**Bulk Milk Transportation Project**
**Detailed Overview**

In early 2006, a Department of Homeland Security (DHS)-funded project led by the University of Kentucky began investigating bulk milk transportation issues with a goal of developing a practical transport security system. Researchers understood any proposed solution would need to be flexible to accommodate varied tanker designs and diverse farm and plant systems. They also recognized the benefits of a complete, integrated system that would improve operational efficiencies as well as ensure food safety and defense measures for the dairy industry. A prototype system was developed based on input from producer groups, processors and transportation companies and includes a **data server**, a **mobile handheld computer** and computer processor installed on the tanker which operates what is known as the **TMS** (Tank Monitoring System).

The **data server** monitors, tracks and stores information related to bulk milk transport activities such as farm, plant and transportation company information. Much of this data is proprietary in nature and is partitioned so that users determine what information is shared with other users. Pertinent data includes GPS coordinates of locations, Interstate Milk Shippers (IMS) or state identification numbers, tanker capacities as well as specific farm attributes such as organic and rBST free status herds. The data stored in the server may be updated as needed by the appropriate users.

The mobile **handheld computer** is “dairy durable” and used by the hauler or other authorized user to enter information that is typically recorded on hand written documents such as the milk ticket or tanker wash tag. The device utilizes a bar code scanner and communicates to the data server via cell phone and with the tanker based **TMS** via Wi-Fi. Documents required to be generated on the farm and at other locations can be printed by wireless communication to a small printer. The handheld device provides up-to-date information regarding items such as farm pick-up status and logistics.

The tanker **TMS** includes a cell phone, GPS receiver, electronic locks, a key pad and temperature sensors. These core components are critical to the system’s record keeping system that identify who, when, where and why a tanker’s door, valve or dome lid was accessed. Temperature sensors monitor milk in transit, the tanker’s wash cycle and, when appropriate, milk samples in the storage cooler. All tanker events are captured and stored. When the **handheld computer** is not accompanying the tanker **TMS**, information can be communicated from the **TMS** to the server via the tanker based cell phone.
The TMS, mobile **handheld computer** and the **data server** synchronize as events occur (i.e. door is opened or data is entered into the handheld). All information is redundantly stored and updates are communicated across the system. The data stored on the server is be partitioned between major users and accessed only by authorized individuals.

The bulk milk transport security system manages by exception, meaning activities exceeding specified criteria will be “flagged” and communicated to system users. Examples of potentially flagged items include inappropriate access to the tanker, tanker wash tag expiration or an elevated milk cargo temperature. The security and traceability features of the system will enhance the dairy industry’s ability to quickly respond to a food safety event. Detailed near real time information relating to a load of milk in transit (i.e. location, volume and temperature) has the potential to increase efficiencies and will benefit marketing agencies, processors and transport companies.

**Field Testing and Project Status**

A prototype was first demonstrated and field tested on a commercial milk truck in 2007 and 2008. Field testing validated the system’s functionality and dairy industry collaborators provided feedback regarding its ease of operation. In October 2008 a complete demonstration of the system was provided for over 160 dairy leaders from across the US and Canada. The audience feedback was positive and several suggestions were made to improve the system. One suggestion was to “compartmentalize” the system to ease its deployment within the dairy industry.

With this important recommendation in mind, development began work in 2009 to improve the system. The team’s goal was to optimize the previously described prototype system that includes the data server, handheld computer and TMS, which became known as the comprehensive system. A simultaneous goal for the team was to “compartmentalize” the system so that the data server and handheld computer could be deployed exclusively. This version of the system became known as the Data Management System. The software for the Data Management System was modified to enable the scanning of bar coded seals to provide accountability regarding access to the tanker.

Compartmentalization allows the system to potentially be deployed in stages. The Data Management System implementation could be integrated into current milk transportation operations rather quickly. Afterwards, the TMS tanker components could be integrated by industry when desired and eventually result in implementation of the complete, comprehensive system.

In late 2009, the compartmentalized Data Management System was field tested for a 30 day period by two milk marketing agencies and a milk transportation
company in New York. Four handheld computers were used by multiple drivers on several routes being delivered to a number of northeast US milk plants. The field test was judged to be a success as milk transportation data was successfully gathered by the handheld computer, communicated to the data server and subsequent documents and reports were successfully generated from the system. At the conclusion of the test, the New York dairy industry collaborators provided valuable insight into the development of the Data Management System and also provided feedback for software enhancements to improve ease of use.

After the conclusion of the New York test, the optimized comprehensive system was field tested in Kentucky for a two week period using multiple transportation companies and milk marketing agencies delivering milk to multiple processors. This field test demonstrated enhanced functionality of the handheld milk assembly software as well as improved information and security data gathering on the TMS. Appropriate information was gathered, stored and communicated to the data server.

A synopsis of the project was provided to DHS, other government officials and dairy industry leaders in Washington D.C. in late 2009. Their evaluation of the project was very positive. Early indications are that government and industry leaders are interested in continuing funding for continued development of the system.

**Concluding Thoughts…**

The project’s objective was to practically enhance food safety and defense protocols associated with milk transportation. To accomplish this objective, reams of data were determined to be necessary to provide surveillance of milk transportation activities. This surveillance data (tanker temperature, location, time of event) also provides numerous operational benefits for milk transportation, including cost reduction and avoidance.

The information gathered by the system can be partitioned, with proprietary information being kept private and normal milk transportation and food protection information being provided to appropriate industry groups. Motivations for industry adoption of the system include improved milk transportation efficiencies coupled with enhanced food protection. Simultaneously, government leaders and consumers can be assured the dairy industry is proactively taking steps to continually enhance all aspects of the dairy supply chain.

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