International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Advance Technique of Automatic Water Regulation for Agriculture Purpose Using RF Module

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Abstract: ***The title itself indicates that the system checks the moisture content in the soil and based on moisture content, motor will be on/off automatically. In this paper, the system divides in three nodes. The central node based on ARM7 and other two nodes are based on AVR. The heart of whole system will be central node. In each nodes, soil moisture sensor, RF module and solenoid valve are attached. By using the soil sensor, we can find, whether the soil will be dry or wet. If the soil is dry then the motor will on and if the soil is wet, motor will off. All information will be display on central node LCD. The motor will be on or off, according to particular node condition. When one node is dry then motor will be on, in that particular node, similarly, same condition will be apply for all nodes. When two nodes will dry, then two motor of that node will be on. Here, the soil sensor gives the status of moisture to the microcontroller through rf modem and this all information send to microcontroller, based on that information motor will be on or off. All information of irrigation stored in data logger in central node. The pumping motor will pump the water into the field until the field is wet. When the soil is wet, motor will off automatically. This saves the water at the same time and on the other hand the plant can get optimum level of water, so increasing productivity of crop.***

Keywords: Irrigation system, soil moisture sensor, ARM 7, AVR, RF module.

1. Introduction

Agriculture is only the source to provide increasing demand of food. Economy and development of our country depends upon agriculture field and it's very important to improve technology which will be used in agriculture. In agriculture, soil plays an important role in the overall yield of crop production. Although it is expected to enhance the yield by applying fertilizers, lack or excess levels of soil nutrients should be monitored. Due to lack of water and scarcity of land water result the decreasing volume of water on earth, the Farmer use irrigation. . Irrigation may be defined as the science of artificial application of water to the land or soil that means depending on the soil type, plant are to be provided with water. There were many intelligent irrigation systems (IISs) available and were used to compute crop water requirements based on climatic data. In the field of agriculture, use of proper method of irrigation is very important from yield point of view and scarcity of water. Sometimes excessive amount of water is continuously given to the crop or sometimes very less amount of water is given to the crop which may spoil the crop. There are many plants that are very sensitive to water levels and they required specific level of water supply for proper growth, if this not they may die or results in improper growth. It's hardly possible that every farmer must possess the perfect knowledge about growing specifications of plants in case of water supply.

An automatic irrigation system used for irrigate sage crop field for 136 days and save 90% water as compare to traditional irrigation system using wireless network and GPRS system(1) . The Brutsaert's model used for measure the moisture of agricultural soils by an accurate, on site, real-time method and also derived the speed-moisture curves, the conditions for the actual validity of the curves, and the suitable sound frequency for performing the measurement, for a wide range of agricultural soils in different physical conditions(2). For automatic irrigation systems irrigate using cellular phone and for power source used solar power (4). Arm also used for monitoring the irrigation system in real time based and for irrigation system, system irrigates using GPRS system (5). Automatic irrigation system control using Zigbee and internet thing (6). GPRS technique has some disadvantage viz speed, distance factor, reliability, so GPRS is not used in our project. Zigbee also have disadvantage i.e. low transmission rate. It is only use for smaller distance. Maximum papers have problem in networking and also some security issues.

2. Methodology

The Automatic Irrigation system consist of three nodes, first node will be central node which is based on LPC21418 microcontroller and other two nodes are based on AVR Atmega16-L microcontroller which is a low power. In this system, there is three soil moisture sensors, three CC2500 RF modules and three solenoid valves required. Soil moisture sensor sense the value of moisture and using CC2500 rf modem pass the signal to the microcontroller and according to the status of moisture, motor will be ON/OFF. In Automatic Irrigation, soil moisture sensors, CC2500 rf modem and Microcontroller is an exclusive instrument that can automatically feed plants with water according to their need without farmer's interference. Design of an intelligent irrigation system will manage flow of water into the field. The system comprises of Soil moisture sensors to know the status of the water level in the farm, Solenoid valves for controlling water flow to the farm.

