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AUTOMATIC IRRIGATION SYSTEM USING WIRELESS SENSOR NETWORKS

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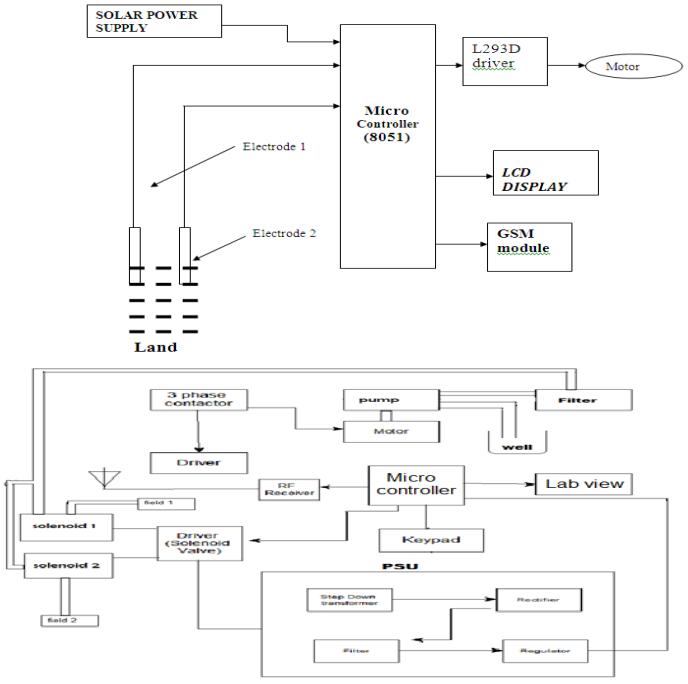
ABSTRACT:

Embedded systems are designed to do some specific task, rather than be a general-purpose computer for multiple tasks. Some also have real time performance constraints that must be met, for reason such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs.

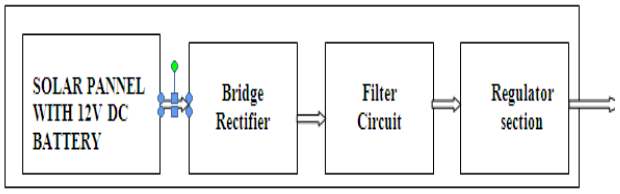
An embedded system is not always a separate block - very often it is physically built-in to the device it is controlling. The software written for embedded systems is often called firmware, and is stored in read-only memory or flash convector chips rather than a disk drive. It often runs with limited computer hardware resources: small or no keyboard, screen, and little memory.

In today's world in cultivation where there is a requirement of pumping water to lands, by using this scenario we can have the knowledge of the land weather it is dry or wet with the help of microcontroller, we can activate the motor with the help of its driver circuit L293D and thereby motor pumps the water into the land, the status of the presence of water available in land can be notified with the help of an SMS in the form of alert to the authorized mobile number which is programmed into the microcontroller. The status of the project is displayed on a 16X2 LCD.

This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 12V battery, which is powered by a solar panel.



POWER SUPPLY:



Technical Specifications:

1. MICRO CONTROLLER AT89S51
2. MAX 232
3. GSM MODEM
4. DC MOTER
5. POWER SUPPLY
6. L239D DRIVER.

SOFTWARE:

