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Water Control System in a Controlled Environment

A thesis submitted for the degree of MS.C in Computer Science

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Abstract

The process of controlling the water needs of plants cultivated in green houses is not an easy process, but if this process has become computerized, it leads to development of agriculture optimally and to an accurate determination of evapotranspiration which is a required measure for many studies that involve estimation of the water balance.

In this thesis , a Water Control Information System was developed , using penman algorithm to calculate evapotranspiration, which was used to determine the required water amount for plant implanted in a known properties environment.

The system database , that contain soil and plant information was build based on FAW [3] , and dedicated circuits that developed to controls temperature were developed .

The system was implemented using Microsoft visual Basic ,simulator of electronic and logic circuits protest , Microsoft SQL Server and Microc and testing results shows the efficiency of system in generating reports that determine the total water amount needed for specific plant, the number of irrigations , amount of water in each irrigation and the period of time between irrigations.

This research has economical benefits that will support agriculture in scientific ways and this will enforce the sudanese agricultural exports in order to be the biggest agricultural exports country in the world.

The research tools used were available that it's made the applying of the system is easy and economically effective in a world depend on technology in order to systemize it's life

المستخلص:

تعتبر عملية التحكم في المياه المطلوبة لري النباتات المزروعة في بيوت محمية ومعرفة الاحتياجات المائية الفعلية لها ليست بالعملية السهلة ، غير أنه إذا تمت حوسبة هذه العملية فسيقود ذلك الى نمو النباتات بطريقة مثلى وذلك نسبةً الى تحديد الاحتياجات المائية الفعلية بطريقة علمية محكمة وتحديد البخر-نتح المرجعي المفيد دراسات تقديرات المياه.

وفي هذا البحث قد تم تطوير نظام للتحكم باستخدام خوارزمية بنمان المعدلة لتحديد المياه المطلوبة لنبات ما مزروع في بيئة معلومة الخصائص.

وقد تم تكوين بيانات النظام والتي تشمل التربة والنباتات بناءً على منظمة الاغذية والزراعة (فاو) ، وتم تصميم دائرة كهربائية لتحسس درجة الحرارة الخارجية ، والتي تعتبر عامل مؤثر في تحديد الاحتياجات المائية.

تم تنفيذ هذا النظام باستخدام مصمم واجهات مايكروسوفت فيجوال بيسك ، ومحاكي الدوائر الكهربائية والمنطقية بروتست، مايركوسوفت إس كيو إل سيرفر لتصميم قواعد البيانات و مايكرو سي لبرمجة الدائرة الكهربائية ، حيث أظهرت النتائج الاختبارية فعالية هذا النظام في الإيفاء بتقرير يحدد إجمالي كمية المياه المطلوبة لزراعة نبات ما ، عدد الريات ، كمية المياه المطلوبة في كل رية والفترة الزمنية بين كل رية وأخرى.

ولهذا البحث فائدة إقتصادية تدعم سبل الزراعة بطرق علمية والتي بدورها تعزز صادر السودان الزراعي مما يجعل من السودان سلة لغذاء العالم .

إن الادوات التي أُستخدمت في هذا البحث ، سهل الحصول عليها مما يجعل تطبيق النظام سهل و ذو جدوى إقتصادية في ظل عالم يعتمد كل وسائل التكنولوجيا في تنظيم حياته.

SCIENCE

1-1 Introduction

Irrigation Water Control is a modern concept need by countries to build a successful , economical policies . hence irrigation control system are helpful in achieving best production of plants which save the food for human who are the base of the state.

The concept of Greenhouse was appeared during the 21st century behind the main reason of planting a new environmental plant in certain environment under the purpose of scientific studies and research or food security.

Water Control System means to control in water quantity for certain purpose throw an automotive machine and electronic circuits to use water in agriculture, industry ..etc.

Water Control Information Systems are supplying us with the information to identify water needed and studding deals of plants that in flounced their use of water in ease of planting well known environment.

1-2 Research Question:

1. What is the amount of water needed for a given plant with known properties?
2. What is the number of irrigations needed ?
3. What is the most appropriate amount of water to wash salts from the soil for the cultivation of a given plant?
4. What will be the adequate time interval between irrigations?

1-3 Objectives

The objective of this thesis is develop a water control system that calculates and control the water requirements for crops planted in a greenhouse, taking in consideration climatic and environmental factors .

The developed system was assumed to provide answers for the questions regarding irrigation in controlled environment.

1-4 Research Scope:

All plants growing in a greenhouse facing a controlled environment variable can be controlled such as Temperature, humidity and solar radiation and from Knowledge of all the variables we can calculate the water needs of plants.

In this study we take the pants, degree of temperature, and degree of humidity, soil type and solar radiation as variable. to build a well defined water control system for a greenhouse or any other controlled environment, there are many factors that has to be take in consideration such as temperature, humidity , soil radiation and sand properties .

In the developed water control system , we consider only factors of soil properties, plant properties, humidity degree and temperature degree ,other factors such as amount of rain water and water for other needs are not consider

1-5 Research Tools:

In the development of water control system the following tools are used: 1- Software:

Microsoft Sql Server: to implement database and to make the rules between factors of plant, soil and weather.

microC to write code of circuit of temperature and humidity (LM35 is sensor of temperature)

Microsoft visual basic: to design interface of application and to connect all components of system.

Protest: to make simulation of hardware

circuits 2- Hardware:

LM35: sensor of temperature.

ATMEGA 16: microcontroller to run program. LCD: to view results.

Electrical heating elements. LED's.

Buzzer tone.

1-6 Methodology:

Descriptive research method used in present situations. It involves the recording, description, analysis and the presentation of the present system. Irrigation control systems in greenhouse are controllers that automatically update the watering schedule to allow for changes in water needs throughout the year. So a smart controller will automatically reduce the watering times as the weather gets cooler and less water is needed. Then as the weather begins to warm up, the controller will add more watering time. The way this typically works is that you set the controller for a default maximum watering time, based on the hottest time of year. Then the controller reduces that time amount by a percentage value when less water is needed. All data used in this system were collected from the FAO [paper FAO 56] and taking readings of the test results and we have also set up an algorithm for the equation of Penman to definition new method (calculable) for calculates the irrigation water requirements.

1-7 Thesis organization

Chapter two describes the greenhouse concept and irrigation water requirements as main core of study and describe the temperature circuit components.

In chapter three the design of proposed system was described, and chapter four show the implementation of the system, testing and results ,and finally in chapter five conclusions and recommendations are given.

