ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 5, Issue 10, October 2016

Database Based Irrigation Management System

Zeena Mohammed Faris, Dr. Muayad Sadik Croock

Abstract—**The saving of the nature resources is considered as the important factors nowadays for human living conditions. Water resources are the most impact factor due to its importance for human body and agriculture side. The recording of maintaining the water resources in the nature as well as the providing and consuming ranges can manage them to be enough for a long time period. These resource are fed mostly from the rain that falling in different period and ranges over the whole lands. This paper presents a database based irrigation monitoring system that notes and processes the related information of watering depending on the type of soil and plant. Different irrigation information fields can be stored in the design database to control the period and required amount. We utilize Microsoft visual studio C# and SQL server for designing the database and related GUI pages. These pages are provided for easing the deal with the whole monitoring system. The introduced system has been tested and the obtained results show the efficiency of the system.**

Index Terms—**Monitoring, database, irrigation.**

I. INTRODUCTION

In the modern irrigation systems, it is important to manage the irrigation by producing a schedule to control the time period of watering. This is to avoid the overwatering that harm the plants as strong as the lack of water (drying). The irrigation schedule can be varied depending on the plant and soil types.

In this manner, water system booking is a critical administration rehearse for irrigators. Water system planning requires information of: the soil, the soil water status, the harvests, the status of product push, the potential yield diminishment if the yield stays in a focused on condition.

Normally, there are three approaches to determine when to irrigate [1]:

- Measure soil-water.
- Gauge soil-water utilizing a bookkeeping approach.
- Measure crop stress.

In [2], the authors proposed an agrarian situation observing server framework for checking data concerning an outside rural generation environment using Wireless Sensor System (WSN) technology. This horticultural environment observing server framework could even screen the natural data on the outside remotely. In [3], a remote checking nodes based framework system utilizing ZigBee was presented. These nodes sent information remotely to a focal server, which gathers the information, stores it in database through web server and permits it to be broke down to be shown as required and can likewise be sent to the customer versatile. In [4], crop variables preceding shelter conclusion were produced by reenactment for an extensive variety of planting and ratoon dates. In this study, Olivier and Singels (2001) report on the utilization of the CANESIM model to build up a database of week by week crop coefficients for use with the Penman– Monteith evapotranspiration gauges. Coefficients are created for mixes of area, water system framework and cycle, column dispersing, beginning month, assortment and yield sort.

The presented system in this paper designs a database to store the collected data from the farm for processing and producing an irrigation schedule. The collected data is assumed to be taken from sensors distributed amongst the farm field. The sensors can be temperature and soil moisture. After completing the collection of data, the irrigation table is presented for managing the watering periods in which the overwatering is avoided. In addition, the produced tables show the monitoring and reporting of the irrigation process across the time in continues way.

II. PRESENTED SYSTEM

As mentioned above, the presented system manages the collected data from the farm field to produce monitoring and irrigation schedule values. In order to ease the reading of this paper, this Section is divided into the following sub-Sections:

A. *System Structure*

The advancement of farming relies on upon different natural parameters, for example, soil temperature, soil dampness, relative humidity, pH of soil, light force, treating property of the soil, and so forth. Any little changes in any of these parameters can bring about issues like sickness, plants are facing problems in their growth stages,

Zeena Mohammed Faris, Computer Engineering Department, University of Technology, Baghdad, Iraq.

Dr. Muayad Sadik Croock, Computer Engineering Department, University of Technology, Baghdad, Iraq.

and so on. And all this is due to the negative results of the outgrowth of the crop.

Fig. 1, explains the block diagram of the presented system. The main unit in this system is the central unit. It collects the data from the farm (from the assumed sensors) of temperature and soil moisture. In addition, the known information regarding the type of considered soil and plant has been fed to the central unit to complete the required data for producing the scheduling time. These information is saved in the created database at the server of the system as tables. In addition, the produced monitoring and schedule tables are presented for the controller or monitor.

