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AUTOMATED IRRIGATION SYSTEM USING SENSOR NETWORK AND GSM MODULE

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Abstract

An automated irrigation system was developed to optimize water use for agricultural crops. The system has a distributeds e n s o r network for soil-moisture andced in the root zone of the plants. In addition, a The motivation for this project came from the countries where economy is based on agriculture and the climatic conditions lead to lack of rains & scarcity of water. The farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of the land. Even if the farmland has a water-pump, manual intervention by farmers is required to turn the pump ON/OFF whenever needed. In this paper we tried to minimize this manual intervention by the farmer. In recent times, the farmers have been using irrigation technique through the manual control in which the farmers irrigate the land at regular intervals by turning the water-pump ON/OFF when required. This process sometimes consumes more water and sometimes the water supply to the land is delayed due to which the crops dry out. Therefore in this paper we use an GSM Module which helps the farmer to ON/OFF the motor without his physical presence in the field.

Key Words: cellular networks, Internet, irrigation, measurement, water resource sensor networks .

Introduction

Irrigation system is critical in the development of agriculture of every country. It has been established that efficient irrigation processes has the potential of literally doubling the amount of food a farm processes. Integrating modern technologies in irrigation management systems is one of the ways of enhancing the irrigation processes to optimize the use of water, electric power consumption, and labour costs. The success of irrigation management systems however, depends on the timely application of the water required to meet the water needs of the crops.

The timing for watering farmlands is also influenced by factors such as rainfall, soil moisture level, characteristics of the soil composition, and nature of crops. Another important factor that is critical to irrigation management system is the scheduling plan or timetable system, which is mostly developed to maximize crop production with minimal water wastage. Although modern irrigation techniques such as drip line and sprinkler systems have been introduced to improve farming activities, integrating modern technologies may further guarantee improvement in food security.

Regardless of the irrigation techniques used, in most developing countries however, many of the irrigation systems that are operated are often located further from the cities and towns with limited telecommunication infrastructure and high service cost. This somehow makes it difficult for most of the farmers to remotely carry out

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effective monitoring and control of the irrigation systems. With the emergence of wireless communication technology such as the GSM (global system for mobile communication) networks which is one of the most vital communication systems that is easily accessed globally with very low SMS (short message service) service cost, new approaches are being explored to revolutionarize the operations of the irrigation systems. Various attempts have been made over the past few years to integrate wireless communication technology in irrigation management systems to promote efficient farming activities and reduce water wastage.

Proposed an integrated GSM technique for the control and management of the irrigation system. To facilitate watering, the system sets the irrigation time using the temperature and humidity data from the sensors and the type of crop. The authors used Bluetooth as a secondary means beyond the SMS to transit information to the user any time the user is located within the coverage range. In the work of Kim , a distributed irrigation system was discussed where a single board computer was used to control the solenoids of a group of nozzles in the network using wireless network and GPS (global positioning system). The conditions of the field were transmitted remotely to a central server using Ethernet radio. Zhou et al also proposed a wireless sensor network based irrigation control system where the zigbee technology was used instead of the conventional wired connection to provide more flexibility in the coordination of the field data.

The general architecture of the implemented GSM-based irrigation controller system . The design consists of three main systems: integrated hardware system, communication system, and control strategy. The integrated hardware system consists of power supply system, microprocessor system, sensing system, pump switching system, intrusion detection system, GSM communication module, and LCD display system. The communication system implements the communication protocol to facilitate data communication among the devices of the integrated hardware and also between the user and the controller system. The control strategy on the other hand is responsible for measures for operating the irrigation system. The operational logic for control of the irrigation system is implemented on the microcontroller. The controller system on initialization checks for the control information and scheduling plan.

transferred every 60 minutes to the SimCard storage space on the GSM module which is interfaced to the microcontroller. The microcontroller controls the functions of the various devices that are interfaced to it and also manages the communication protocols required to execute specific tasks. A 16 x 2 line LCD driver circuit is interfaced to the microcontroller The GSM module also serves as the medium for system data transfer from the controller system to the user and also requests (conditions and operations) from the user to the controller system via SMS. To controller system is equipped with intrusion detection system interfaced to the microcontroller which generates alarm signal and transmitted to the user via SMS any time the controller system is opened or tampered with by unauthorized users.

