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Implementation of Wireless Sensor Network for Automatic Irrigation by Using GPRS

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ABSTRACT: An automated irrigation system was developed to optimize water use for agricultural crops. The system has a distributed wireless network of various parameters like soil-moisture, temperature sensors, humidity sensor, light etc. The total system architecture includes a set of sensor nodes, a base station, and an internet data centre. With an ATmegh32 microprocessor and embedded operating system, screen display, system configuration and GPRS based remote data forwarding. Through a Client/Server mode the management software for remote data centre achieves real-time data distribution and time-series analysis. Farmers go through large financial losses because of wrong prediction of weather and incorrect irrigation methods. In this paper, with the evolution of sensor devices coupled with wireless technologies, it is possible remotely monitor parameters such as moisture, temperature and humidity.

KEYWORDS: Base station, embedded operating system, GPRS/GSM Modem, TCP/IP Protocol, Wireless sensor network.

I. INTRODUCTION

Now a days ,today's world is world of automation and everything is being automated. For automation microprocessor and microcontroller based automatic systems are very general due to their accuracy and precision. They are flexible and user friendly due to their programmable nature. Controlling manually is generally not so accurate due to the errors involved. 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 only dependent on the rains and bore wells for irrigation of the land. Even if the farm land has a water-pump, manual involvement by farmers is required to turn the pump on/o_ whenever needed. The aim of our project is to minimize this manual involvement by the farmer, which is why we are using a micro-controller (ATMEGA32A).

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/o_ when required. This method sometimes consumes more water and sometimes the water supply to the land is delayed due to which the crops dry out. In addition to this slowed growth rate, lighter weight fruit follows water deficiency. This problem can be completely rectified if we use Automated Irrigation System in which the irrigation will take place only when there will be intense requirement of water, as suggested by the moisture in the soil.

The GPRS Based Irrigation System is a project in which we get continuous up to date status of the operation carried out in field (Farms) by using LCD displays. Actually this project is for our farmers. They work hard and hard not only everyday but also every night in the field. Because in the day they do their field work and in the night our farmers have to irrigate the field land at some intervals.So to wake up in the night from a sleep and then go to field and irrigate the land is to typical for a farmer. There are many drawbacks of this irrigation system that if a farmer started the irrigation system in the night and he forgot to switch o_ the irrigation system again. In this condition the a lot of water goes to wastage and the crops may get harm or sometimes he forget to switch on the irrigation system then again the crops get dried due to lack of water. This depends on the type of crops. Lighter weight fruits always follow slight water deficiency. So to resolve this problem I have bring this is electronic project .No hard work need to be done by the farmer. This project works on two mode. This project is developed based on EMBEDDED and GPRS Technology

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II. RELATED WORK

In [1] Automated Irrigation System Using a Wireless Sensor Network and GPRS Module Developed algorithm with threshold values of temperature and soil moisture that was programmed into a microcontroller based gateway to control water quantity. This system is used for optimizing water resources for agriculture production, the places with water scarcity. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. 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. In [2] author proposed that 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.Kay Smarsly proposed that automatically scheduling irrigation events based on soil moisture measurements has been proven an effective means to reduce freshwater consumption and irrigation costs, while maximizing the crop yield. Focusing on decentralized autonomous soil moisture monitoring, this paper presents the design, the implementation, and the validation of a low-cost remote monitoring system for agricultural ecosystems. The prototype monitoring system consists of a number of intelligent wireless sensor nodes that are distributed in the observed environment. The sensor nodes are connected to an Internet-enabled computer system, which is installed on site for disseminating relevant soil information and providing remote access to the monitoring system. Autonomous software programs, labelled “mobile software agents”, are embedded into the wireless sensor nodes to continuously analyse the soil parameters and to autonomously trigger irrigation events based on the actual soil conditions and on weather data integrated from external sources [3]. In [4] the system developed by Author based on Greenhouse monitoring and controlling using Android mobile application was designed to monitor and control the humidity inside a green house. Here software uses an android mobile phone and using Wi-Fi, which connects via serial communication to a microcontroller and humidity sensor. In [5] paper proposed by Author to developed monitoring system of soil based on wireless sensor networks uses a wireless sensor network as information acquisition and processing platform. The coverage was big, effectively resolves the disadvantages of wired communications. Adopting the technology based on ZIGBEE, GPRS and Web Services technology, it designed a set of low cost, low power consumption, flexible automatic networking temperature humidity monitoring system of soil. And the system was a complete set of wireless sensor network induction, acquisition, storage, application, reporting, solution, has a good man-computer exchange interface. In [6] the advanced development in wireless sensor networks was implements for monitoring various parameters in agriculture. In this context, with the evolution of miniaturized sensor devices coupled with wireless technologies, it was possible remotely monitor parameters such as moisture, temperature and humidity. In this paper it was proposed to design, develop and implement a wireless sensor network connected to a central node using ZIGBEE, which in turn was connected to a Central Monitoring Station (CMS) through General Packet Radio Service (GPRS) or Global System for Mobile (GSM) technologies. The system also obtains Global Positioning System (GPS) parameters related to the field and sends them to a central monitoring station. This system was expected to help farmers in evaluating soil conditions and act accordingly. In [7] paper present the Monitoring System for Vegetable Greenhouses based on a Wireless Sensor Network designed for monitoring the life conditions of greenhouse vegetables. The complete system architecture includes a group of sensor nodes, a base station, and an internet data centre. For the design of wireless sensor node, the JN5139 micro-processor was adopted as the core component and the ZIGBEE protocol was used for wireless communication between nodes. With an ARM7 microprocessor and embedded ZKOS operating system, a proprietary gateway node was developed to achieve data influx; screen display, system configuration and GPRS based remote data forwarding. Through a Client/Server mode the management software for remote data centre achieves real-time data distribution and time-series analysis. Besides, a GSM-short-message-based interface is developed for sending real-time environmental measurements, and for alarming when a measurement is beyond some pre-defined threshold. The whole system has been tested for over one year and satisfactory results have been observed, which indicate that this system was very useful for greenhouse environment monitoring.