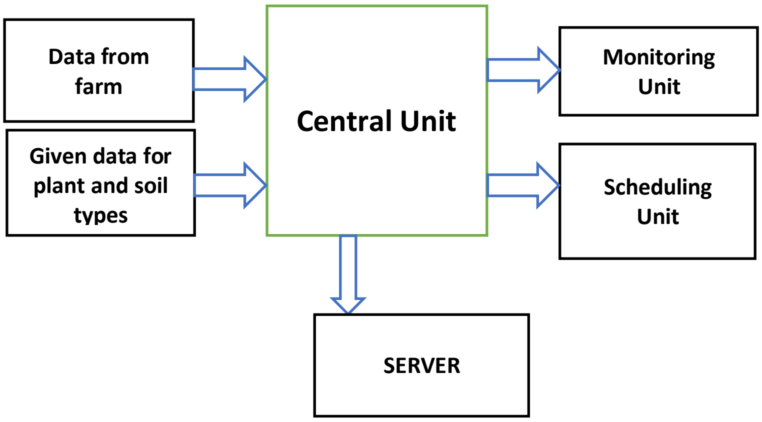


Figure 1: The block diagram of presented system

B. ***Database***

Database is a sorted out gathering of data that is separated into tables. Every table is further isolated into lines and sections; these segments store the genuine information [4]. The built database is accessed utilizing Organized Inquiry Dialect (SQL), which is a standard dialect bolstered by most database programming including SQL Server, Access, and Prophet [5].

Fig. 2, indicates to the relational IRRIGATION Database which consists of three tables for irrigation scheduling and monitoring system. These tables are Climate Daily Data, Reading-Table and Irrigation Schedule. Each table includes different elements and each of which is represented by an individual column in the table. Climate Daily Data includes ***Date*** for the current date, ***Tmax_C*** is the maximum temperature, ***Tmin_C*** is the minimum temperature, ***T_C*** is the average Temperature, ***Hmax*** is the maximum humidity, ***Hmin*** is the minimum humidity, ***SRt*** is the total solar radiation, ***WS_avg*** is the average wind Speed, ***WS_max*** is the maxim wind Speed, and ***Et***$_o$***_avg*** is the average evapotranspiration.

