ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Real Time System for Determination of Drinking Water Quality and Distribution Systems

K. Sai Kiran
M.Tech (Embedded systems),
Sindhura College of Engineering and Technology.

M.Sandeep
Assistant Professor,
Sindhura College of Engineering and Technology.

ABSTRACT:

This paper presents the design and development of a low cost system for real time monitoring of drinking water quality at consumer sites. The system 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 deployments enabling a sensor network approach for providing spatiotemporally rich data to water consumers, water companies and authorities. Extensive literature and market research is performed to identify low cost, on-line 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 micro systems for analog signal conditioning, processing, logging, and remote presentation of data. Finally, an algorithm for fusing on-line multi sensor measurements is developed to assess the water contamination risk.

Index Terms:

Water quality monitoring, pH sensor, temperature sensor, multi-sensor system, Raspberry Pi processor, water level indicator.

I. INTRODUCTION:

Clean drinking water is a critical resource, important for the health and well-being of all humans. Several experimental studies [1], [2] indicate the need for continuous on-line water quality monitoring with efficient spatio-temporal resolution and demonstrate that the conventional reagent-based water quality methods fail to satisfy this requirement due to higher labor and operational cost. US Environmental Protection Agency has carried out an extensive experimental evaluation [3] of water quality sensors to assess their performance on several contaminations.

The main conclusion was that many of the chemical and biological contaminants used have an effect on many water parameters monitored including Turbidity (TU), Oxidation Reduction Potential (ORP), Electrical Conductivity (EC) and pH. Thus, it is feasible to monitor and infer the water quality by detecting changes in such parameters. A limited number of on-line, reagent-free water monitoring systems exist (e.g. Hach HST GuardianBlue [4], JMAR BioSentry [5]), but these systems are bulky (sensors are installed in flow cells located in cabinets) and remain cost prohibitive for large scale deployments (cost tens of thousands of dollars per unit). It is worth mentioning that cost is mostly attributed not to sensing probes but to instrumentationautomation controllers (analyzers) and panels. Such systems can take frequent samples of the water quality at a very limited number of locations. However, substantial proportion of contamination problems is attributable to problems within distribution systems and due to the limited spatio-temporal sampling, it is impossible for the water companies and consumers to know the quality of potable water delivered to consumer households.

II. RELATED WORK:

2.1 BLOCK DIAGRAM:

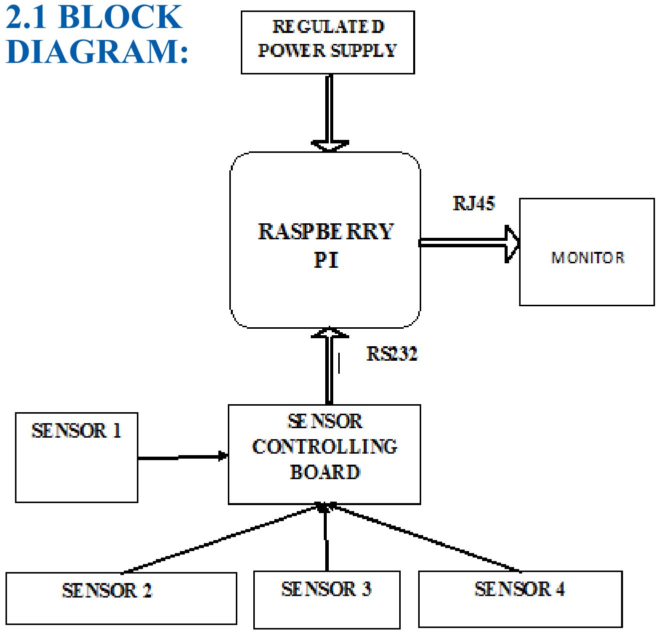

Figure-1: Block diagram

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2.2. EXISTING METHOD:

Many systems have already been developed based on the topics of remote monitoring and security either separately or jointly. In existing system we just monitoring the water level based on water level we will give the intimation to the metropolitan areas.

2.3. PROPOSED METHOD:

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.The proposed method is used to overcome the drawbacks present in existing method. Embedded Linux operating system and embedded web server run on the main controller to manage various types of equipments including sensor networks, so on. We are connecting different sensors to monitor the conditions of water. The block diagram of Proposed Method is shown below. This system makes use of ARM11 architecture, different types of sensors.

