

Report for 2001KS981B: REAL TIME CROP WATER MANAGEMENT AND IRRIGATION SCHEDULING WEB SITE

- Other Publications:

- Masters Thesis in Computer Science: Mr. Deep Kapadia. Thesis titled: "real Time Crop Management and Irrigation"; May, 2001. A presentation was made at the 2002 Water and the Future of Kansas Conference. Title: Real Time Crop Water Management and Irrigation Scheduling Web Site.
- Masters Thesis in Computer Science: Mr. Deep Kapadia. Thesis titled: "real Time Crop Management and Irrigation"; May, 2001. A presentation was made at the 2002 Water and the Future of Kansas Conference. Title: Real Time Crop Water Management and Irrigation Scheduling Web Site.

Report Follows:

Project Title: Real Time Crop Water Management and Irrigation Scheduling Web Site

Project Number:

Start Date: March 1, 2001

End Date: February 28, 2002

Investigators and Affiliations:

Gary A. Clark, Department of Biological and Agricultural Engineering

Daniel A. Andresen, Department of Computing and Information Sciences

Danny H. Rogers, Department of Biological and Agricultural Engineering

Research Category: Statewide Competitive Grant

Focus Categories:

Descriptors: Irrigation, Water Management, Irrigation Scheduling, World Wide Web

Problem and Research Objectives:

Irrigation accounts for over 90% of the water use in Kansas. With increasing concern over current water usage and supplies, substantial emphasis has been focused on improved irrigation management practices. To help with irrigation management, water balance, evapotranspiration-based (ET-based) irrigation scheduling approaches have been promoted for over 30 years. However, the process requires frequent (often daily) maintenance of weather and system data records and can be rather tedious without the use of computer software. Accurate and reliable ET data are a key component of the scheduling process, and within recent years have become readily available from automated weather stations. However, some of those weather stations in Kansas only provide data for the current (or previous) day and the user must call or access the weather station on a daily basis. Recently, data from some Kansas weather stations is available on a Kansas State University web-site that contains historic data for the current year. With the availability of such data, a web-based water management account could be used to access and utilize those data on an automatic basis so that the user is not required to obtain and enter those data.

Because access to and interest in the use of the World Wide Web has been growing at a fast pace, this project was designed to improve the transfer of production-based agricultural irrigation water management knowledge and technology for resource conservation through the use of a Water Management Web Site. The goal of this project was to develop, test, and display a user friendly water management and irrigation scheduling web-based program that provides a personal crop water management account that utilizes web-based, real-time evapotranspiration data. This computer assisted decision tool can be used to improve water use efficiency and utilization, crop management and planning, and economic returns.

Methodology:

A water budget, account-based irrigation scheduling program (KanSched) was developed to help incorporate real-time evapotranspiration data into a farm-level irrigation scheduling procedure. The KanSched program was originally written in 1998 as a Microsoft Excel spreadsheet. During 1999 – 2001, that spreadsheet program was tested and calibrated using farm-based data and feedback from selected farmers in south-central Kansas. This project was designed to create a version of KanSched that would be as a web-based, personal accounting program. During the last phase of this project a stand-alone Visual Basic (VB) executable file version was simultaneously created and tested as a shared activity with another project (this is discussed below).

During 2000 and 2001, the spreadsheet program design was written in Java computer language and designed as a web-based decision aid for farmers to assist in the task of water management

and irrigation scheduling. The Java-based irrigation scheduling website program is located at <http://kwri.cis.ksu.edu/servlet/login> and the basic architecture of the entire application is shown in Figure 1. Weather data is downloaded daily from different weather stations all over Kansas and is available as a text file, which can then be downloaded for processing or into a client's system. A small Java program converts the available data into a format where it can be inserted into the database. One of the goals is to provide for server side scalability by restricting most of the computation to the client end. The central figure in the system is the web server, which acts as the interface between the client and the database. Most of the middle tier is comprised of servlets running on the web server.