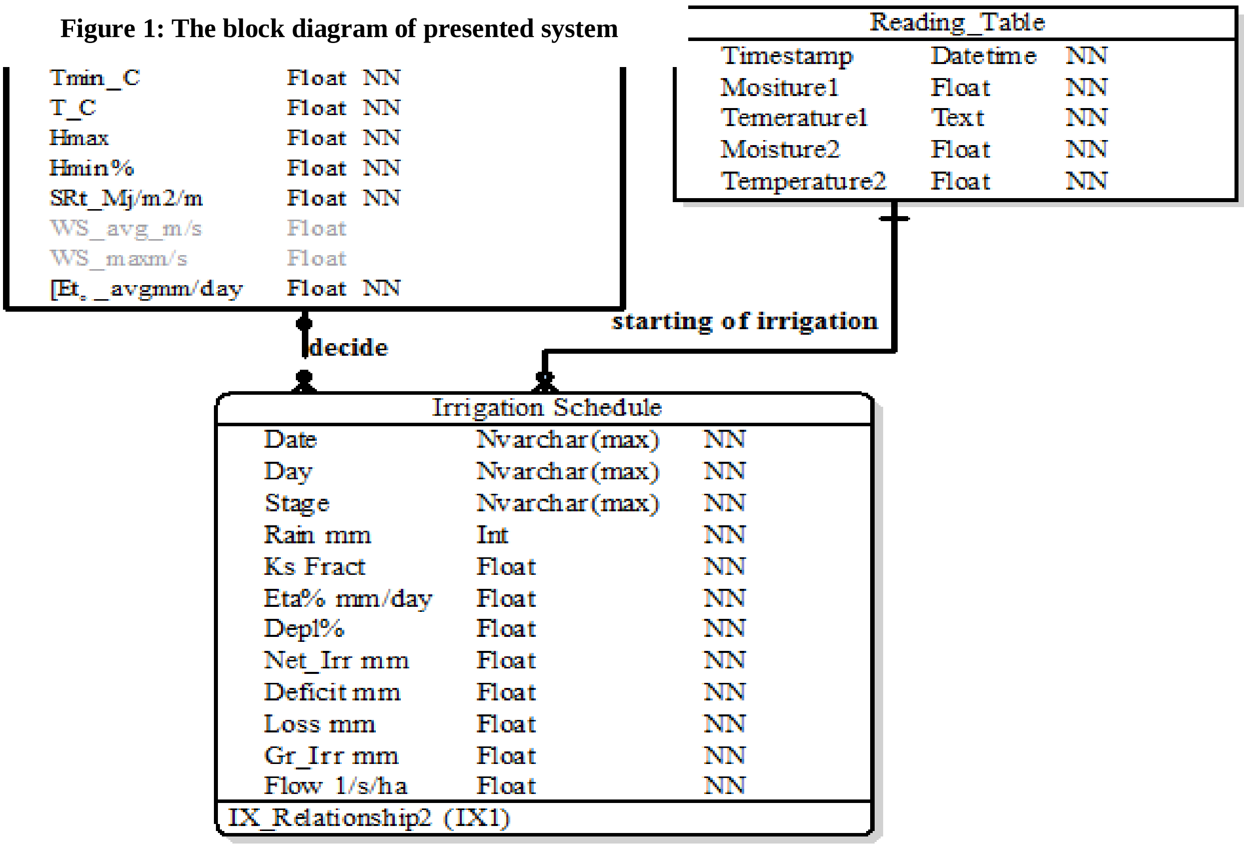


Figure (2): Irrigation Database Diagram

Reading Table involves the collected data readings from the assumed sensors fixed at the farm represented in ***Moisture1***, ***Temperature1***, ***Moisture2*** and ***Temperature2*** as there are just two considered sensor types in addition to constant value and ***time stamp***.

Table of Irrigation Schedule contains ***Date*** and ***Day*** for irrigation, ***Stage*** is the crown stage of plant, ***Rain*** is The measure of rain water which is available to the harvests., ***Ks*** depicts the impact of water strain on harvest transpiration (there is no soil water strain, Ks = 1), ***Eta*** is the crop water deficit, ***Depl*** represents the permissible depletion scale , ***Net_Irr*** is the net irrigation depth (mm), ***Deficit*** is the deflection of water, ***Loss*** water loss out of the root zone by profound permeation on day i[mm], ***Gr_Irr*** is the gross irrigation system profundity (mm), and ***Flow*** is the persistent water flow necessary.

C. GUI Design

In the simulation based methodology, the information gathered from the sensors is sent to the designed Graphical User Interface (GUI) of the presented system fields accordingly. This is to sort them and then store them in the correlated tables at the built database. The introduced GUI page is designed to ease the dealing with collected data either manually or automatically from the serial information using the selected computer port. Fig. 3, shows the designed GUI page that includes different fields according to the corresponding elements of the related tables. The right side of the page gives the user the option of selecting the desired serial port for importing the readings of sensors. While the readings and corresponding date and time are showing down to the port selection. This page connects the database's tables with the received sensors' readings by filling the related fields on the left side of the page. This information at the fields are stored at the tables. At the other hand, there are different operations for processing the stored data shown above the page, such as adding new record, removing a record, reporting the performance of the irrigation system, displaying the current status of the system, the printing option and finally the clear all for deleting the shown information.

