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Gprs based real time monitoring of water tanks and contamination detection in metropolitan cities

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Abstract:
Now-a-days, along with the growth of population, there is an increased demand for water in agriculture, industry, etc. This paper presents a low cost and holistic approach to the water quality monitoring problem for drinking water distribution systems as well as for consumer sites. Our approach is based on the development of low cost sensor nodes for real time monitoring and assessment of water quality on the fly. To observe the contamination factor in water, sensor setup is installed in water tank. The parameters such as temperature, turbidity, ph value of water which is very important and even water level of tank is monitored and all these data is transmitted to control room through zigbee wireless communication to alert the authorized persons. Voice speaker has been added which gives voice announcements for different thresholds and also the data has been updated to GPRS webpage.

Keywords: LPC2148 Development Board, Power Supply, GPRS Modem, LCD display, Temperature Sensor, Water Level Sensor, Turbidity Sensor, PH sensor, Zigbee, Voice IC

I. Introduction

Carefully researched, documented and peer-reviewed study of the drinking water systems, found that pollution and deteriorating, out-of-date plumbing are sometimes delivering drinking water that might pose health risks to some residents. The existing laboratory based methods are too slow to develop operational response and do not provide a level of public health protection in real time. Aging pipes can break, leach contaminants into the water they carry and breed bacteria. If steps are not taken now, our drinking water will get worse. Qualitative and Quantitative measures are needed from time to time to constantly monitor the quality of water from various sources of supply. Government should be doing all it can to ensure that citizens get clean, safe drinking water every time they turn on a faucet or stop at a public water fountain.

II. The hardware system

Microcontroller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (**LCD**): It is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

I. Design of proposed hardware system

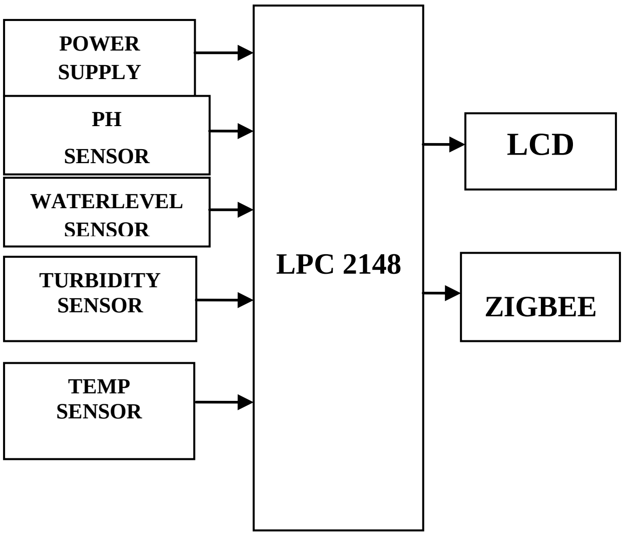

Fig.1. Block Diagram

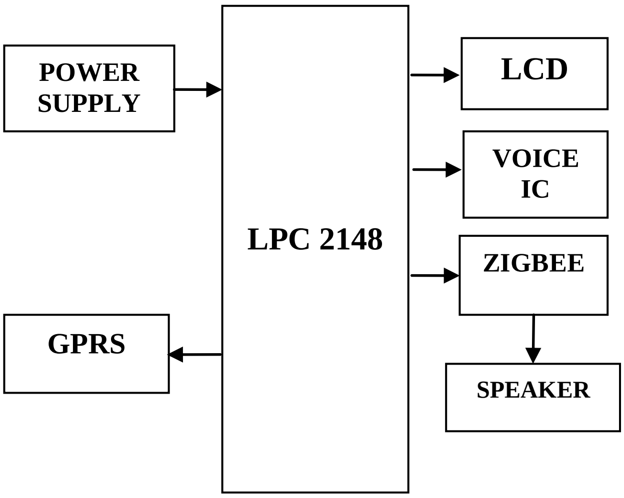

Fig.2.Block Diagram

In this paper, the development of the automated irrigation system based on microcontrollers 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. A microcontroller for data acquisition, and transceiver; the sensor measurements are transmitted to a microcontroller based receiver. This gateway permits the automated activation of irrigation when the threshold values of soil moisture and temperature is reached. Communication between the sensor nodes and the data receiver is via the Zigbee. This receiver unit also has a duplex communication link based on a cellular Internet interface, using General Packet Radio Service (GPRS) protocol, which is a packet oriented mobile data service cellular global system for mobile communications (GSM).

III. Board hardware resources features

Temperature Sensor: A thermistor is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements. Thermistors differ from resistance temperature detectors (RTD) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a higher precision within a limited temperature range, typically −90 °C to 130 °C.

Turbidity Sensor: The circuit designed uses a 5V supply, fixed resistance of 100Ω, variable resistance of 10KΩ, two copper leads as the sensor probes, 2N222N transistor. It gives a voltage output corresponding to the conductivity of the water. The conductivity of water depends upon the amount of flow in it. The voltage output is taken at the transmitter which is connected to a variable resistance. This variable resistance is used to adjust the sensitivity of the sensor.

PH sensor: The pH of a solution indicates how acidic or basic (alkaline) it is. The pH term translates the values of the hydrogen ion concentration which ordinarily ranges between about 1 and 10 x -14gram equivalents per litre - into numbers between 0 and 14.When immersed in the solution, the reference electrode potential does not change with the changing hydrogen ion concentration. A solution in the reference electrode also makes contact with the sample solution and the measuring electrode through a junction, completing the circuit.

Voice IC: A **voice IC** (or) **sound chip** is an integrated circuit (i.e. "chip") designed to produce sound. It might be doing this through digital, analog or mixed-mode electronics. Sound chips normally contain things like oscillators, envelope controllers, samplers, filters and amplifiers. During the late 20th century, sound chips were widely used in arcade game system boards, video game consoles, home computers, and PC sound cards.

ZigBee: Zigbee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-

2003 standard for Low-Rate Wireless Personal Area Networks (LR-WPANs), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range radio needing low rates of data transfer. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking.

ZigBee is a low-cost, low-power, wireless mesh networking standard. First, the low cost allows the technology to be widely deployed in wireless control and monitoring applications. Second, the low power-usage allows longer life with smaller batteries. Third, the mesh networking provides high reliability and more extensive range.

GPRS: GPRS technology enabled much higher data rates to be conveyed over a cellular network when compared to GSM.GPRS technology offering data services with data rates up to a maximum of 172 kbps, facilities such as web browsing and other services requiring data transfer became possible. GPRS and GSM are able to operate alongside one another on the same network, and using the same base stations. However upgrades are needed. The network upgrades reflect many of those needed for 3G, and in this way the investment in converting a network for GPRS prepares the core infrastructure for later evolution to a 3G W-CDMA / UMTS.

IV. Conclusion

The design and development of a low cost sensor node for real time monitoring of drinking water quality at consumer sites is presented. The proposed sensor node consists of several in-pipe water quality sensors with flat measuring probes. Unlike commercially available analyzers, the developed system is low cost, low power, lightweight and capable to process, log, and remotely present data. Moreover, contamination event detection algorithms have been developed and validated to enable these sensor nodes to make decisions and trigger alarms when anomalies are detected. Such implementation is suitable for large deployments enabling a sensor network approach for providing spatiotemporally rich data to water consumers, water companies and authorities. In the future, we plan to investigate the performance of the event detection algorithms on other types of contaminants (e.g. nitrates) and install the system in several locations of the water distribution network to characterize system/sensors response and wireless communication performance in real field deployments. Finally, we plan to investigate network-wide fusion/correlation algorithms to assess water quality over the entire water distribution system

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