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AUTOMATED IRRIGATION SYSTEM USING ARM CONTROLLER & GPRS MODULE

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ABSTRACT

This project probes into the design of the automated irrigation system based on ARM controller. This Embedded project is to design and develop a low cost feature which is based on embedded platform for water irrigation system. This project uses temperature and soil moisture sensors to detect the water quantity present in agriculture. The project uses ARM micro controller which is controller to process the information. The aim of our embedded project is to monitor status of the sensors on remote PC through a web page.
The system has a Distributed wireless network of temperature and soil moisture sensors can be monitored on web page through Arm controller. In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. The web-servers connected to Internet. The system was powered by photovoltaic panels and had a duplex communication link based on a Cellular-Internet interface that allowed for data inspection and Irrigation scheduling to be programmed through a web page. The owner on the PC is also connected to same Internet. By typing the IP-address on the web browser, the owner gets a web page on screen. This page contains all the information about the status of the sensors or else the owner can also monitor the results through mobile if the mobile has internet facility. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated areas.

KEY WORDS — Arm Controller, ZigBee, GPRS Module, irrigation, water resources, wireless sensor networks.

INTRODUCTION

India is the agriculture based country. Our ancient people completely depended on the agricultural harvesting. Agriculture is a source of livelihood of majority Indians and has great impact on the economy of the country. In dry areas or in case of inadequate rainfall, irrigation becomes difficult. So, it needs to be automated for proper yield and handled remotely for farmer safety. Increasing energy costs and decreasing water supplies point out the need for better water management. Irrigation management is a complex decision making process to determine when and how much water to apply to a growing crop to meet specific management objectives. If the farmer is far From the agricultural land he will not be noticed of current conditions. So, efficient water management plays an important role in the irrigated agricultural cropping systems

A low cost alternative solution for efficient water management currently in use is drip irrigation systems that consist of an automated controller to turn on & off the control values, which in turn helps the farmers by managing the water supply to the crop fields and further maintains the Moisture levels of soil that helps in better crop production within the short span of time In environmental applications, sensor networks have been used to monitor a variety of environmental parameters or Conditions in marine, soil, and atmospheric contexts. Environmental parameters, including humidity, pressure, temperature, Soil water content, and radiation with different spatial and temporal resolution and for event detection such as disaster monitoring, pollution conditions, floods, forest fire, and debris flow is continuously monitored.

Applications in agriculture have been used to provide data for appropriate management, such as monitoring of environmental conditions like weather, soil moisture content, soil temperature, soil fertility, mineral content, and weed disease detection, monitoring leaf temperature, moisture content and monitoring growth of the crop, automated irrigation facility and storage of agricultural products. Various commercial WSN's exist, ranging from limited and low-resolution devices with sensors and embedded processors, to complete and expensive acquisition systems that support diverse sensors and include several communication features. Recent advances in microelectronics and wireless
Technologies created low-cost and low-power components, which are important issues especially for such systems such as WSN. Power management has been addressed in both hardware and software with new electronic designs and operation techniques.

In this project the development of the deployment of an automated irrigation system based on ARM controllers and wireless communication at experimental scale within rural areas is presented. The aim of the implementation was to demonstrate that the automatic irrigation can be used to reduce water use.

1.1 Need Of Automated Irrigation System:

There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer's side. With the recent advancement of technology it has become necessary to increase the annual crop production output entirely agro-centric economy. The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops is one of the main aims of incorporating such technology into the agricultural domain of the

country. To save farmers effort, water and time. Irrigation management is a complex decision making process to determine when and how much water to apply to a growing crop to meet specific management objectives. If the farmer is far from the agricultural land he will not be noticed of current conditions. So, efficient water management plays an important role in the Irrigated agricultural cropping systems.

PROPOSED METHOD

The automated irrigation system hereby reported, consisted of two components wireless sensor units and a wireless information unit , linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses ZigBee technology. The server via the public mobile network. The information can be remotely monitored online through a graphical application through Internet access devices.