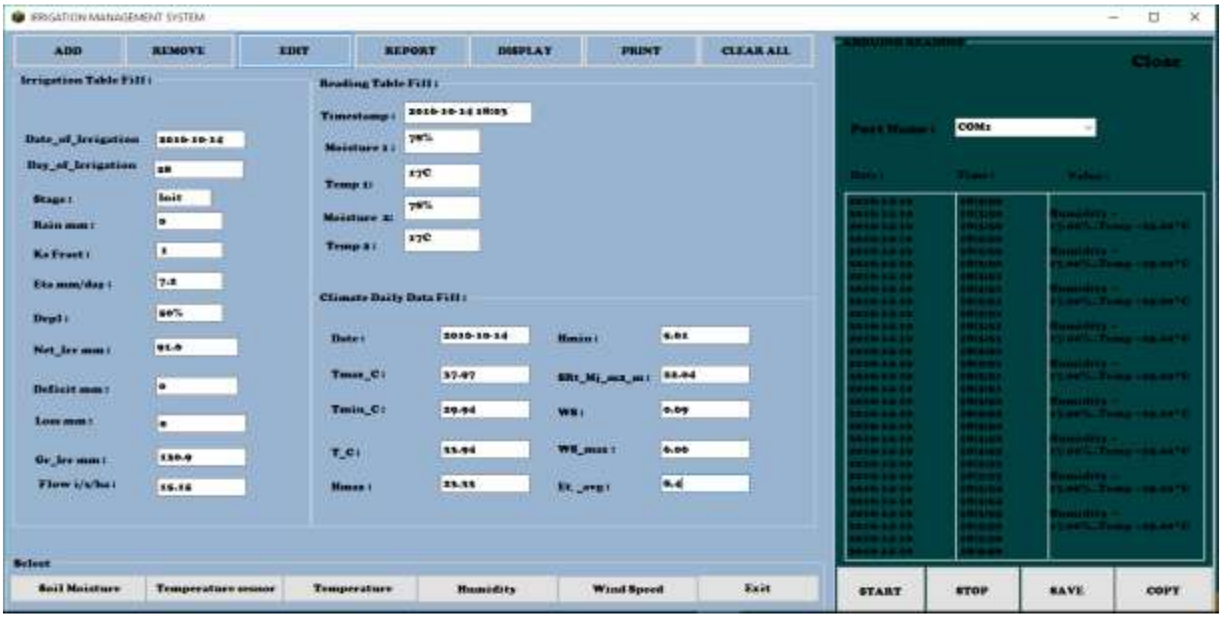


Figure (3): The designed GUI page.

III. RESULTS

The presented system has been tested over a simulated farm that provides the database with the required data for producing the desired irrigation scheduling table over a specific time period. This is to ensure the efficiency of the presented system. Fig. 4, explains the imported data from the selected shown at the right side of the page. Additionally, the right side of the page shows the recruited data from sensors. At the same time, the left side illustrates the transferred data from the port to the related columns of tables. Three table of the database have been filled with the readings from sensors as well as the constant values related to the soil and plant types.