III. HARDWARE IMPLEMENTATION:

3.1. AT89S52 MICROCONTROLLER:

The AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the indus-try-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory pro-grammer.

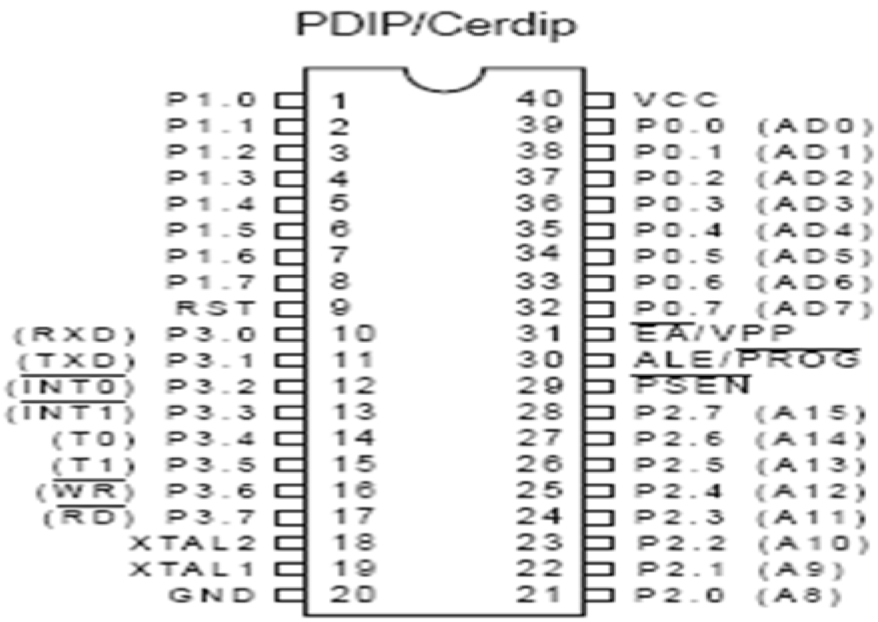

Figure-2: AT89S52 pin diagram

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3.2 PROCESSOR:

In the proposed ALPR system we used the Raspberry Pi is a credit-card sized single board computer developed in the UK by the Raspberry Pi foundation. The Raspberry Pi has Broadcom BCM2836 system on chip (SoC), which includes an ARM1176JZF-S 700 MHz processor. Video Core IV GPU, and was originally with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built in hard disk or solid state drive. But uses an SD Card for booting and long term storage.

3.3 TEMPERATURE SENSOR(LM35):

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in oC). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 oC temperature rise in still air. The operating temperature range is from -55°C to 150°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.

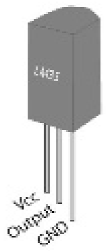

Figure-3: Temperature sensor

3.4 PH SENSOR:

The probe is a key part of a pH meter. It is a rod like structure usually made up of glass. At the bottom of the probe there is a bulb which contains the sensor. The bulb should never be touched by hand and should be cleaned with the help of an absorbent tissue paper, being careful not to rub the tissue against the glass bulb in order to avoid creating static. To measure the pH of a solution, the probe is dipped into the solution. The probe is fitted in an arm known as the probe arm. For very precise work the pH meter should be calibrated before each measurement. For normal use calibration should be performed at the beginning of each day.

The reason for this is that the glass electrode does not give a reproducible e.m.f. over longer periods of time Calibration should be performed with at least two standard buffer solutions that span the range of pH values to be measured. For general purposes buffers at pH 4.01 and pH 10.00 are acceptable. The pH meter has one control (calibrate) to set the meter reading equal to the value of the first standard buffer and a second control which is used to adjust the meter reading to the value of the second buffer. A third control allows the temperature to be set. Standard buffer sachets, which can be obtained from a variety of suppliers, usually state how the buffer value changes with temperature.

For more precise measurements, a three buffer solution calibration is preferred. As pH 7 is essentially, a “zero point” calibration (akin to zeroing or taring a scale or balance), calibrating at pH 7 first, calibrating at the pH closest to the point of interest (e.g. either 4 or 10) second and checking the third point will provide a more linear accuracy to what is essentially a non-linear problem. Some meters will allow a three-point calibration and that is the preferred scheme for the most accurate work. Higher quality meters will have a provision to account for temperature coefficient correction, and high-end pH probes have temperature probes built in.