3. System Architecture

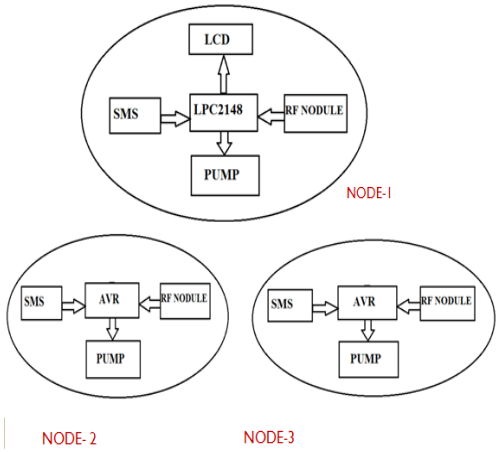

Figure 1: Block diagram of RF module based intelligent irrigation system

3.1 LPC21418 microcontrollers

The LPC21418 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kB to 512 kB. A 16/32-bit microcontroller with 44-pins and that operates in a range 2.0 to 3.6 V. One or two 10-bit ADCs provide a total of 6/14 analog inputs, with conversion times as low as 2.44 us per channel. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code Execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs. These microcontrollers are well suited for remote application, industrial control and medical systems.

3.2 AVR Atmega16-L microcontroller

In this system ATmega16L microcontroller is used. The ATmega16L is a low-power CMOS 8-bit microcontroller with 8- channel based on the AVR enhanced RISC architecture with operating range from 2.7 to 5.5 V. A microcontroller has High-performance, High Endurance Non-volatile Memory segments, Peripheral Features. The microcontroller has 10-bit ADC, Programmable Serial USART, On-chip Analog Comparator and Special Microcontroller Features like External and Internal Interrupt Sources, Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby.

3.3 Soil moisture sensor

There are different types of soil sensor technologies and measurement techniques that have been developed for the measurement of soil moisture content. The commonly used soil sensors are based on frequency domain reflectometry (FDR), which uses capacitance probes to measure the dielectric permittivity of the soil. In this work however, we used a resistive soil sensor, which was developed using two probes to pass electrical currents into the soil and reads the response or resistance to get the moisture content of the soil. The resistive sensor works on the principle that the more moisture we have in the soil makes the soil to conduct electricity easily due to lower resistances while dry soil conditions makes the soil conducts electricity poorly due to higher resistance. Although conditions such as salinity and temperature from intense sunshine are likely to affect the resistance and subsequently the sensitivity of the sensor, we however, consider these effects minimal on the measured soil moisture values. Another type of simple soil sensor is a resistive sensor. It's made of two exposed electrodes, and uses the fact that the more water the soil contains, the lower the resistance between the two electrodes. The resistance can be measured using a simple voltage divider and an analog pin. While it's very simple to construct, resistive sensors are not extremely reliable, because the exposed electrodes can degrade and get oxidized over time.

3.4 CC2500 modem

CC2500 RF Modem also called the transceiver module which provides easy to use RF communication which operate at 2.4 Ghz ISM band. It can be used to transmit and receive data at multiple baud rates from any standard CMOS/TTL source. In this module no extra hardware circuit and no extra coding requires to turn wires communication into wireless one. This module is a direct line in replacement for your serial communication. This module provides communication in both directions, but only one direction at same time. This switching from receiver to transmitter mode is done automatically. This module works at multiple baud rates like 4800/9600/19200/38400. It also supports multiple frequencies within the same band rate thus avoiding data collision. There is no complex wireless connection software or intimate knowledge of RF is required to connect your serial devices. Designed of this module is easy to use as cables and also no external Antenna required. It works on 5v to 9v DC supply. For interfacing this module UART used.

3.5 Solenoid Valve

A solenoid valve is an electromechanical valve. The valve is controlled by an electric current through a solenoid coil. Solenoid valves may have two or more ports: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold. A solenoid valve has two main parts: the solenoid and the valve. The solenoid converts electrical energy into mechanical energy which, in turn, opens or closes the valve mechanically.

A solenoid is an electromechanical device which allows for an electrical device to control the flow of a gas or liquid. The electrical device causes a current to flow through a coil located on the solenoid valve. This current flow in turn results in a magnetic field which causes the displacement of a metal actuator. The actuator is mechanically linked to a mechanical valve inside the solenoid valve. The valve then changes state, either opening or closing to allow a liquid or gas to either flow through or be blocked by the solenoid valve.

4. Results and Conclusions

The results of this work are shown in the pictures.

In this paper, An Automated Irrigation System was developed which control the flow of water as per the requirement in different field and result are achieved satisfactory. By using soil moisture sensor, we can find whether the soil is wet or dry. If the soil is dry, motor will be on automatically. With the use of low cost instrument and better quality product, poor farmer also bought that system. The implementation of this project gives the water saving and also plant can get optimum level of water which will increase the productivity of crop.

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