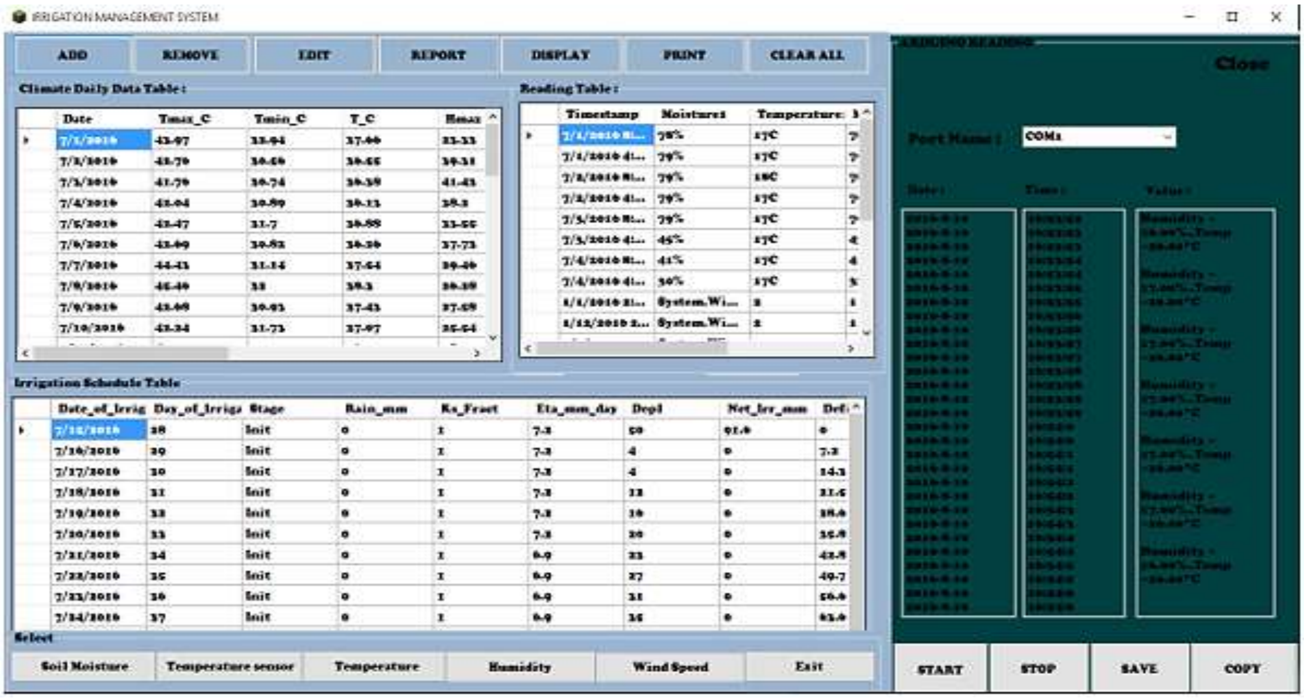
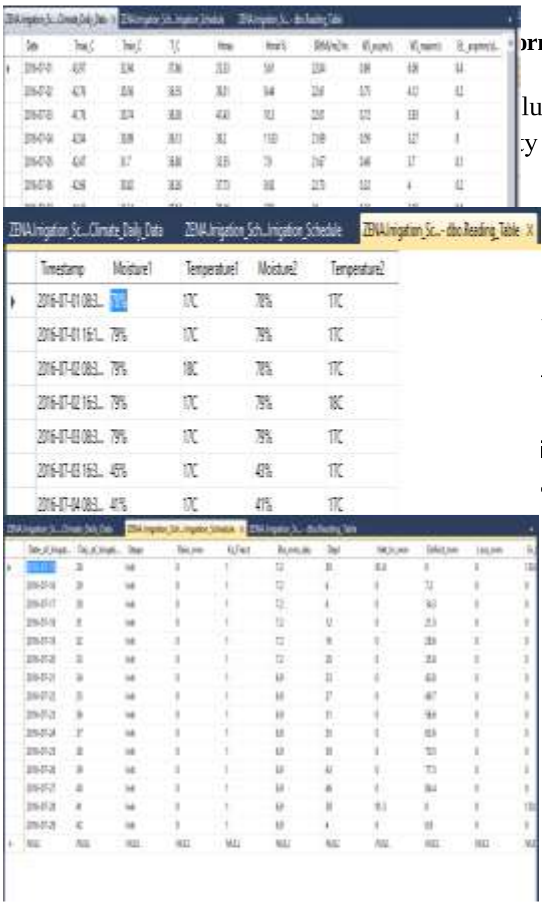


Figure (4): The data at the GUI page.

Fig. 5, shows Climate Daily Data table filled with the imported data from the GUI page. It is shown that all the columns are filled with the information of forecast and other soil and plant related information.



ormation.

ludes the
y of two

ion.

rigation
and the
ield has
aning.