2.1 Wireless Sensor Unit:

A WSN is a system comprised of radio frequency (RF) transceivers, sensors, micro controllers and power sources. Recent advances in wireless sensor networking technology have led to the development of low cost, low power, multifunctional sensor nodes. Sensor nodes enable environment sensing together with data processing. Instrumented with a variety of sensors, such as temperature, humidity and volatile compound detection, allow monitoring of different environments. They are able to network with other sensor systems and exchange data with external users. Sensor networks are used for a variety of applications, including wireless data acquisition, machine monitoring and maintenance, smart buildings and highways, environmental monitoring, site security, automated on-site tracking of expensive materials, safety management, and in many other areas. A general WSN protocol consists of the application layer, transport layer, network layer, data link layer, physical layer, power management plane, mobility management plane and the task Management plane. Currently two there standard technologies are available for WSN: ZigBee and Blue tooth. Both operate within the Industrial Scientific and Medical (ISM) band of 2.4 GHz, which provides license free operations, huge spectrum allocation and worldwide compatibility. In general, as frequency increases, bandwidth increases allowing for higher data rates but power requirements are also higher and transmission distance is considerably shorter.Multihop communication over the ISM band might well be possible in WSN since it consumes less power than traditional single hop communication. It is also possible to create a WSN using Wi-Fi (IEEE 802.11), but this protocol is usually utilized in PC-based systems because it was developed to extend or substitute for a wired LAN.Its power consumption is rather high, and the short autonomy of a battery power supply still remains an important disadvantage.

2.2 Wireless Information unit:

The soil moisture and temperature data from each WSU are received, identified, recorded, and analyzed in the WIU. The WIU consists of a master microcontroller an ZigBee radio modem, a GPRS module an RS-232 interface MAX3235E and a deep cycle 12 V at 100-Ah rechargeable battery which is recharged by a solar Panel through a PWM charge controller All the WIU

electronic components were encapsulated in a Waterproof box. The WIU can be located up to 1000m line-of-sight from the WSUs placed in the field.

SYSTEM DEVELOPMENT:

1.1 Bloch Diagram:

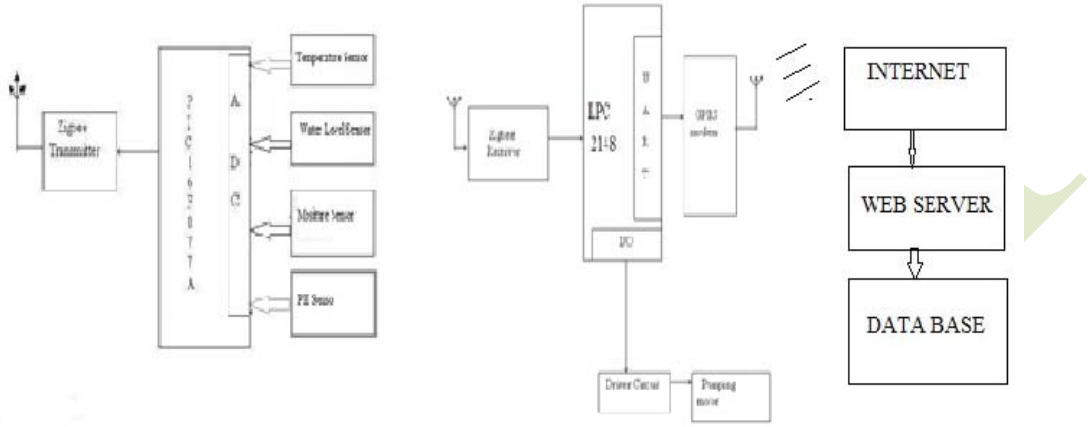

Figure 3.1: Block Diagram

3.1.1Temp Sensor:

The temperature sensor used to measure the temperature at the field is LM 35.The LM35 series Are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade).The LM35 does not require any external calibration or trimming to provide typical accuracies of degree C at room temperature and degree C over a full -55 to +150C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy

3.1.2: Humidity Sensor:

A Humidity sensor also called a hygrometer, measures and regularly reports the relative humidity in the air. A humidity sensor senses relative humidity. This means that it measures both air temperature and moisture. Relative humidity, expressed as a percent, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold. The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature. The most common type of humidity sensor uses what is called "capacitive measurement

This system relies on electrical capacitance, or the ability of two nearby electrical conductors to create an electrical field between them. The sensor itself is composed of two metal plates with a non-conductive polymer film between them. The film collects moisture from the air, and the

Moisture causes minute changes in the voltage between the two plates. The changes in voltage are converted into digital readings showing the amount of moisture in the air.

