

# Use of Mobile Device Technology in Dairy Data Management

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## Abstract

Over the last 10 years, mobile device technology has become a part of everyday life throughout the world. Cellular phones, have replaced land based phones and everywhere we go, someone is using a mobile device to communicate or perform their job. At the same time, there has been an explosion of mobile device technology applied to agriculture, and data management has transitioned from local management on individual devices or computers, to centralized server (“cloud”) based systems. There are numerous operating systems, physical configurations, and features available. Potential users should think carefully about how they want to use a device and ask many questions when deciding which one to purchase. Regardless of the device, mobile device applications allow us to work smarter, faster, and less expensively. They allow us to work with little to no writing, receive nearly immediate, more accurate, feedback on how a farm is performing, and focus on more timely decision-making rather than on data collection and processing.

## Introduction

In the last decade, mobile device technology has become a part of everyday life throughout the world. Cellular phones have replaced land based phones and everywhere we go, someone is using a mobile device to communicate or perform their job. At the same time, there has

been an explosion of mobile device technology applied in the agriculture sector. Mobile devices of today have more computational power and features than the desktop computer of the last decade. Applications allow us to work smarter, faster, and less expensively. They allow us to work with little to no writing, to receive nearly immediate, more accurate, feedback on how a farm is performing and to focus on more timely decision-making rather than on data collection and processing. The following article is an overview of the current state of mobile device technology and where this technology is headed in the future.

## Data Management

Since its initial release in 1982, the Internet and associated technology has continued to grow at an explosive pace. Since the inception of the Internet, data management has transitioned from local management on individual devices or computers, to centralized server (“cloud”) based systems. Local computers have been replaced with mobile devices (smartphones, notepads, and tablets) that are predominately used for data entry and some crude feedback, with most report generation performed on a server. Advantages to this system is that only one piece of reporting software needs to be updated and maintained and data from all users may be stored and benchmarked in one central location. Because of these desired functions, mobile software applications may be classified as the following: standalone device

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programs, client-server (hybrid) programs, and Internet browser-based programs. Standalone device programs are programs in which all data collection and reporting is performed on the device. Client-server programs combine data from the device with data stored on the server to generate web based reports. An example of a simple, web-based report is shown in Figure 1. In some of these programs, server data may be electronically transmitted to the device, such that the client and server are synchronized or “synched”. Browser-based applications are web-based applications that run locally through a device Internet browser. Little to no data are stored on the device and the software requires a live Internet connection, either through a wireless signal or cellular phone connection, to properly function. In parallel to the development of the Internet has been the development of a data transfer standard. The eXtensible Markup Language (XML) was created as a standardized way to share data files between two different machines. The XML files consist of elements included in tags, which consist of the tag name, attributes of the tag, and the raw data. Advantages of XML files include the following: standardized data format and structure, people can understand the data layout just by the file appearance, lack of dependency for data input in every field, and universal adoption as a standard for the software industry.

### Choosing a Mobile Device

Choosing a mobile device may seem to be an overwhelming task. There are numerous operating systems, physical configurations, and features commercially available. At the time of this article, there are three major operating systems on the consumer market: Android, iOS, and Windows. Android is a free, open source operating system that is closely tied to Google, Inc (<http://www.android.com>). Android-based programs are written in the JAVA language and may be freely distributed from 3<sup>rd</sup>-party developers or made available on the Google Play market ([\[play.google.com/store\]\(http://play.google.com/store\)\). The iOS is an operating system developed by Apple, Inc \(<http://www.apple.com/ios>\) and is used in all the “i” devices \(iPhone™, iPod™, iPad™\). Most iOS programs are written in the Objective C language. All iOS applications must be distributed through the iTunes market managed by Apple \(<http://www.apple.com/itunes>\). Third party developers must pay a royalty to Apple to have their products hosted through the iTunes market. The Windows Mobile operating system \(now known as Windows Phone\) was developed by Microsoft, Inc. with programs written in a variety of different languages. Following the iTunes business model, Windows Phone applications must now be distributed through Microsoft’s Windows Phone market \(<http://www.windowsphone.com>\).](https://</a></p>
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Mobile devices come in a wide variety of sizes and configurations. One advantage of modern mobile technology is that the same software will (generally) operate on any device with the same operating system. For example, an iPhone application will run on an iPhone™, iPod™, or iPad™. For each operating system, a potential user can choose a phone (usually < 4" tall), a hybrid (usually 5 to 6" tall), or a tablet (7 to 10" tall). Most of these devices can connect to the Internet either through a wireless connection, a cellular phone connection, or both, allowing users to browse the Internet, or send and receive emails and text messages on the device. There are vast numbers of different features and capabilities across different devices. Often, there are features from one class of devices that may be found in another class of devices. For example, many hybrids and tablets have slots for Subscriber Identity Module (SIM) cards, which enables the device to function as a cellular phone. An important consideration when purchasing a device is to determine future usage and function of a mobile device. A user should ask many questions when deciding which device to purchase.