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III. PROPOSED SYSTEM

A. *Design of the system*

The system is to design and deploy a Wireless Sensor Network(WSN) for the monitoring of crops based on the AT mega 32 microcontroller that works as a wireless sensor device equipped with different specific modules.

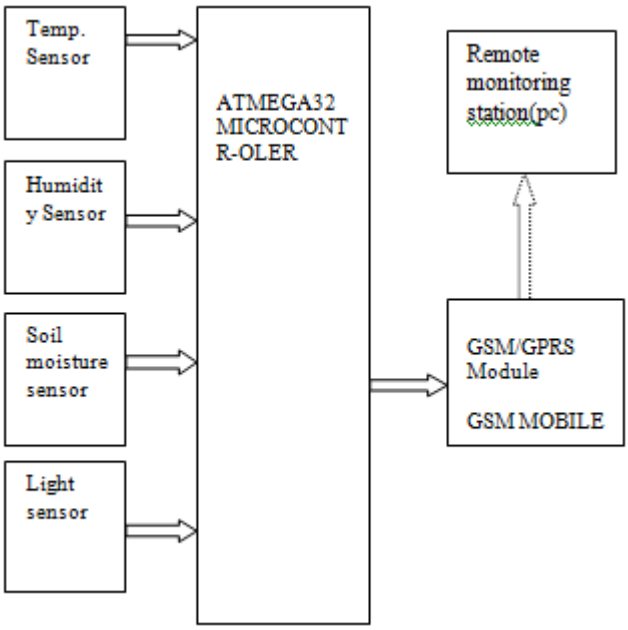

Fig.a basic block diagram of system

Sensors note weather's different parameters. The readings will then give to the microcontroller which has in built 10 bits A/ D convertor. This convertor converts all analog data to equivalent digital form, and then sends to GSM mobile. At GSM, by using mobile, various AT commands SMS can be sent to the user mobiles. At the same time, we can visualize the data on TCP/IP protocol suit.

B. *Description of the Proposed system:*

The components required to this project include three parts according to the hardware. They are the requirements of ATMEGA 32 microcontroller, GSM/GPRS kit and sensors. As the core part, requirement of microcontroller can be divided into different modules that will be used in communication between the microcontroller and TCP/IP data logger. These modules include power module, TCP/IP data logger software, GSM module.

1. ATMEGA 32 microcontroller

The Atmel®AVR®ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system design to optimize power consumption versus processing speed.

2. Temperature Sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius temperature. The LM35 is operates at -55˚ to +120˚C. The output voltage varies by 10mV in response to every ºC rise/fall in ambient temperature, *i.e.*, its scale factor is 0.01V/ºC.

3. Humidity sensor

The SY-HS-220 series Humidity sensor is a simple to use sensor based on capacitive technology. This module converts relative humidity to output voltage. Its operating voltage is 5V DC. Its operating temperature is 0 - 60˚ C and its operating humidity is 30- 90% RH. Its standard output at 25˚C and 60%RH is 1980mV DC.

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4. Soil moisture sensor

To optimize use of water and to provide needed water to the crop soil moisture is developed based on resistive principle. This sensor detects presence of liquid or moisture between two wire leads and gives active low output as an analog input to the ADC pin of the microcontroller. This is interfaced with Microcontroller to detect liquid levels. ADC pin of microcontroller converts it into digital output and display on LCD which is interface with Microcontroller. Moisture of soil is for detection for automatic watering of plants which will drive by relay driver circuit used in project.

