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MICROCONTROLLER BASED PLANT IRRIGATION

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ABSTRACT

Appropriate environmental conditions are necessary for optimum plant growth, improved crop yields, and efficient use of water and other resources. Automating the data acquisition process of the soil condition allows plant growth with less labor requirement. The existing systems employ PC or SMS-based systems for keeping the user continuously informed of the conditions of the field; but are unaffordable, bulky, difficult to maintain and less accepted by the technologically unskilled workers. By using ZigBee technology, we can monitor water by taking readings from a remote location. We can implement this system in parks, agricultural fields, and lawns by placing sensors in the soil that monitors the moisture level in the soil. If the water content is reduced, then the system will send the information about the moisture level to the microcontroller by using ZigBee modules. The objective of this project is to design a simple, easy to install microcontroller-based circuit to monitor and record the values of soil moisture and fertilizer level that are continuously modified and controlled in order to optimize them to achieve maximum plant growth and yield. The microcontroller (8051) used is a low power, cost-efficient chip by ATMEL. It communicates with the sensor modules in real-time in order to control the irrigation process

Efficiently inside a field by actuating a motor (to irrigate the field) according to the necessary condition of the crops. The design is quite flexible as the software can be changed any time. It can thus be tailor-made to the specific requirements of the user. This makes an efficient system for optimization of yield with minimum use of water. This system is also economical, portable and user friendly.

Keywords: Micro controller; Temperature Sensor; Humidity Sensor; Soil Moisture Sensor

I. INTRODUCTION

Agriculture uses 85% of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial, and institutional improvements .There are many systems to achieve water savings in various crops, from basic ones to more technologically advanced ones. For instance, in one system plant water status was monitored and irrigation scheduled based on canopy temperature distribution of the plant, which was acquired with thermal imaging. In addition, other systems have been developed to schedule irrigation of crops and optimize water use by means of a crop water stress index (CWSI).The empirical CWSI was first defined over 30 years ago. This index was later calculated·

Monitoring of temperature and humidity is important for obtaining high quality environment. Remote monitoring is efficient method in order to avoid the interference of environment. Today use Ethernet network,

RF module and ZigBee wireless network used to transmit data in remote monitoring system these paper gives GSM-ZIGBEE based remote control and monitoring system with automated irrigation system is proposed. The design represented has advantage of ZigBee and GSM technology.

II. LITERATURE SURVEY

In this paper, soil moisture sensor, temperature sensors placed in root zone of plant and gateway unit handles the sensor information and transmit data to a web application. One algorithm was developed for measure threshold values of temperature sensor and soil moisture sensor that was programmed into a microcontroller to control water quantity. For power photovoltaic panel was used. Another facto like cellular-Internet interface used that allowed for data inspection and irrigation scheduling to be programmed through a web page.

The automatic system was tested for 136 days and save 90% compared with traditional irrigation system. Three replicas of the automated system have been used successfully in other places for 18 months. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated area.In this paper, soil moisture content has been detected using acoustic based technique was developed. The main propose of this technique is development for measure soil moisture in real time method. The technique based on relationship between two quantities i.e. speed of sound and the degree of saturation with water in soils. This experiment found that the speed of sound decreases with the moisture content following, depending on the kind of soil.

This paper design a model of automatic irrigation system which is based on microcontroller and solar power was used only for source of power supply. Various sensors are placed in paddy field. Sensors sense water level continuously and give the information to farmer through cellular phone. Farmer controls the motor using cellular phone without going in paddy field. If the water level reaches at danger level, automatically motor will be off without conformation of farmer. The automatic system based on ARM and for communication GSM technology was used. Irrigation system provides foe adequate irrigation in particular area which is real time. Soil moisture sensor placed in root zone in paddy field and sense water level. The system was set up using ARM7TDMI core and GSM. GSM is an important part of these this system. System communicates using GSM. GSM operate through SMS and is a link between ARM processor and centralized unit. This system detects climate condition and field condition in real time. This information send to user in the form of SMS and GSM modem is controlled with the help of standard set of AT (Attention) commands. These commands are used to control majority of the functions of GSM model.

In the paper, automatic irrigation technique irrigated using wireless sensor network i.e. Zig-Bee and internet technology. The idea was developed for improve irrigation system and reduced cost of irrigation water. Sensors are placed in farm and sense continuously and collect he information. This information stored at center monitor and also passes to data collection interface and then transmits to the wireless sensor node. Using this information system was control automatically using internet.