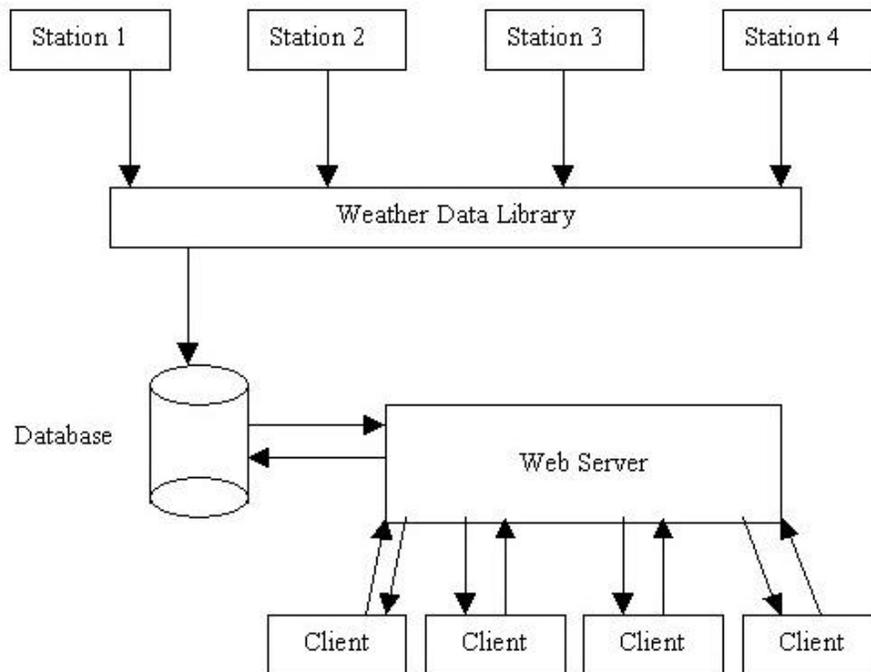


Figure 1. General structure of the system with a basic three-tier architecture associated with most Internet applications.

The scheduling program opens with a general login page (Fig. 2) with inputs for a username and password. A data input page (Fig. 3) is then used to input general information on the planting date, hybrid maturity, soil characteristics, and crop growth characteristics. The client's system then runs a Java applet that computes the soil water content based on the inputs provided by the user at the beginning of the growing season and the accumulated values of crop water use, rainfall and irrigation. Whenever the client accesses the program, their water budget is automatically updated with the current weather data. That data is used to calculate estimated crop water use from reference evapotranspiration data and a generated crop coefficient function. The web site will provide automatic links and electronic access to a Kansas weather database maintained by the Kansas State University Research and Extension State Climatologist (http://www.oznet.ksu.edu/wdl/bbw_et.htm).

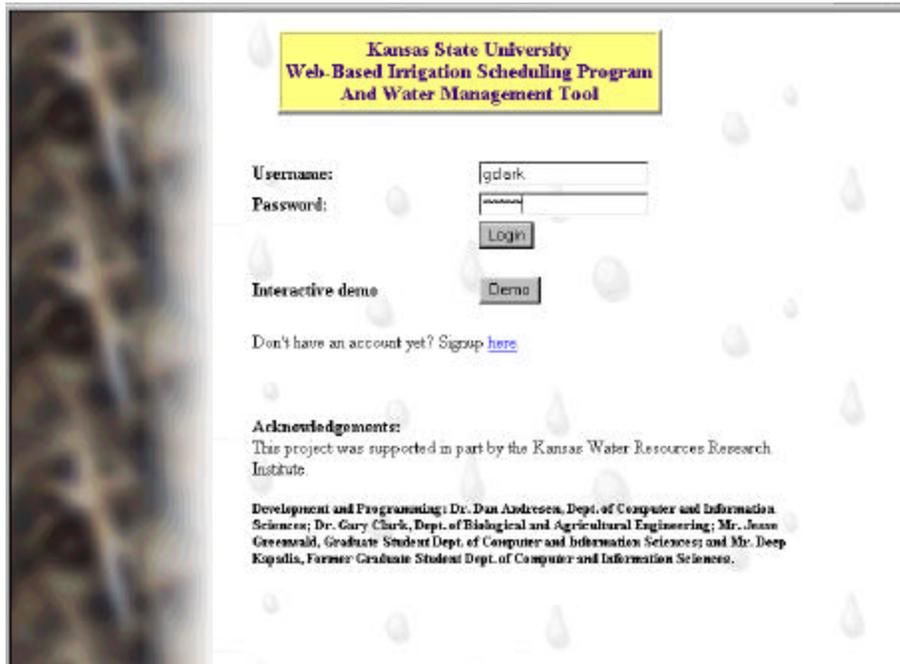


Figure 2. Logon screen.

