida and about 10% of them come from overseas. Florida has been called an agricultural “sentinel state” because if an agricultural disease or pest outbreak, or agro-terrorist event occurs in the U.S., there is a good chance it will occur in Florida. Given the potential for devastating natural disasters, exotic species invasion or bioterrorist attack, effective cooperation and communication among county, state, federal, and volunteer organizations are essential to conduct emergency management. To respond to an emergency quickly and effectively, fast and reliable communication, readily available emergency response information, and effective collaboration on resources are essential. In Florida, there are several groups and agencies involved in agricultural emergency management and planning. However, these agencies are normally scattered across the state and there is a lack of an effective statewide cooperation and communication system on emergency
management among these agencies. In particular, there is a lack of a database that can provide detailed county resources for emergency management.

In 2004, Florida State Agricultural Response Team (SART) was developed to meet the needs of animals and animal stakeholders during the relief period of a declared disaster. SART is an interagency, coordinated effort, dedicated to effectively communicating and planning for agriculturally-related emergencies and disasters that will occur within the State of Florida. The team’s mission is to develop and implement procedures and train participants to facilitate a safe, environmentally sound and efficient response to agricultural emergencies on the county, district, and state levels (SART, 2005). To achieve the mission of SART, information technology (IT) is a vital component to facilitate better preparation for and respond promptly to agricultural emergencies. The immediate goals of this project are: 1) to develop a Web-based application that can provide a secure communication bridge between SART, county SART participants, and participating agencies, 2) to provide readily available information on county resources for emergency management, 3) to provide updated training materials for SART participants and general public, and 4) to post emergency alerts and notices to county SART and other participating agencies.

2 System Description

Figure 1 illustrates the SART system design. The system is a three-tier client/server application, where the user interface, business logic and data services are designed to run as three separate tiers. This design offers a great flexibility in distribution, as the tiers could reside anywhere from a single desktop to servers and clients around the world. This design enables the application to scale easily and it also offers the side benefit of being able to place the different tiers on computers that are optimized for roles as servers or as clients, which enhances the performance of the application.

The client tier, or a presentation layer, provides an easy-to-use user interface to elevate user productivity. This thin-client presentation layer uses HTML, template, server-side include, and Cascading Style Sheets (CSS) for static Web presentation. JavaScripts and Java Server Page (JSP) were used for client-side data validation and dynamic page display with a personalized user interface depending on each user’s role.

The business tier is a server-side representation of business logic behind SART. This tier uses Java servlets, Java Beans (EJBs), and JavaMail. Server-side Java provides important features for developing Web server applications. Model -View - Controller (MVC) paradigm was implemented in the system to separate content and Web presentation. Servlets are the controller; JavaBeans are the model; and JSPs are for Web presentation. Servlet and JSP communication is established and messages are sent from servlets to JSPs for dynamic Web presentation.

The data tier is responsible for storing persistent data and business objects in a database management system (DBMS). Java database connectivity (JDBC) driver is used for servlets and database connection. In consideration of concurrent users and slow open database connection, the pooling mechanism of JDBC Connection is used for thread control and to cache open connections to the database in order to achieve higher system performance.
2.1 SART Modules

The main objective of SART is to improve the capacity of decision-makers to take needed action. Effective information management and a telecommunication system are essential. The system focuses on data collection, consolidation, and dissemination of the information. More importantly, the information is delivered to the right decision-makers at the right time to satisfy their needs. As Figure 2 shows, nine modules have been developed and more modules will be included in future development.

Figure 1. SART main modules.
Alerts: The alert module is designed to be a communication vehicle for the rapid dissemination of emergency information from SART core agencies to members, affected counties, and the public through e-mail, fax, and mobile phone text message.

County Emergency Management (EM) Resources: This module provides much needed information at the county level for emergency management, such as a county emergency plan, resources for animal care, animal transport, animal rescue, animal shelter, animal disposal, pet friendly motels, maps related to the resources, and a customized reporting system. Authorized county users can update the resources anytime.

Emergency Contact: The module provides traditional and 24/7 contact information for the county Emergency Operation Center (EOC), Emergency Support Function 17 Coordinator (ESF 17), county SART administrator, and a third party directory service of people and businesses.

Training Module: Training modules provide extensive training materials and web resources for emergency management developed by SART specialists and other agencies.

Agencies: This module provides contact information and responsibilities of federal, state, universities, and other institutions that participate in SART.

Calendar of Events: This module displays SART related events posted by members.

Communication: This module has three components: 1) a bulletin board (discussion forum) for SART member, 2) a member only ListServ, and 3) a ListServ for members of the general public who are interested in SART.

Disaster Photo Gallery: This module includes a collection of historical disasters and SART activity photos that can be used for education and presentation.

Members Area: This module is a restricted area for members only. Based upon their role, users may perform tasks such as: 1) updating web content, 2) approving content, 3) posting an alert or an event, and 4) sharing multimedia during an emergency event.

2.2 User Profiles and Role

County and state agencies are involved in SART and it’s critical to have the most up-to-dated information on the database in the event of an emergency. SART content contributors are distributed around the state and are the users who know local emergency resources, contact information and county specific information. The system provides a means for users to update content anywhere if they have a proper role. The following roles have been defined and more roles could be created for the future development.

- Member – view member-only information
- Member administrator – assign user role and add/update/approve members
- County contributor – add/update county resources for a specific county
- County administrator – add/update county resources for all counties
- Agency administrator – add/update agency information
- Calendar contributor – add/update his/her own calendar information/events
- Calendar administrator – add/update/approve calendar of events
- User administrator – manage user accounts and assign roles for users
- System administrator – all above functions

As a role based system, each user may perform certain tasks accordingly on a user specific user interface. Figure 3 shows a user case for different users in the Members Area.
3 Summary

SART is a new concept in US and only a few states have implemented the concept. The effort has increased partnerships among county, state, and other institutions. The web application (www.flsart.org) provides essential information that could strengthen our abilities to respond to agricultural emergencies. Yet the biggest promise of the SART system is to provide a new platform as a resource repository and a communication bridge among agricultural emergency response teams. Although the initial release of the SART web application offers very limited functionalities, the system has already provided much needed information for agricultural response teams in Florida. Future developments could provide mobile solutions for emergency management. Technologies such as GIS/GPS and PDAs could be used as decision support tools that can quickly link environmental, demographic, emergency resource, location, and communications information from many sources. More importantly, the system could be enhanced to incorporate each of the elements of agricultural emergency management (preparedness, training, response, communication and information sharing, recovery, and mitigation) into its overall development matrix.

4 Acknowledgement

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5 References


NEMA, 2002, Model emergency support function for production agriculture, animal and animal industry. September, pp. 11.