III. NEED OF AUTOMATIC IRRIGATION

Automatic irrigation systems are convenient, especially for those who travel. If installed and programmed properly, automatic irrigation systems can even save you money and help in water conservation. Dead lawn

grass and plants need to be replaced, and that can be expensive. But the savings from automatic irrigation systems can go beyond that. Watering with a hose or with oscillator wastes water. Neither method targets plant roots with any significant degree of precision. Automatic irrigation systems can be programmed to discharge more precise amounts of water in a targeted area, which promotes water conservation.

IV. THE HARDWARE SYSTEM

4.1 GSM Module

GSM/GPRS module is been used to bring internet connectivity. It includes an embedded transmission control protocol/internet protocol to bring this internet connectivity. It also consists of UFL antenna connector and SIM (subscriber identity module) socket. If your native language is not English, please get a native English-speaking colleague to carefully proofread your paper.

4.2 Microcontroller

Microcontroller: entire automation is done using microcontroller.

4.3 Wireless Sensor Unit

Several WSU are been deployed in-field to configure the distributed sensor network for automated irrigation system. WSU comprises of radio frequency transceiver, sensors, a microcontroller, and power.

4.4 Wireless Information Unit

Wireless information unit: all data from WSU is been received, identified, and analyzed in WIU. It consists of master controller, GPRS module, and web application.

V. DESIGN OF PROPOSED HARDWARE SYSTEM

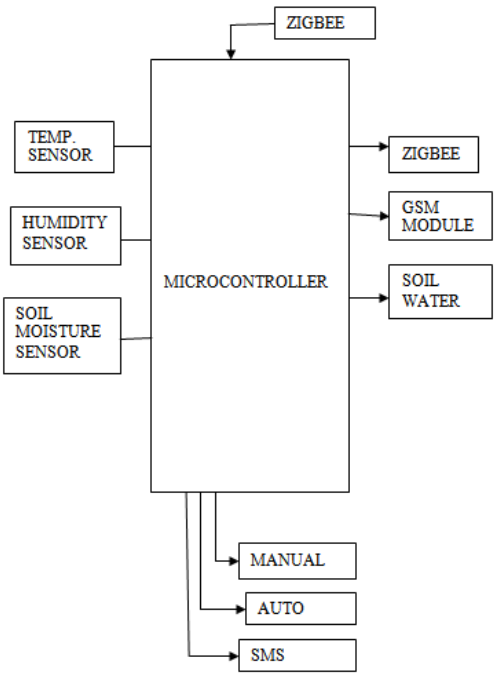

Fig.1 Block Diagram

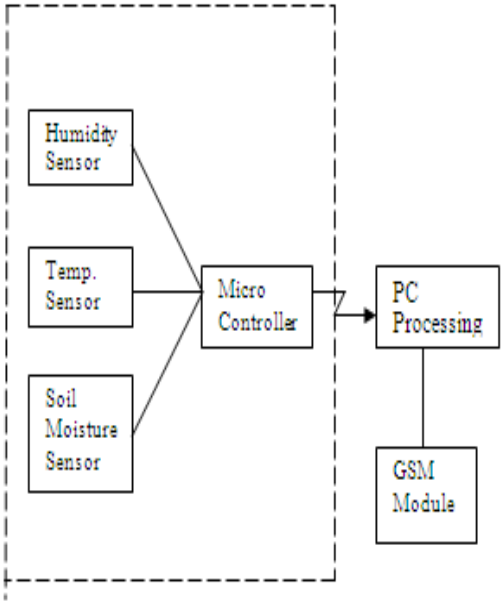

Fig.2 Proposed System Block Diagram

VI. BOARD HARDWARE RESOURCES FEATURES

6.1 Temperature Sensor

Thermistors are thermally sensitive resistors whose prime function is to exhibit a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature. Negative Temperature Coefficient (NTC) thermistors exhibit a decrease in electrical resistance when subjected to an increase in body temperature and Positive Temperature Coefficient (PTC) thermistors exhibit an increase in electrical resistance when subjected to an increase in body temperature U.S.Sensor produces thermistors capable of operating over the temperature range of -100° to over +600° Fahrenheit. Because of their very predictable characteristics and their excellent long term stability, thermistors are generally accepted to be the most advantageous sensor for many applications including temperature measurement and control.

Fig.3 Temperature Sensor

6.2 Soil-Moisture Sensor

Soil moisture sensors measure the water content in soil. Most of soil moisture sensors are proposed to measure soil volumetric water content base on the dielectric constant of soil. Through the electric constant can find the transmit electricity. Electricity constant depend on the water content of soil so if dielectric constant increases as water content of the soil increases. Thus, measurement of the dielectric constant gives a predictable estimation of water content. Soil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors.