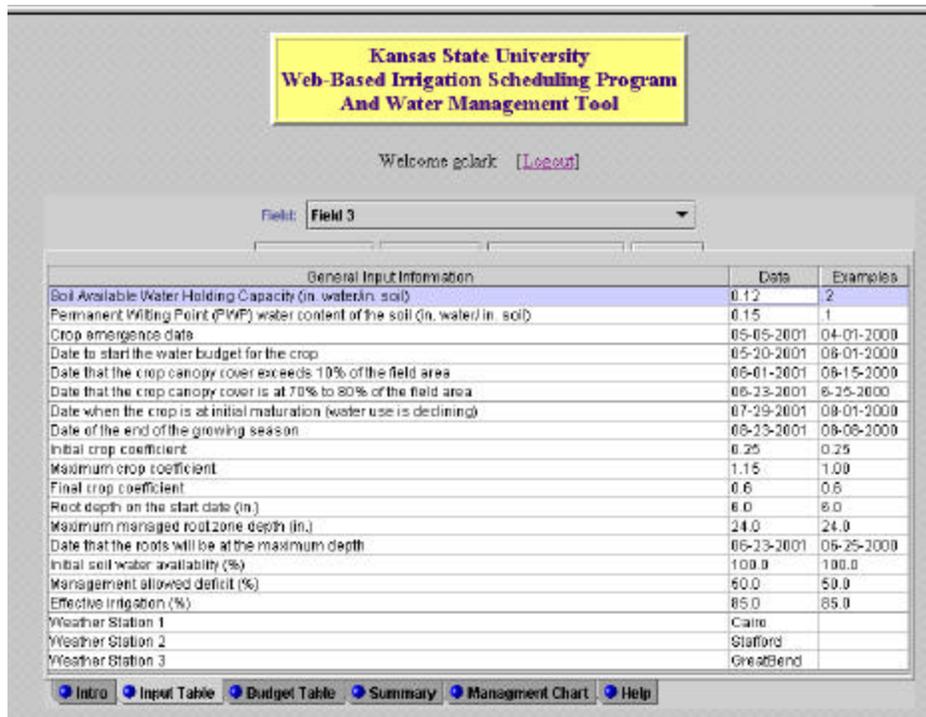


Figure 3. General field and crop data input page.

The website program creates crop water management accounts for individual users and multiple field sites based upon inputs of their crop, soil, and geographic location. The user can identify up to three weather stations per field so that if the primary station has data problems, the second or third station data can be used as needed. In addition, the user can also enter their own field-based data if they so desire. The individual will input rainfall and irrigation amounts that are associated with their production field to complete the water budget. Crop water use, irrigation and rainfall data are displayed on a budget page (much like a spreadsheet) and the resultant field water status data are displayed on a Management Chart (Fig. 4).

