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Microcontroller-Based System For Water Quality Monitoring Using Electronic Sensors

Deepesh Kumar Jain[1] , Arun Parakh[2] , Dr. H. K. Verma[3]

[1] M.E. Student, Department of Electrical Engineering, SGSITS, Indore, India
[2] Assistant Professor, Department of Electrical Engineering, SGSITS, Indore, India
[3]Professor, Department of Electrical Engineering, SGSITS, Indore, India

ABSTRACT: The concept of Electronic Tongue has been used in some experiment to establish the need of fast and virtual monitoring of aqueous samples. Electronic Tongue can be used to identify specific ingredients in a solution. Many experiments have conducted using electronic tongue to virtually monitor the quality of solution like drinking water, milk and juice. In addition, several improvements on basic method have been reviewed. In the present study, a conceptual scheme is presented for water quality monitoring using Electronic sensor based system. This paper focuses on Sensor, Digital Signal Processing, Interfacing, Monitoring circuitry and Display device.

KEYWORDS: Electronic Tongue, Sensor, Water quality.

I.INTRODUCTION

A major environmental challenge for most health and security authorities is the water quality monitoring. Although the quality of drinking water is generally high when leaving the purification plant, the quality of water can deteriorate on its way to the consumers. Reservoirs may become source of contamination, if they are not cleaned periodically. The major health related problems incorporate with quality of water. In many industries, water is one of the main raw materials; if the quality of water is not up to the mark then the overall quality of product being manufactured will be affected. So there is need of a fast, robust and simple sensor system which can monitor the quality of water. For water quality assessment, the main parameters which are to be measured are its pH, dissolved oxygen concentration, conductivity and temperature.

Electronic tongue [1], [2] is also known as artificial tongue, is used to analysis the total complex chemistry of sample. Basically, Electronic tongue is a multi sensor array system. These system shows the following advantages: (a) requires small sample volume, (b) decreased measurement time, (c) objectivity compared to sensory panel, (d) small size of sensors, (e) easily operated by unskilled personnel and (f) amenability to fully automatic long-term routine application. The schematic diagram of electronic tongue is shown in Figure 1.

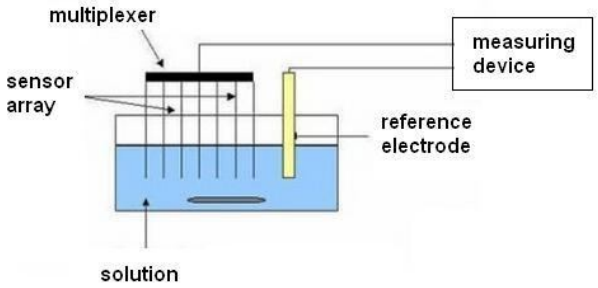

Figure 1: Schematic diagram of Electronic Tongue

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II.PREVIOUS METHODS

Several researchers have been working on this direction. They have used some modified electronic sensor system to monitor the quality of drinking water; a prototype for water-conductivity measurements based on a four-electrode sensor is used [3]. The system also includes a temperature sensor to provide compensation of conductivity measurements caused by temperature variation and in [4], it is shown that how an "electronic tongue" can be used to monitor the quality of water in a production plant for drinking water. The sensor system works on the principle of LAPV, large amplitude pulse voltammetry, a technique where a current is measured at different potentials, is well used in analytical chemistry. The measured current reflects the redoxactive compounds that are either oxidized or reduced at one of the four working electrodes. In [5], thick-film based sensors are used in determining the water quality. They have designed sensor arrays to simultaneously measure temperature, conductivity, pH, dissolved oxygen and redox potential. In [6], a lipid membranes designed taste sensor detects pollutants and unusual tastes in water. The authors have made comparisons while testing two test samples of known quality. One is normal tap water and another is tap water with an unusual taste due to 50 ppm of poly aluminium chloride. They have shown that the taste sensor is able to distinguish between them.