## Implementing Mobile Device Technology

There is a wide variety of mobile device applications that have been, or are being created, for the dairy industry. These applications may be classified based on function. One class of applications is calculator and counter applications. A calculator might be used for feed ration balancing or calculating sample size numbers for data analysis. A second class of applications is input / data collection systems for existing desktop computer systems. An example of this is “pocket” versions of dairy recording systems, such as DC 305™, PCDart™, and DHI-Plus™. A third class of software application is dairy scoring systems. These applications allow a user to record observations, such as body condition scores, manure scores, or other on-farm observations, to enable the creation of analytical reports on dairy performance. Another class of applications is auditing / survey tools for evaluations, such as animal welfare audits. Lastly, nearly all mobile devices have the capability to receive or send e-mail, text messages, or photographs.

The benefits of employing mobile device technology are numerous. First, mobile device applications improve the speed and accuracy of data collection. Second, field use of mobile applications on the farm provides near-immediate feedback to the consultant and producer. Third, well-designed mobile applications can dramatically reduce or eliminate the need for writing. Finally, mobile device software can perform calculations and prepare reports in a fraction of the time necessary to conduct these activities by hand.

### New Advances on the Horizon

There are several new technologies which may prove to be very useful for agricultural mobile device usage in the near future. Near field communication (NFC) modules are electronic chips that have been incorporated into certain mobile

devices. These chips allow data from one NFC-enabled device to instantaneously transfer data to a second NFC-enabled device when the two devices come within an inch of one another. When used with radio frequency identification (RFID)-enabled chips with data storage capability, NFC allows modest datasets (e.g. a cow’s entire health and production history) to be electronically transferred between a cell phone and a chip the thickness of a piece of paper and diameter of a quarter. This could also be used to store ration information with a batch of feed.

Voice-enabled data entry has been available for several years, but until recently, it has been very impractical for language translation purposes due to a voice recording requiring transmission to a voice translation server and back via an Internet connection. With Android version 4.0 or higher devices, Google has now introduced local translation technology which will not require an Internet connection and is much faster. Users can perform data entry by speaking and keep their hands free to simultaneously perform physical activities.

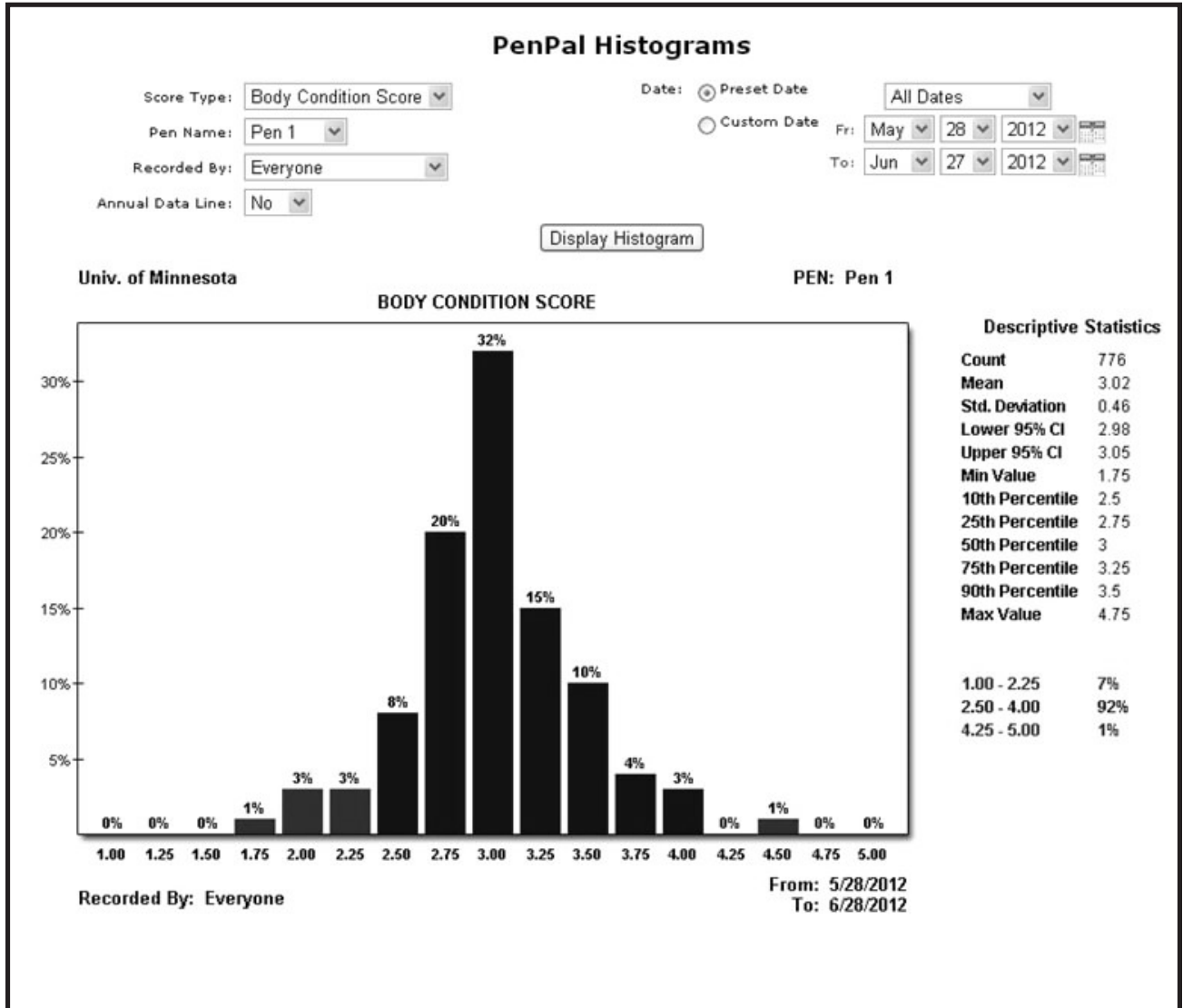
In recent years, bar code technology has greatly improved. With the advent of the “QR code” (a two dimensional bar code readable with a device camera), more information can be transferred by scanning an image, allowing more accurate and efficient data transfer.