Fig.4 Soil Moisture Sensor

6.4 Humidity Sensor

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical and biological processes.

In agriculture, measurement of humidity is important for plantation protection (dew prevention), soil moisture monitoring, etc. For domestic applications, humidity control is required for living environment in buildings, cooking control for microwave ovens, etc. In all such applications and many others, humidity sensors are employed to provide an indication of the moisture levels in the environment.

Fig.5 Humidity Sensor

6.5 Zigbee

ZigBee is a specification for a suite of high-level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is based on an IEEE 802.15.4 standard. Though its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics, ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys.) ZigBee has a defined rate of 250 kbit/s, best suited for intermittent data transmissions from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that require short-range low-rate wireless data transfer. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi.

ZigBee was conceived in 1998, standardized in 2003, and revised in 2006. The name refers to the waggle dance of honey bees after their return to the beehive.

6.6 Reason why ZigBee is been used are:

- Standards based
- Low cost
- Can be used globally
- Reliable and self-healing
- Supports large number of nodes
- Easy to deploy
- Very long battery life
- Secure

Fig.6 Zigbee

6.7 GSM Modem

Short Message Service is GSM techniques to transfer data from distant places such as from one area to the area of the same city or from another city .In our project we are using SMS technique to instant or quick transfer of data or notice to the required destination. It is a convenient facility of the GSM network. A message consisting of a maximum of 160 alphanumeric characters can be send to or from a mobile station. If the subscriber's mobile unit is powered of f or has left the coverage area, the message is stored and offered back to the

subscriber when the mobile is powered on or has reentered the coverage area of the network. This function ensures that the message will be received.

Fig.7 GSM Modem

6.8 8051 Microcontroller

The 8051 Microcontroller was designed in 1980's by Intel. Its foundation was on Harvard Architecture and was developed principally for bringing into play in Embedded Systems. At first it was created by means of NMOS technology but as NMOS technology needs more power to function therefore Intel re-intended Microcontroller 8051 employing CMOS technology and a new edition came into existence with a letter 'C' in the title name, for illustration: 80C51. These most modern Microcontrollers need fewer amount of power to function in comparison to their forerunners. There are two buses in 8051 Microcontroller one for program and other for data. As a result, it has two storage rooms for both program and data of 64K by 8 size. The microcontroller comprise of 8 bit accumulator & 8 bit processing unit. It also consists of 8 bit B register as majorly functioning blocks and 8051 microcontroller programming is done with embedded C language using Keil software. It also has a number of other 8 bit and 16 bit registers. For internal functioning & processing Microcontroller 8051 comes with integrated built-in RAM. This is prime memory and is employed for storing temporary data. It is unpredictable memory i.e. its data can get be lost when the power supply to the Microcontroller switched OFF.

Fig.8 8051 Microcontroller

VII. ADVANTAGE OF PROPOSED SYSTEM OVER PREVIOUS MODEL

Less hardware involve: this proposed system consist of less hardware as compared to the previous model hence it is compact as compared to the previous system.

Cost efficient: this proposed stem is more cost efficient than the previous system this claim is made on the fact that the proposed system does not need the heavy and expensive hardware for implementation.

VIII. BASIC ADVANTAGES

Saves water: studies show that this type of automated irrigation system consumes 40-50% less water as compared to the traditional system.

Improves growth: ideal growth condition is been provided when small amount of water is been applied over large amount of time. This smart irrigation system extends watering time for plants, and provides ideal growth condition.

Save time: in this sprinklers moving and setting is not required hence it saves time and timer delay as per the environmental condition can be added for automatic watering.

Adaptable: this smart irrigation system can be adjusted and modified according to the changing environment.

Simpler method: it is simple to operate it starts by designing the map of your garden and marking the location of planting. Then the required distance is been measured for length of plastic tubing so that the desired area can be reached.

IX. CONCLUSION

This type of system requires less man power for operation. The water is been supplied by the system only when the soil humidity goes below the reference level. The soil ratio at the root zone is been maintained constant at some extent by providing direct transfer of water to the roots which further result in less water consumption. The system helps minimizing the overall watering and crops production cost.

This system is relatively low cost and user friendly due to a ZigBee network used. Besides the monetary savings in water use, the importance of the preservation of this natural resource justify the use of this kind of irrigation systems.

This system is considered to be cost effective and allow cultivation of agricultural products and plants in the area where there is water scarcity. It requires very less maintenance and is adjustable according to the changing environment.

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