In the similar manner, a four-electrode conductivity probe is used in [7]. An optical fibre sensor system is presented to detect particle concentrations in water [8]. Water quality instruments used as a multi-sensor system is presented in [9]. To simulate water quality, artificial neural networks is presented in [10]. The concept of the electronic tongue has been developed to attract the needs of on-line monitoring of aqueous samples, e.g., in the food industry [11], [12], [13], [14] as well as for environment monitoring [15]. In this paper we present block diagram approach for developing an electronic sensor based system that will estimate the quality of water.

III.PROPOSED METHODOLOGY

The quality of drinking water depends on various facts. Some of them are its origin and quality of the raw water used, untreated surface or ground water, and also due to efficiency variations in the drinking water production process. Problems can be related to the occurrence of algae, bacteria, pesticides and herbicides, industrial contamination, etc., in the raw water. The character of the raw water, the biological activity at the production plant as well as in the distribution net may all cause quality problems, like bad taste, or could be unhealthy. Controls are repeatedly done on the performance of the drinking water production process, but due to a rather low sampling frequency, an effective monitoring of occasional changes is hard to detect. A method for monitoring variations in the raw water quality as well as the water quality before entering the consumer would therefore be of considerable value.

In the proposed scheme, sensor system is going to be combined with enhanced signal conditioning unit and also advanced signal processing technique, thus the accuracy of overall system can be increased. The proposed system may be modified to an electronic system that can be used for monitoring the quality of liquids like milk, water, juices, etc. Research work includes monitoring of the liquids under test, and evaluation of properties of liquid and hence quality of liquid. The block diagram of system is shown in the Figure 2.

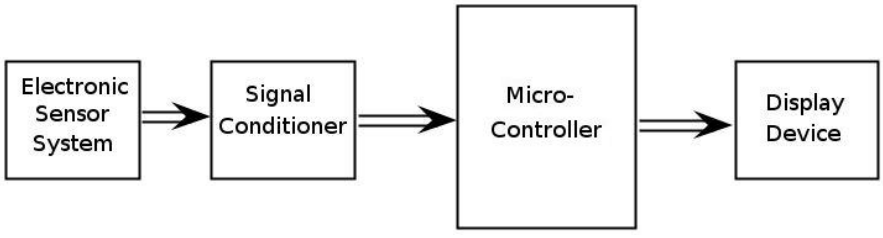

Figure 2: Block Diagram of Proposed System

The flowchart of program is shown in Figure 3.

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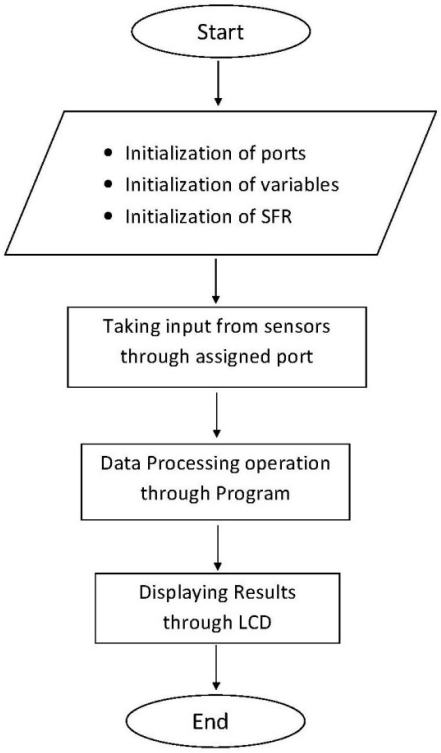

Figure 3: Flow chart

The future research work aims at

- Detailed study of sensors.
- To design hardware of Microcontroller-based system for water quality monitoring using Electronic Sensors.
- Testing of water quality monitoring system with different test samples and study of obtained results.
- PC interface will be developed for online testing and monitoring of raw water and final water leaving the plant.

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