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WATER QUALITY MEASUREMENT BY THE USE OF LOW COST SENSOR NETWORKS

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Abstract: 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 and in-pipe monitoring and assessment of water quality on the fly. The main sensor node consists of several in-pipe electrochemical and optical sensors and emphasis is given on low cost, lightweight implementation, and reliable long time operation. Such implementation is suitable for large scale deployments enabling a sensor network approach for providing spatiotemporally rich data to water consumers, water companies, and authorities. Extensive literature and market research are performed to identify low cost sensors that can reliably monitor several parameters, which can be used to infer the water quality. Based on selected parameters, a sensor array is developed along with several microsystems for analog signal conditioning, processing, logging, and remote presentation of data. Finally, algorithms for fusing online multisensor measurements at local level are developed to assess the water contamination risk. Experiments are performed to evaluate and validate these algorithms on intentional contamination events of various concentrations of heavy metals (arsenic). Experimental results indicate that this inexpensive system is capable of detecting these high impact contaminants at fairly low concentrations. The results demonstrate that this system satisfies the online, in-pipe, low deployment-operation cost, and good detection accuracy criteria of an ideal early warning system.

Keywords: *Temperature sensor, Turbidity sensor, co2 sensor, ZIGBEE.*

I. Introduction

Clean drinking water is a critical resource, important for the health and well-being of all humans. Drinking water utilities are facing new challenges in their real-time operation because of limited water resources, intensive budget requirements, growing population, ageing infrastructure, increasingly stringent regulations and increased attention towards safeguarding water supplies from accidental or deliberate contamination.

There is a need for better on-line water monitoring systems given that existing laboratory-based methods are too slow to develop operational response and do not provide a level of public health protection in real time. Rapid detection (and response) to instances of contamination is critical due to the potentially severe consequences to human health. In existing system we just monitoring the water level based on water level we will give the intimation to the metropolitan areas. The objective of the paper is to present a conceptual model of a microcontroller based we will monitor the water quality and also contamination detection. Here in this proposed system we are using different sensors for quality measurement and also contamination detection.

II. The Hardware System

Micro controller: 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**) 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.

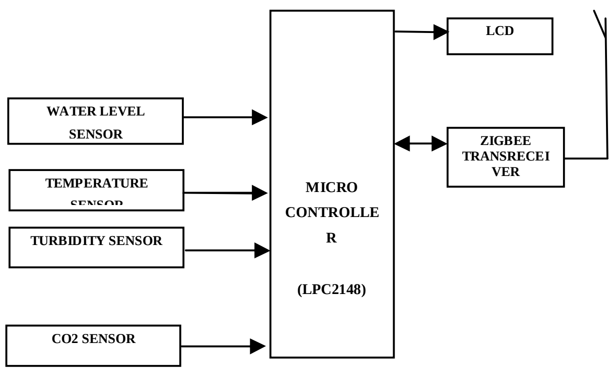

Fig: Field section

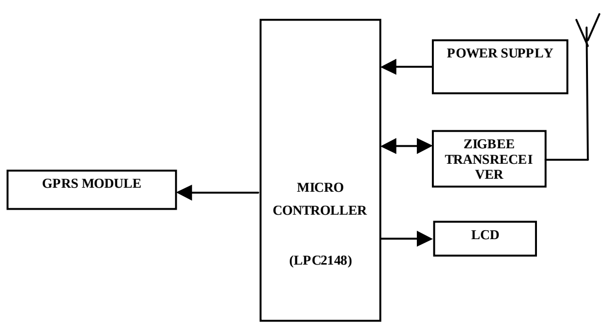

Fig: Monitoring section

Primarily for Real time atomization of agricultural environment for social modernization of Indian agricultural system. In our project, we are basically concentrating on following applications such as:

1) To continuously monitor the flow level.
2) To continuously monitor the water level of well.
3) To check the temperature to forecast the weather condition.
4) And also measure the quality of water continuously monitor by the use of turbidity sensor.
5) To monitor & control the whole system through GPRS module.

III. Board hardware resource features

Water level sensor:

The sensor used for measurement of fluid levels is called a level sensor. The sensing probe element consists of a special wire cable which is capable of accurately sensing the surface level of nearly any fluid, including water, saltwater, and oils. The sensor element is electrically insulated and isolated from the liquid into which it is inserted, and will not corrode over time. Unlike, other sensors, the measurement range is adjustable from a few centimeters to over several meters. A variety of sensors are available for point level detection of solids. These include vibrating, rotating paddle, mechanical (diaphragm), microwave (radar), capacitance, optical, pulsed-ultrasonic and ultrasonic level sensors.

Fig: Capacitive water level sensor

ZIGBEE:

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this case is ensure that the host’s serial port logic levels are compatible with the XBee’s 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level

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translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The below table gives the pin description of transceiver. The X-Bee RF Modules interface to a host device through a logic-level asynchronous Serial port. Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device.

Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

Temperature sensor:

A thermistor is a type of resistor whose resistance is dependent on temperature. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting overcurrent protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.

Fig: Temperature sensor

Co2 sensor:

They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, i-butane, propane, methane, alcohol, Hydrogen, smoke. The surface resistance of the sensor Rs is obtained through effected voltage signal output of the load resistance RL which series-wound. The relationship between them is described:

Rs\RL = (Vc-VRL) / VRL

Fig: Co2 sensor

Turbidity sensor:

Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.

Fluids can contain suspended solid matter consisting of particles of many different sizes. While some suspended material will be large enough and heavy enough to settle rapidly to the bottom of the container if a liquid sample is left to stand (the settable solids), very small particles will settle only very slowly or not at all if the sample is regularly agitated or the particles are colloidal. These small solid particles cause the liquid to appear turbid

Fig: Turbidity sensor

GPRS:

GPRS (general packet radio service) is a packet-based data bearer service for wireless communication services that is delivered as a network overlay for GSM, CDMA and TDMA (ANSI-I36) networks. GPRS applies a packet radio principle to transfer user data packets in an efficient way between GSM mobile stations and external packet data networks. Packet switching is where data is split into packets that are transmitted separately and then reassembled at the receiving end. GPRS supports the world's leading packet-based Internet communication protocols, Internet protocol (IP) and X.25, a protocol that is used mainly in Europe. GPRS enables any existing IP or X.25 application to operate over a GSM cellular connection. Cellular networks with GPRS capabilities are wireless extensions of the Internet and X.25 networks.

GPRS data speeds will range from 14.4 kbit/s (using one radio timeslot) to 115kbit/s (by amalgamating timeslots) and offer continuous connection to the Internet for mobile phone and computer users. GPRS data speeds are likely to average at about 56 kbit/s, with between 28 and 40 kbit/s initially. The higher data rates will allow users to take part in video conferences and interact with multimedia web sites and similar applications using mobile handheld devices as well as notebook computers.

IV. CONCLUSION

In this paper, 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 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.

V. REFRENENCES

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