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Design and Implementation of Real Time Irrigation System Using a Wireless Sensor Network

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ABSTRACT:

In this paper, a real time irrigation system was developed to optimize water use for agricultural crops. 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. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. 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 automated system was tested in a sage crop field for 136 days and water savings of up to 90% compared with traditional irrigation practices of the agricultural zone were achieved. Three replicas of the automated system have been used successfully in other places for 18 months. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated area.

I.INTRODUCTION:

As there is no unexpected usage of water, a lot of water is saved from being wasted. The irrigation system is use only when there is not sufficient moisture in the soil and the microcontroller decides when should the pump be turned on/off, saves a lot time and water for the farmers. As there is no unanticipated usage of water, a lot of water is saved from creature wasted. This also gives much wanted rest to the farmers, as they don't have to go and revolve the pump on/off automatically. The constant increasing command of the food provisions requires a rapid improvement in food production technology.

In a lot of countries like India where agriculture and the climatic conditions are isotropic, at a standstill we are not able to make full use of agricultural possessions . The main reasons is the not have of rains & insufficiency of land lake water. The continuous removal of water at normal intervals from earth is dropping the water level as a result of which the zones of un-irrigated land are frequently increasing. Also, the unexpected use of water accidentally results in wastage of water. In an Automated Irrigation System using (LPC2148), the most significant advantage is that water is supplied only when the moisture in soil goes below a determined threshold value.

In current times, the farmers have been using irrigation system through the labor-intensive control in which the farmers irrigate the land at regular intervals by turning the water-pump on/off when essential. These procedures sometimes consume more water and sometimes the water supply to the land is delayed due to which the crops dry off. Water shortage deteriorate plants enlargement before visible wilting occurs. In addition to this slow development rate, lighter mass fruit follows water shortage.

II.RELATED WORK:

1.ARM PROCESSOR:

The conventional 8 and 16bit Microcontrollers has its deficiencies when compared with 32bit microcontroller. This proposed system design uses the ARM processor. ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

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The Philips LPC2148 which is based on 32 bitARM7 TDMI core supporting real time simulation. When ARM processor combined with RTOS with timing constraint can be realized for the data acquisition and transmission of data with high precision.

2.BLOCK DIAGRAM:

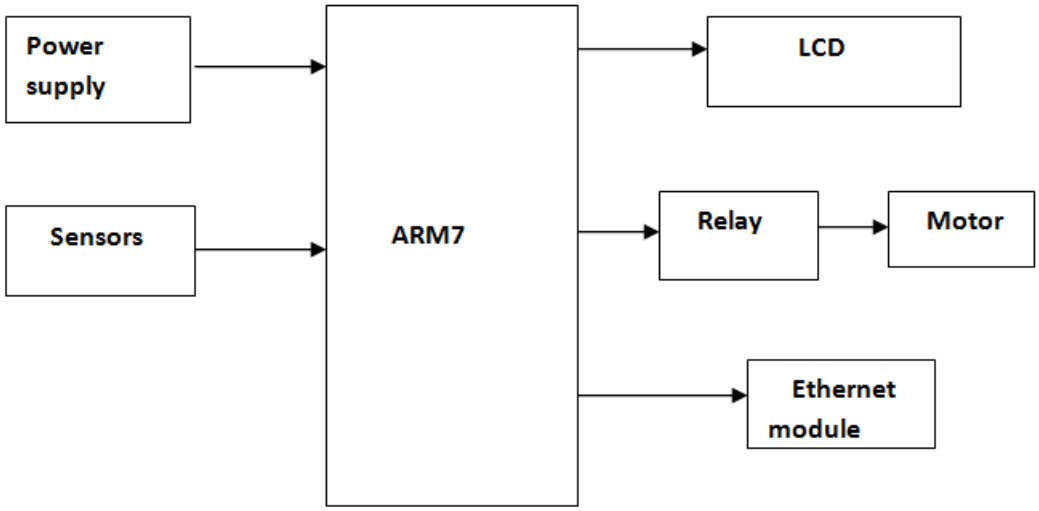

Figure-1: Ethernet based diagram

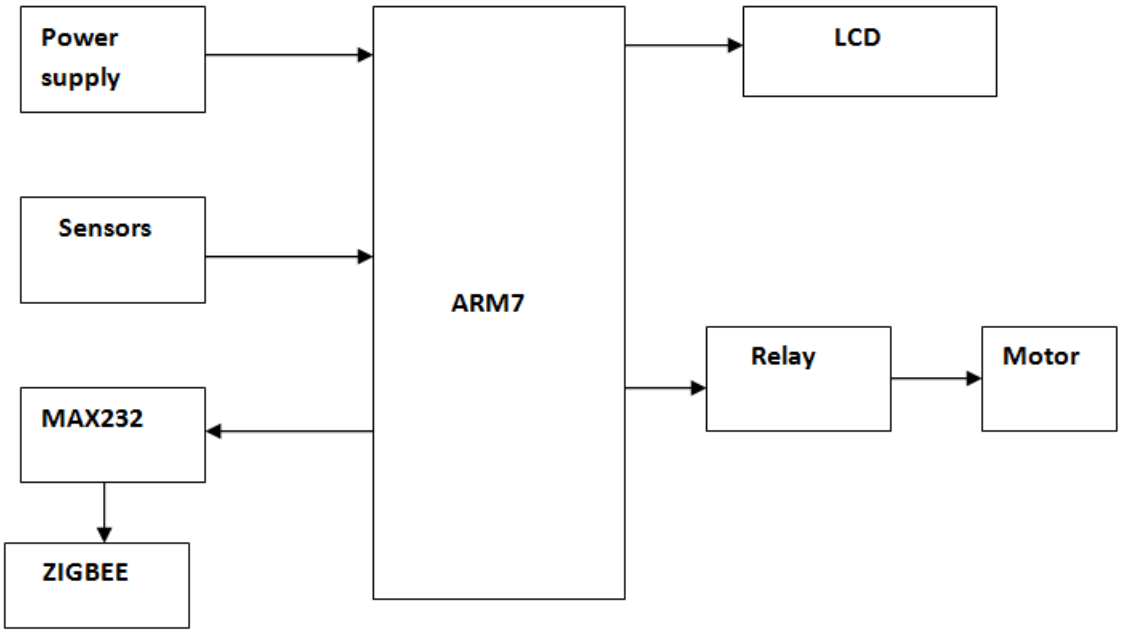

Figure-2: zigbee based diagram

3.SENSORS

Temperature 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 +150øC 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.

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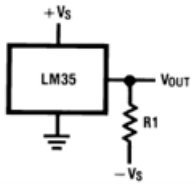

Figure-3: temperature sensor

Humidity sensor:

Humidity is a term for the amount of water vapor in the air, and can refer to any one of several measurements of humidity. Formally, humid air is not "moist air" but a mixture of water vapor and other constituents of air, and humidity is defined in terms of the water content of this mixture, called the Absolute humidity. In everyday usage, it commonly refers to relative humidity, expressed as a percent in weather forecasts and on household humidistat, it is so called because it measures the current absolute humidity relative to the maximum. Specific humidity is a ratio of the water vapor content of the mixture to the total air content (on a mass basis). The water vapor content of the mixture can be measured either as mass per volume or as a partial pressure, depending on the usage.

4.ZIGBEE MODULE:

ZigBee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. ZigBee chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory. ZigBee operates in the industrial, scientific and medical (ISM) radio bands; 868 MHz in Europe, 915MHz in the USA and Australia, and 2.4GHz in most jurisdictions worldwide. Data transmission rates vary from 20 to 900 kilobits/second. The ZigBee network layer natively supports both star and tree typical networks, and generic mesh networks. Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance. Within star networks, the coordinator must be the central node. Both trees and meshes allow the use of ZigBee routersto extend communication at the network level.

ZigBee builds upon the physical layer and medium access control defined in IEEE standard 802.15.4(2003 version) for low-rate WPANs. The specification goes on to complete the standard by adding four main components: network layer, application layer, Zigbee device objects (ZDOs) and manufacturer-defined application objects which allow for customization and favor total integration.

5.ETHERNET MODULE:

The ENC2SJ60 is a stand-alone Ethernet controller with an industry standard Serial Peripheral Interface (SPI). [t has on chip [o Mbps Ethernet Physical Layer Device (PHY) and Medium Access Controller (MAC), providing reliable packet-data transmission/reception based on an industry standard Ethernet protocol [6]. The PHY contains analog circuitry to encode and decode the data on the twisted pair interface while the MAC contains digital circuitry to control when to transmit, handle automatic retransmission when a collision occurs, calculates and validates CRCs (Cyclical Redundancy Check), and do other necessary tasks. A total of S kilobytes of RAM present on the device. The microcontroller can configure how much of the SKB is allocated to the receive hardware.

III.RESULTS:

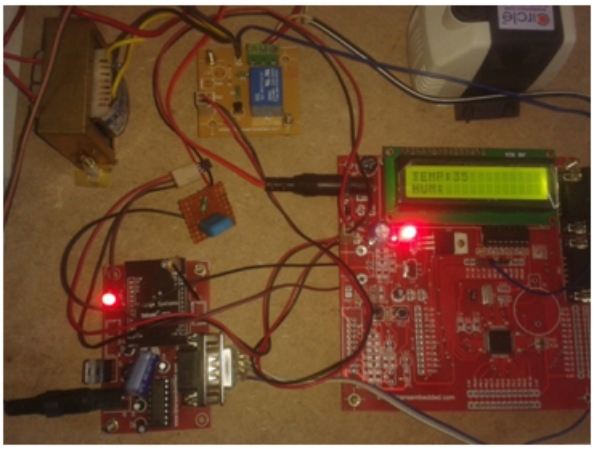

Figure-4: zigbee based hardware result

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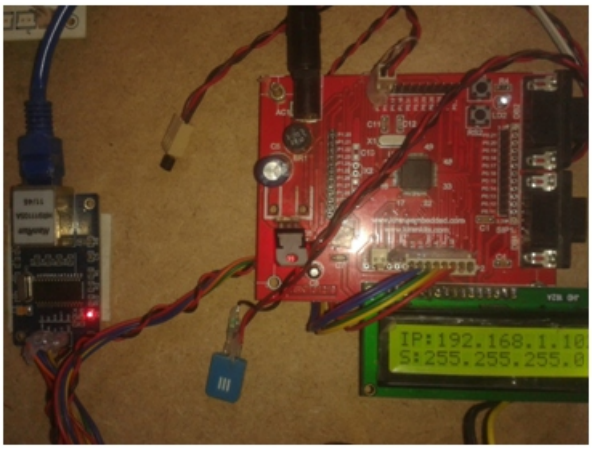

Figure-5: Ethernet based hardware result

IV.CONCLUSION:

In this paper, a wireless sensor network based real time irrigation system has been designed, implemented and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

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