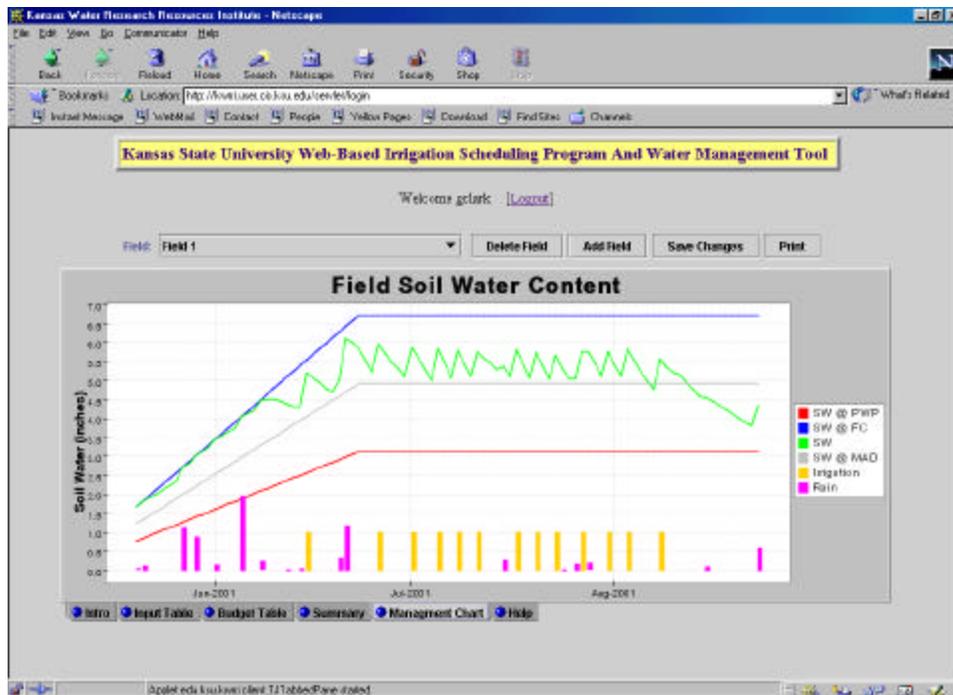


Figure 4. Field Water Management Chart Page.

Principal Findings and Significance

The website program has been tested with production site field data from the year 2000. The website has been deployed on Sun Solaris, Redhat Linux 6.0 and Microsoft Windows NT platforms and has been easy to configure on all of them. The client side applet has been tested on Microsoft Internet Explorer 5.0 and 5.5, Netscape Navigator 4.7 and 6.0 and Mozilla 0.7 browsers on Windows 98/NT and on Netscape Navigator 4.7 on Sun Solaris and Redhat Linux 6.0. All browsers require the user to download the Java plug-in except for Netscape 6.0 and Mozilla, which come bundled with the plug-in. The applet download process sometimes requires several steps when using some versions of Netscape Navigator which can be confusing to some computer novices, but is automatic with Internet Explorer. Because of the size and the requirement of several steps with the download process, the entire procedure can take a long time on some modem-based connections. Thus, as discussed below, another version of KanSched was created.

The application also worked through a firewall because all the communication is being done over HTTP. One drawback was identified when the user operated the applet on a Windows NT machine. Under such conditions, they need to have administrative rights to that machine and should be logged on as an administrator. A permanent server host is being located for the Java-based irrigation scheduling website. That server requires the loading of a Java servlet program and details are being discussed with a KSU-based website server administrator.

During the website development process it was also observed that the web-based weather station database (administered by another group) was not always up-to-date. This is a situation that could not be influenced by this project team. Therefore, due to this concern and the applet download requirements as previously discussed, it was decided to develop a stand-alone, Visual Basic (VB) coded version of KanSched that farmers could use for multiple field sites while not having to rely on a web-based connection. That program and other water management based items are available on a Mobile Irrigation Lab (MIL) website (<http://www.oznet.ksu.edu/mil/>) that was developed as a shared activity with another related project (K-State, Mobile Irrigation Lab, MIL; supported in part by Kansas Water Plan Funds through the Kansas Water Office). The MIL web site was designed to provide relevant photos, PDF files of publications, and electronic tools that would be useful for agricultural system irrigation system operators/managers and related industry/agency personnel. While the VB coded version of KanSched is also large (~6 Mb), it is being distributed on a CD as part of a MIL electronic toolkit. Hands-on workshops on using the VB version of KanSched have been conducted with farmers and agricultural industry representatives. After completing the workshop (about 1-1/2 hours long), participants are provided with a copy of the MIL toolkit CD. The MIL toolkit CD has been coded to automatically load the KanSched program and associated files onto the users computer. To date, approximately 75 copies of the MIL toolkit CD have been distributed and tested.

Current and future efforts are focusing on the enhancement and continued development of the MIL irrigation and water management website, loading and displaying the website-based Java coded version of KanSched, and enhancing the VB version of KanSched. That effort is currently being supported in-part by State Water Plan Funds through the Kansas Water Office and by the Kansas Corn Commission.

Articles in Refereed Scientific Journals None at this time.

Book Chapters None at this time.

Dissertations Masters Thesis in Computer Science: Mr. Deep Kapadia. Thesis titled: "Real Time Crop Management and Irrigation"; May, 2001.

Outreach

A presentation was made at the 2002 Water and the Future of Kansas Conference. Title: Real Time Crop Water Management and Irrigation Scheduling Web Site.