3.1.3 Zigbee Module:

Zigbee technology is the standard of choice among other wireless technologies due to its efficient low- power connectivity and ability to connect a large number of devices into a single network. Zigbee technology uses the globally available, license-free2.4GHz frequency band. It enables wireless applications using a standardized set of high level communication protocols sitting atop cost-effective, low-power digital radios based on the IEEE 802.15.4standard for wireless personal area networks. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability and larger range.

3.1.4 PIC 16F877A Micro-controller:

PIC is a family of modified Harvard architecture micro-controllers 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, Peripheral interface controller is the most powerful micro-controller which is a 40 pin device which is used as RISC architecture. Reduced instruction set computing, or RISC is a CPU design strategy based on the insight that simplified (as opposed to complex) instructions can provide higher performance
if this simplicity enables much faster execution of each instruction. One advantage of reduced instruction set computers is that they can execute their instructions very fast because the instructions are so simple. Another, perhaps more important advantage, is that RISC chips require fewer transistors, which makes them cheaper to design and produce.

3.1.5 ARM7 Micro-controller:

The arm7 processor describes a family of RISC architecture. RM processors require significantly fewer transistors than processors that would typically be found in a traditional computer. The benefits of this approach are lower costs, less heat, and less power usage, traits that are desirable for use in light, portable, battery-powered devices such as smart phones and tablet computers.

3.1.6 GPRS:

GPRS stands for General Packet Radio Service.GPRS is one of the technologies to improve 2G phones (second generation phones) to enable them for transferring data at higher speed. GPRS allows mobile phones to remain connected to network and transfer requested or sent data instantly, e.g. if you receive MMS from other mobile phone, you do not need to press a button to check if you have any new MMS, instead mobile handset notifies you when new MMS is downloaded to your mobile. GPRS technology can provide you up to 32 kbps to 48 kbps. One of the features of GPRS technology which makes it even more useful and practical is that data can transfer during the call and there is no requirement of disconnecting call to receiving incoming or outgoing data. For example, you can receive SMS during the call and you can reply to it without having to disconnect your ongoing call.GPRS technology enabled to move 2G networks closer to the performance of 3G networks. 3G (Third Generation) support networks are best at transferring data to unbelievably higher data rates which can go up 2 Mbps.

3.1.6 Web Application:

Graphical user interface software was developed for real time monitoring and programming of irrigation based on soil moisture and temperature data. The software application permits the user to visualize graphically the data from each WSU online using any device with Internet Besides the soil-moisture and temperature graphs, the web application displays the total water consumption and the kind of the IA. The web application also enabled the user direct programming of scheduled irrigation schemes and adjusting the trigger values in the WIU according to the crop species and season management. All the information is stored in a database. The web application for monitoring and programming was coded in C language of Microsoft Visual Studio 2010. The database was implemented in SQL Server 2005.

ADVANTAGES

1) Relatively simple to design and install.
2) It is safest system and no manpower is required.
3) The system helps to farmer or gardener to work when irrigation is taking place, as only the area between the plants are wet.
3) Reduce soil erosion and nutrient leaching.
4) The system need smaller water sources, as it consumes less than half of the water.
5) Fertilizers can also be provided by using the system.
6) PH content of the soil is maintained
Through the suggestions which helps for healthy plant growth.

CONCLUSION

There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer's side. With the recent advancement of technology it has become necessary to increase the annual crop production output of our country India, an entirely agro-centric economy. The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops is one of the main aims of incorporating such technology into the agricultural domain of the country. To save farmer's effort, water and time has been the most important consideration. Hence systems need to be designed to provide this ability efficiently using wireless sensor networking, Irrigation, GPRS, technology and readily available mobile phone devices is a certain help to the farmers to get better yield on a large scale and thereby increasing the agricultural wealth and the economic growth of our country. The irrigation system can be adjusted to a variety of specific crop needs and requires minimum maintenance. The modular Configuration of the automated irrigation system allows it to be scaled up for larger greenhouses or open fields.
In addition, other applications such as temperature monitoring, moisture monitoring, and water level monitoring & monitors ph level of water. Production can be easily implemented. The Internet controlled duplex communication system provides a powerful decision-making device concept for adaptation to several cultivation Scenarios. Furthermore, the Internet link allows the supervision through mobile telecommunication devices, such as a smart phone.

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