Fig. 8, explains the temperature and soil moisture obtained from the sensors' readings. It shows the variation of these two important factors in the irrigation scheduling.

Figure (8): Temperature and soil moisture chart.

The measured humidity from the forecast expectation is shown in Fig 9. Fig. 10, shows the recording wind speed. This is also important factor in the evaluation of irrigation scheduling.

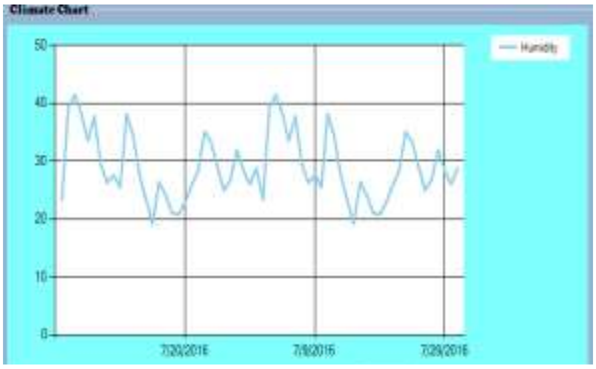


Figure (9): Humidity chart.

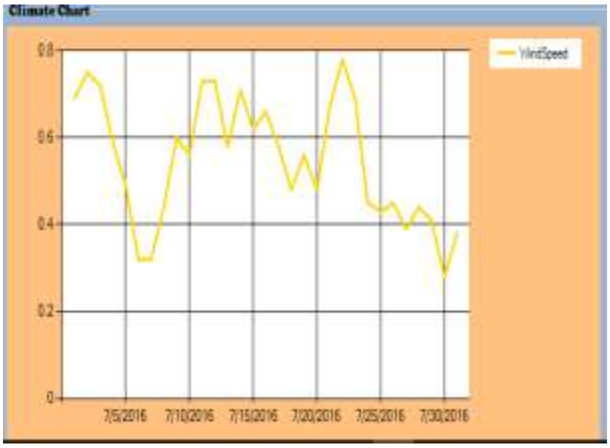


Figure (10): Wind speed chart.

IV. CONCLUSIONS

A database based irrigation management system has been introduced. The system includes two parts: a database and GUI design. The database includes three tables: Climate Daily Data, Reading, and Irrigation Scheduling. These table contains the information from the forecast, sensors' readings and types of considered soil and plants. The presented system provided the user with the irrigation scheduling that manage the watering of plants to avoid the overwatering that harms the plants. In order to ease the dealing with the system as well as connecting the imported readings with the database, a GUI page has been built. This page used one of serial ports of the computer to collect the readings of sensors. These readings were transferred to the related tables of the built database. The presented system was tested, and the obtained results showed the efficiency and accuracy of it.

REFERENCES

[1] "Irrigation Scheduling to Improve Water- and Energy Use Efficiencies", Online https://www.bae.ncsu.edu/programs/extension/evans/ag452-4.html.

[2] H. Jeonghwan, SH. Changsun, and Y. Hyun, "Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Networks", National University, www.mdpi.com/journal/sensors , 2010.

[3] V. Agarwal, "Beginning C# 5.0 Database", Second Edition, Copyright © 2012 by Vaidya Vat Agarwal.

[4] K. Gopala, C. Yaashuwanth and K. Venkatesh, "A Wireless Remote Monitoring of Agriculture Using ZigBee", Department of Information Technology, SRM University, International Journal of Engineering and Innovative Technology (IJEIT), 2013.

[5] P. Jason, "Mastering C# Database Programming", San Francisco London, 1151 Marina Village Parkway, Alameda, CA 94501, 2003.

[6] A. Singels and F. Olivier, "A Database of Crop Water Use Coefficients for Irrigation Scheduling of Sugarcane", South African Sugarcane Research Institute, https://www.researchgate.net/publication/265753724, 2016.