1. EMBEDDED 'KEIL C' LANGUAGE
2. MICRO FLASH\FLASH MAGIC

Introduction

For automatic irrigation controller, we need to measure different parameters i.e. atmospheric temperature, Humidity, Wind speed, Wind direction, Radiation, Soil temperature, Sunshine and Rain fall etc. The key objective of this project is to report on a developed indigenous low cost microcontroller based irrigation scheduler which performs user defined functions and outputs commands to derive appropriate actuators (relay, solenoid valves, motor). A soil moisture sensor was modeled, simulated and tested for achieving, low-cost, accurate and reliable measurements. This system presents the design and development of Irrigation controller System built using Micro controller. The system consists of water storage tank, fertilizer tank, moisture sensor to measure the moisture level of the soil temperature sensor (thermistor), a control system, LCD display, solenoid valves and driver circuit relay to switch on/off a motor. The sensor, made of two stainless steel nuts and bolts, is embedded in the soil near the plant. It constantly relays the moisture level of the soil to the electronic control system equipped with an LED panel. The blue light on the display panel indicates dry soil. When the blue LED lights up, the control system activates the solenoid valve, opening up water supply through the hose. As the soil becomes wet, the red LED glows and the water supply is cut off by the valve. The control unit can be adjusted for different moisture levels. The important feature of our project is the automatic fertigation system which automatically mixes the organic fertilizer with water and sends it to the agricultural land.

Keywords: Irrigation controller,fertigation system,moisture sensor,temperature sensor, Buck boost converter.

Introduction:

In India, Agriculture plays an important role in the development of the country's economy.Since scorching summers threatens our planet every year, our farmers are unable to cultivate our traditional crops at their suitable seasons. On other hand farmers are wasting water abundantly without proper management. This leads to the scarcity of water at the time of requirement. And also we read the article published in "cronicas de los tienpos " in April 2002 which shows the human life will be in 2070 due to scarcity of water .This article and the present day situation motivated us to do this innovative project. Dipping irrigationpracticing in some part of our country inspired us to do this advanced project. At present farmers are doing the irrigation manually, but in our project it is designed to irrigate automatically.

Technical Background:

The main themeis to control the water management for an irrigation system by automatic method does not require any man power. The important parameters are soil moisture sensor and temperature sensor, it Sense the soil moisture level and temperature level in the atmosphere, based on these transmit the signal by A/D converters to microcontroller. Microcontroller turn ON the relays to run the motor and to open the solenoid valve for specific fields and the water supply is made through the system to fields. In our project, we use microcontroller to control the overall system, it is the brain of the system. We use temperature sensor and soil moisture sensor, which are the main parameters. A 16x2 display is used to display the soil moisture content and temperature. The signals

are transmitted wirelessly by A/D converters to the microcontroller in the control room by a solar harvester fixed in the field. It work automatically and does not require power from external source and the turn ON the relays to run the motor and open the solenoid valves to supply the water to the specific field. These relays are controlled by high current driver ICs. After a certain period of time the moisture content in the soil increases and it Damage the crop. The moisture sensor transmits the signal to the microcontroller and turn OFF the motor. When the motor turn ON or OFF a message will be sent to the farmer's mobile. We also include a fertigation process that will automatically pass the fertilizer through the water to the field at a specific period of time. This way of water management to the field give good yield for the farmers, power consumption is low, water does not go waste. This project is a low cost product which can be brought by poor farmers. It is suitable for all climatic conditions.

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Proposed solution:

The Input Parameters used in the system are:
Power supply:

A 230 volt input AC supply is given to the transformer. It steps down into 12V AC supply and it is fed to the 7805 & 7812 Regulators converts it into regulated 5V&12V DC supply. It is then distributed to all the driver and relay circuits. 5V is given to the microcontroller and to all ICs used in the system.

Temperature sensor:

It is a measure of temperature at different levels of the Earth's atmosphere. It is governed by many factors, including incoming solar radiation, humidity and altitude. Here,we are using the thermistor(temperature sensitive resistor)for monitoring the soil temperature at regular intervals. When it exceeds the particular temperature,it sends the signals to the microcontroller. Then the process is carried out,it turns the motor ON and sends the water to the field.

Soil Moisture sensor:

The health of a plant is influenced by many factors, one of the most important being the ready availability of moisture in the soil. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. We are using the moisture sensor to monitor the moisture content of the soil. It consists of a connecting probe which is lays down in the soil. It is used to sense the moisture of the soil and sends the signals to the controller, if the moisture level reaches the preset value. Then the water is sent to the field. These sensors have no moving parts, they are precise, never wear out, don't need calibration, work under many environmental conditions, and are consistent between sensors and readings. Moreover they are not expensive and quite easy to use.