5. Light sensor

Light Dependent Resistors (LDR) is also called photo resistors. They are made of high resistance semiconductor material. When light hits the device, the photons give electrons energy. This makes them jump into the conductive band and thereby conduct electricity.

3.2.6 GSM/GPRS sim900 kit

A GSM/GPRS Module like SIM900 can be used for any embedded application that requires a long range communication. The SIM900 KIT is a fully integrated module with SIM card holder, power supply etc. The basic communication is over asynchronous serial line. This is the most basic type of serial communication that's why it is very popular and hardware support is available in most MCUs. The data is transmitted bit by bit in a frame consisting a complete byte. Thus at high level it is viewed as a simple text stream. There are only two streams one is from MCU to SIM900 and other is from SIM900 to MCU. Commands are sent as simple text. For GPRS based applications, SIM900 provide better functionality.

7. LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find wide range of applications. This 16x2 LCD display is very basic module and very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being is that LCDs are economical, easily programmable and have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

IV. DESIGN OF SOFTWARE

TCP/IP data logger

TCP/IP data logger is software that inputs TCP/UDP data coming from sever directly into log file created by it. It allows collecting information coming from any device or instrument in real time. It collects real time data coming from different sensing parameter.

Advanced TCP/IP Data Logger works with TCP/IP or UDP ports and sockets. It is working as a client which receives o/p coming from TCP/UDP server. It receives data in text, binary and in protocol. No programming is required to configure the software to collect data.

V. RESULTS

Figure.1 shows the log file is created in the user pc by using TCP/UDP Data logger. For tcp/ip data remote srever checks the request coming from TCP/UDP. It check the port adress and port number of the TCP/UDP client. And send the data through TCP/UDP to computer monitor. Which shows the real time parameter of the agricultural parameter.

TCP server sends this information on IP address and port number of TCP/UDP client. when TCP/UDP conect is in process server checks IP address request coming from TCP/UDP client and send information to the client application. So user gets real time data from server to the users computer monitor. Which shows real time data like temperatute, humidity, soil moisture,light. If want to check this data later we can do this too. Becouse log file is created within data logger software in which real time parameter are stored with date and time. We can used to see it anytime, whenever we want.

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Figure 1. shows that log file is created and it shows real time which was stored.

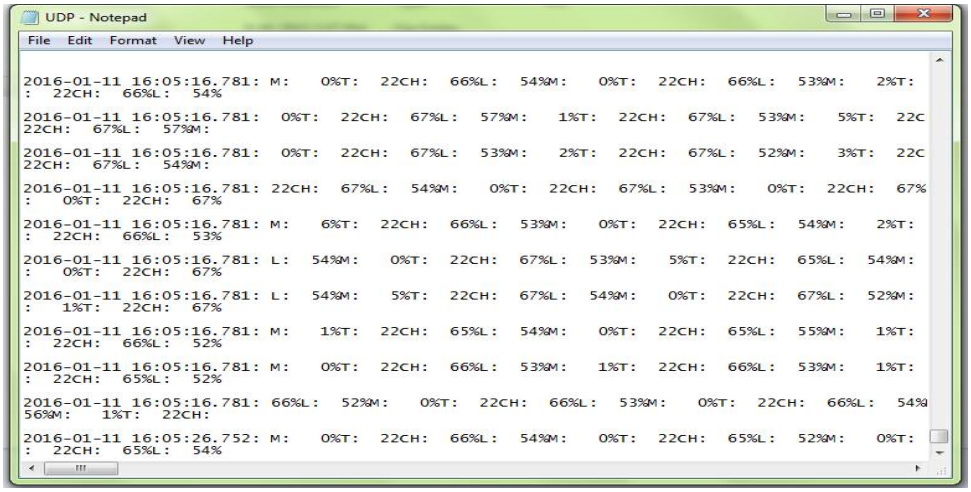

Fig. 1.Log File Created By TCP/UDP Data logger

VI. CONCLUSION AND FUTURE WORK

Implementation of Wireless Sensor Network for Automatic irrigation by using GPRS used to increase the yield of plants by monitoring and controlling environmental conditions (parameter) and thus providing necessary information. The wireless sensors sense the various agricultural parameters by using microcontroller which accepts data from sensor and transmitted through the TCP/IP Protocol which provide direct access to the internet and obtain the information from the Agricultural area to the client PC. With the help of the wireless sensor network, people could monitor the environmental parameters of crops in real-time from remote places. This project is based on an emerged wireless sensor network protocol.This system is designed for monitoring parameter. In future a system can be designed so that it is capable of monitoring more parameter. The system developed in the presented work is not limited to the Environmental parameter monitoring. It also can be used for other applications such as: Home automation, Remote control application, health care monitoring, and Retail services. Also, other modules can be added like video camera module for the visual monitoring of the Crops development.

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BIOGRAPHY

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