A. Sensor Unit

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. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel.Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort.Controlling or monitoring humidity is of paramount importance in many industrial & domestic applications. In semiconductor industry, humidity or moisture levels needs to be properly controlled & monitored during wafer processing. In medical applications, humidity control is required for respiratory equipments, sterilizers, incubators, pharmaceutical processing, and biological products. Humidity control is also necessary in chemical gas

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purification, dryers, ovens, film desiccation, paper and textile production, and food processing.

To mention moisture levels, variety of terminologies are used. The study of water vapour concentration in air as a function of temperature and pressure falls under the area of psychometrics. Psychometrics deals with the thermodynamic properties of moist gases while the term "humidity' simply refers to the presence of water vapour in air or other carrier gas.

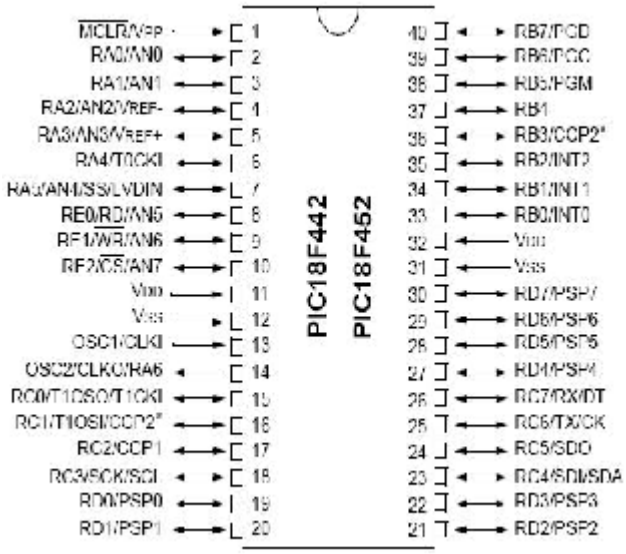
Humidity measurement determines the amount of water vapor present in a gas that can be a mixture, such as air, or a pure gas, such as nitrogen or argon. Various terms used to indicate moisture levels .

PIC MICROCONTROLLER

PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller" now it is "PIC" only.

PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

The original PIC was built to be used with General Instrument's new CP1600 16-bit CPU. While generally a good CPU, the CP1600 had poor I/O performance, and the 8-bit PIC was developed in 1975 to improve performance of the overall system by offloading I/O tasks from the CPU. The PIC used simple microcode stored in ROM to perform its tasks, and although the term was not used at the time, it shares some common features with RISC designs.



LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

GSM MODULE

GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation

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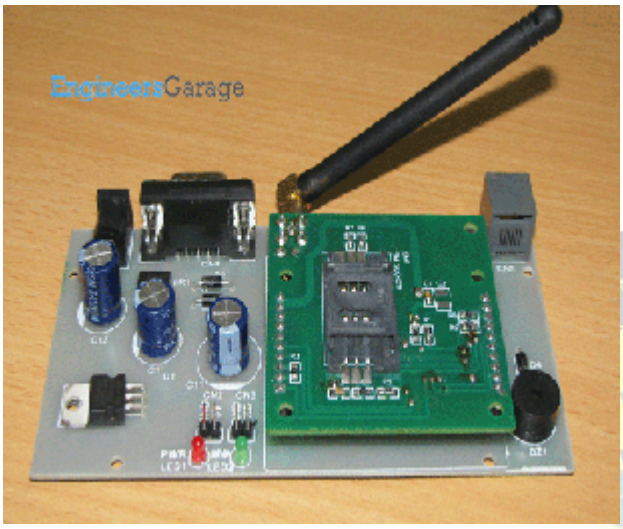
(2G) digital cellular networks used by mobile phones. It is the default global standard for mobile communications with over 90% market share, and is available in over 219 countries



GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI(International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:

GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network—macro, micro, pico, femto, and umbrella cells.

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Cell horizontal radius varies depending on antenna height, antenna gain, and propagation conditions from a couple of hundred metres to several tens of kilometres. The longest distance the GSM specification supports in practical use is 35 kilometres (22 mi). There are also several implementations of the concept of an extended cell, where the cell radius could be double or even more, depending on the antenna system, the type of terrain, and the timing advance.

Indoor coverage is also supported by GSM and may be achieved by using an indoor picocell base station, or an indoor repeater with distributed indoor antennas fed through power splitters, to deliver the radio signals from an antenna outdoors to the separate indoor distributed antenna system. These are typically deployed when significant call capacity is needed indoors, like in shopping

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