The output parameters used in the system are:

Microcontroller:
This stage converts the water flow rate, temperature, air humidity, wind speed and light intensity to the actual well balanced readings. The microcontroller accepts data from sensors and compares data with the pre-set points, corresponding signal is generated. According to this, the relay can switch on and off. Simultaneously it sends all sensor data from SIM300 to mobile user at control station. When we want to read data of all the sensors monthly/yearly we can access that data from external memory card storage.

GSM modem:

Short Message Service uses 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 sent to or from a mobile station. If the subscriber's mobile unit is powered off or has left the coverage area, the message is stored and offered back to the subscriber when the mobile is powered on or has re-entered the coverage area of the network. This function ensures that the message will be received. In our project we are using SIM300 for transfer of data from weather station. SIS is the leading manufacturers of GSM modems for lower price in India.

Solenoid valve:

Solenoid valve is an electrically operated device which consists of an energizing coil and a soft iron piece with a valve which cuts off or supplies the fluid. When supply is given to the coil it energizesand pulls the valve and the valve opens and water flows. When the coil de-energize, the valve closes automatically due to spring action and cuts off the supply of water.

Relay:

Relay is also an electrically operated device which consists of operating coil, two contacts of NC and NO which is elaborated as Normally Closed and Normally Open contacts. When there is no supply to the coil there is no change in the contact position. When supply is given to the coil the contact NO closes and NC opens. It is unchanged until the coil is in energized condition.

Organization of the report:

The field work was carried out at the field near to our college owned by our management. The scope of the project can be is discussed as below:

Design and development of the monitoring system:

It is important that measurements are made regularly and recorded systematically to allow improvement in irrigation scheduling and soil/plant management decisions. The need to determine the moisture status of the soil is a critical factor influencing plant production. Moisture content of the soil is a major factor determining plant's growth, especially in irrigated systems. The basic objective of irrigation scheduling is to minimize water stress of the plant, that of over irrigation, and under irrigation. The basic requirement is the ability to regularly obtain objective data. The ability to accurately measure soil water content, plant size and condition is an integral mechanism in the process of developing an irrigation scheduling program that allows a better understanding of plant and soil water relations. The objective of present work is to get an efficient weather monitoring system. Here efficient system which is reliable in any situation andconsistent in data transmission. To achieve this objective, GSM modem- SIM300 as a transmitting media is chosen.

Proposed Solution:

The area which is to be irrigated will be divided into a plurality of discrete zones of possible different soil conditions, where each zone includes moisture sensor, temperature sensor and solar panel. A solenoid valve having an "on" state and an "off" state for controlling the flow of water to the required field moisture sensor disposed in the soil in each of the zones and, when interrogated, produces an electrical signal proportional to the level of moisture in the soil proximate that sensor. The sensor gives an alert about the dryness of the land to the moisture sensing unitthat will be displayed in the LCD display in the wireless method. The result from the sensor switches ON or OFF the water irrigation system used to pump the water for the fields. Fertilizer tank consist of

fertilizer and water mixture which is distributed to the field at specified time.

The following table shows the assumptions of input and output terms:

Atmospheric Temperature (.c)	Soil Temperature (.c)	Soil moisture Content (%)	Motor Status
20	19	65	OFF
31	30	19	ON
30	29	27	ON
23	20	54	OFF
31	30	6	ON
29	28	12	ON

For example:if the moisture level is below 30% then the motor will be ON. If the moisture is above 30% then the motor will be in OFF.

Conclusions:

With the use of this technique we can reduce water consumption. If our project comes as the product we have a further enhancement idea. Now we are using solar power to transmit and receive signal. We planned to use solar power for all operations in this system. Chemical fertilizer will make the soil infertile soon. So we planned to use biological fertilizer which is programmed to mix with water at proper proportion to get high yield without any side effect to soil and human begins. In future we planned to implement artificial intelligence and satellite forecasting of crops etc. So the goal of our system is to use water efficiently and our system is fully automated which does not require any manual assist. Totally it is farmer friendly hence we named our product as" KRISHAK BANDHU".

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