Finally, the methods in which online reports are being presented is going through a transformation as well. Internet sites are migrating away from static pages to widget-based dashboards where the appearance of a particular web site is customizable to user preferences (Figure 2). In essence, widgets are moveable, resizable miniature web pages (“frames”), and the user’s visual dashboard is a customizable web page similar in appearance to the dashboard in a car that provides performance feedback from numerous systems in one view.

## Conclusion

Mobile device technology has experienced rapid development in the last 10 years. Current commercially available devices have greater computational power than a desktop computer of 10 years ago and have more features and applications. Numerous operating systems, device configurations, and software applications exist. Mobile devices can perform a wide range of functions from performing calculations, collecting data, recording farm observations, and sending messages and images to colleagues worldwide. They allow users to work with little to no writing, receive nearly immediate and accurate feedback on farm performance, and focus on decision-making rather than data collection and processing.





**Figure 1.** Example web-based report for body condition scores.



## Agrimetrica Navigation Portal

Home Admin Dairy Assessment admin Logout

Home > My Portal

+ Add Widget to Portal Manage Widgets

### Your Emotions

:- HAPPY  
  :o - AH  
  :) - FUN  
  :( - SAD

- Admin - Assessments (FOR TEST ONLY)
- Admin - My First Assessment (FOR TEST ONLY)

### MilkLab (DEMO)

REGENTS OF UNIV OF MN Search

+ Dairy Data

Sample Date	Milk Fat	Protein	MNU	SCC	Yield
7/16/2010	3.28%	2.99%	15	412	15031
7/18/2010	0%	0%	0	0	14756
7/20/2010	3.38%	3%	17.5	476	14526
7/22/2010	3.47%	2.96%	16.4	461	14449
7/24/2010	3.34%	2.97%	17.5	496	11414

+ Benchmarks  
+ Export Dairy Data  
+ Dairy Settings

### My Assessments (DEMO)

+ Assessments (24) More ...

Assessment	Action
NMPF FARM Assessment	Go
Agrimetrica Animal Well Being Assessment	Go
Agrimetrica Antibiotic Stewardship Assessment	Go
Milk Quality Self Assessment	Go

### Members Admin (DEMO)

+ Members (2780)  
+ Member Groups (50)  
+ Email Lists (2780)

### Site News (DEMO)

- Announcing Agrimetrica Portal
- Report: Facebook deleting fake accounts, likes
- Occupy protester can't keep tweets from DA
- Cops: 'Several' dead in Minneapolis workplace shooting
- New virus in Africa looks like rabies, acts like Ebola
- Ravens outlast Browns in regular refs' NFL return
- Political paralysis in DC restrains job growth
- Boy Scouts: Response to sex abuse 'insufficient'

**Figure 2.** Example web dashboard page with moveable, resizable widgets.