IV. RESULTS:

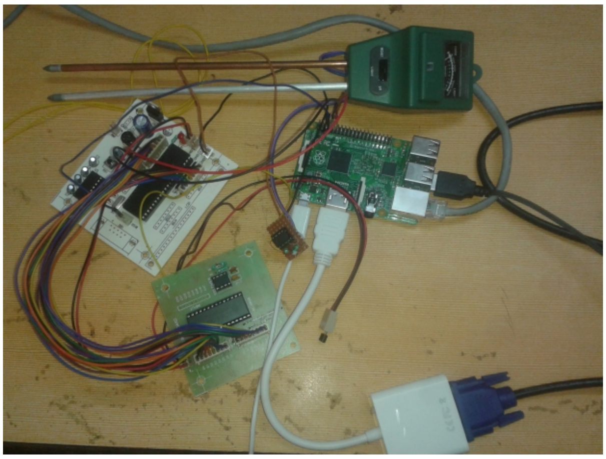

Figure-4: Hardware Interfacing

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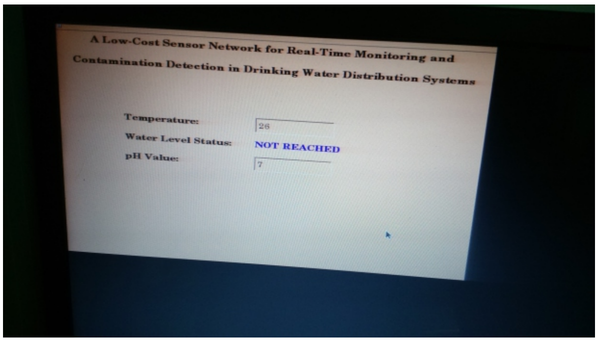

Figure-5: Simulation Results

V.CONCLUSION:

The design and development of a low cost system for real time monitoring of drinking water quality at consumer sites is presented. The proposed system consist of several in-pipe water quality sensors with flat measuring probes and unlike commercially available on-line analyzers, it is low cost, lightweight and capable of processing, logging, and remote presentation of data. 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 fusion algorithm on intentional contamination events and install the system in several locations of the water distribution network to collect spatiotemporally rich water quality data and characterize system/sensors response in real field deployments.

VI. REFERENCES:

[1] A. Aisopou, I. Stoianov, N. Graham, In-pipe water quality monitoring in water supply systems under steady and unsteady state flow conditions: A quantitative assessment, Water Research, 46(1), pp. 235-246, 2012

[2] S. Panguluri, G. Meiners, J. Hall, J.G. Szabo, Distribution System Water Quality Monitoring: Sensor Technology Evaluation Methodology and Results, U.S. Environmental Protection Agency, EPA/600/R-09/076, 2009

[3] J. Hall, A.D. Zaffiro, R.B. Marx, P.C. Kefauver, E.R. Krishnan, R.C. Haught, and J.G. Herrmann, On-line Water Quality Parameters as Indicators of Distribution System Contamination, Journal AWWA, 2007

[4] Hach HST, GuardianBlue Early Warning System Brochure.

[5] JMAR, BioSentry Contamination Warning System Technical Overview.

[6] World Health Organization Guidelines for drinking-water quality, fourth edition, 2011.

[7] European Communities Drinking Water Regulations (No.2), 2007.

[8] U.S. Environmental Protection Agency 2012 Edition of the Drinking Water Standards and Health Advisories, EPA 822-S-12-001.

[9] C.N.Haas, M.A. Meyer, and M.S. Paller, Microbial alterations in water distribution systems and their relationship to physical-chemical characteristics, in Journal of American Water Works Association, 1983.

[10] K.N. Power and L.A. Nagy, Relationship between bacterial regrowth and some physical and chemical parameters within Sydney's drinking water distribution system, in Water Research, 1999.

Author's Details:

K. Sai Kiran
M.Tech (Embedded systems),
Sindhura College of Engineering and Technology.

M.Sandeep
Assistant Professor,
Sindhura College of Engineering and Technology.